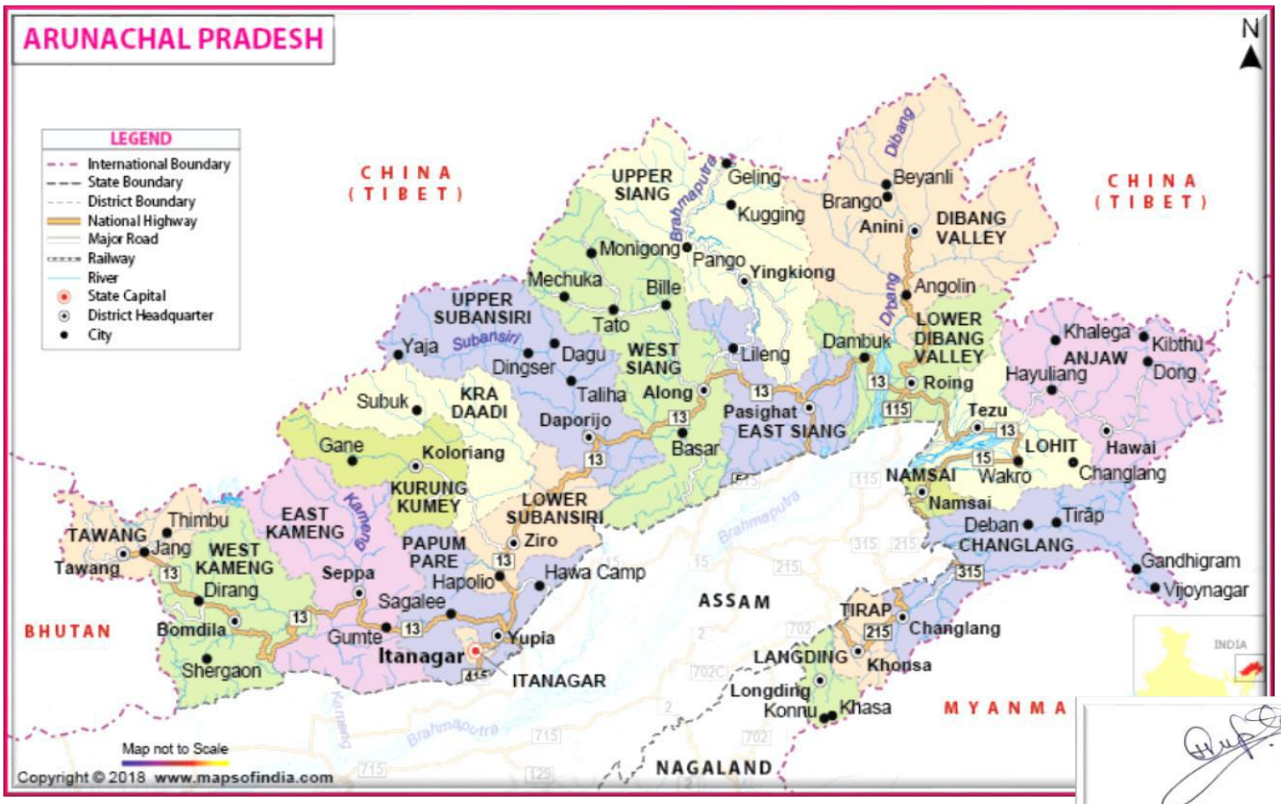
Environmental Impact Assessment Report

Safeguard Policies for Environment

With

Environmental Checklist, Management and Monitoring Plan

EIA/ IEE for BRO – Moying to Migging Road, Arunachal Pradesh State



BRO: Border Road Organization,

May – 2020

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ABBREVIATIONS AND ACRONYMS

AADT	Annual Average Daily Traffic
AC	Asphaltic Concrete
ADT	Average Daily Traffic
BBD	Benkelman Beam Deflection
BC	Bituminous Concrete
BM	Bituminous Macadam
BOQ	Bill of Quantities
BOT	Build Operate Transfer
BSNL	Bharat Sanchar Nigam Limited
BT	Bituminous Track
CBR	California Bearing Ratio
CD	Cross Drainage
CGWB	Central Ground Water Board
CMSA	Cumulative Million Standard Axles
COI	Corridor of Impact
CRRI	Central Road Research Institute (India)
CVPD	Commercial Vehicle Per Day
DBFOT	Design, Build, Finance, Operate & Transfer
DBM	Dense Bituminous Macadam
DLC	Dry Lean Concrete
DTM	Digital Terrain Model
EA	Environmental Assessment
EASL	Equivalent Standard Axle Load
EIA	Environment Impact Assessment
EIRR	Economic Internal Rate of Return
FFR	Final Feasibility Report
FIRR	Financial Internal Rate of Return
GAD	General Arrangement Drawing
GDP	Gross Domestic Product
GOI	Government of India
GPS	Global Positioning System
GSB	Granular Sub – Base
GTS	Geodetic Triangulation Survey
Ha	Hectare
HDM – 4	Highway Design & Maintenance Model (Series – 4)
HDMQ	Highway Design and Maintenance Model with Congestion Analysis
HFL	High Flood Level
IRC	Indian Road Congress
IRR	Internal Rate of Return
Km	Kilometre
KMPH	Kilometre Per Hour
LA	Land Acquisition
LT/ HT	Low Tension/ High Tension Electric Lines
m	Meters
MDR	Major District Road
mm	Millimetre
Dia.	Diameters
EPC	Engineering, Procurement, and Construction
PPR	Peste – des Petits Ruminants
LMI	Labour Market Information
SARA	Saturates, Aromatics, Resins and Asphaltenes
PET	Poly – Ethylene Tere – phthalate
FRC	Fibre Reinforced Concrete
PCM	Public Consultation Meeting
UTC	Universal Time Coordinated
DEM	Digital Elevation Model
FCW	Flush Cause Way
CVPD	Commercial Vehicles Per Day
CCCT	Centre for Computers and Communication
NWL	Normal Water Level
CCP	CIVIL CONSTRUCTION PRACTICES
GSD	Ground Sample Distance
NRSC	National Remote Sensing Centre
DEM	Digital Elevation Model
NHAI	National Highway Authority of India

MOEF	Ministry of Environment and Forests
MORT & H	Ministry of Road Transport & Highways
BRO	**Border Road Organisation**
MSA	Million Standard Axles
MSL	Mean Sea Level
NH	National Highway
NMT	Non – Motorized Traffic
NPV	Net Present Value
NSDP	Net State Domestic Product
NTPC	National Thermal Power Corporation
O&M	Operation & Maintenance
O – D	Origin Destination
OFC	Optical Fiber Cable
OMC	Optimum Moisture Content
PCC	Plain Cement Concrete
PCU	Passenger Car Unit
PIU	Project Implementation Unit
PPM	Parts Per Million
PPP	Public Private Partnership
PPR	Preliminary Project Report
PQ	Pre – Qualification
PQC	Pavement Quality Control
PWD	Public Works Department
QAP	Quality Assurance Plan
QC	Quality Control
R&R	Resettlement and Rehabilitation
RAP	Resettlement Action Plans
RCC	Reinforced Cement Concrete
RHS	Right Hand Side
RL	Reduced Level
ROB/ RUB	Road Over Bridge/ Road Under Bridge
ROW	Right of Way
Rs.	Rupees
SH	State Highway
SIA	Social Impact Assessment
Sq. Km.	Square Kilometers
TBM	Temporary Bench Mark
Temp	Temperature
TOR	Terms of Reference
TRL	Transportation Research Laboratory
UG	Under Ground
VDF	Vehicles Damage Factor
Veh.	Vehicles
VGF	Viability Gap Funding
WB	World Bank
WBM	Water Bound Macadam
WMM	Wet Mix Macadam
PPE	Personal Protective Equipment
GAD	General Administration Department
MSE	Mean Squared Error
ACZ	Agro – Climatic Zone
SEDP	Sustainable Environmental Development
PCM	Public Consultation Method
FGD	Focus Group Discussion
GPS	Global Positioning System
DTM	Digital Terrain Model
CRRI	Central Road Research Institute
ATTC	Advanced Technical Training Centre
CRPF	Central Reserve Police Force
TAR	Tibet Autonomous Region
NSSDA	National Standard for Spatial Data Accuracy
DGPS	Differential Global Positioning System
GIS	Geographical Information System
RL	Reduced Level
CPWD	Central Public Works Department

This is a Draft Report on **Environmental and Social Management Framework (ESMF)** for the proposed **Enhancing Land, Air, Water, Noise and Road Construction Resource Efficiency (ELAWNRCRE)** Project with financial assistance from the **BRO/ NHAI/ ITBP/ CPWD/ PWD/ MPRDC/ MSRDC/ ADB/ NDB OR World Bank** etc. This is hereby disclosed with a view to soliciting comments/ suggestions on or before **December 2019**. In this regard, please send your comments/ suggestions by email to h.g@rediffmail.com or by WhatsApp Number 09329213257 to ***Dr. Harish Kumar Gupta, Environment Expert, L. N. M. Infra Projects Pvt. Ltd., Bhopal (M.P.).***

CHAPTER – 1: ENVIRONMENTAL IMPACT ASSESSMENT AND EMP FOR ARUNACHAL PRADESH

1. INTRODUCTION AND BACKGROUND OF THE PROJECT

Arunachal Pradesh is one of the 29 States of India. Located in North – East India it holds the most North – Eastern position among the other states in the North – East region of India. Arunachal Pradesh borders the states of Assam and Nagaland to the South, and shares international borders with Bhutan in the West, Burma in the East and China in the North. Itanagar is the capital of the state and Arunachal Pradesh is also known as the ***Orchid State of India*** or the ***Paradise of the Botanists***. Geographically, it is the largest among the North – East Indian states commonly known as the ***Seven – Sister States***. As in other parts of Northeast India, the people native to the state trace their origins from the Tibeto-Burman people. In recent times, large number of migrants from various parts of India and foreign lands has been affecting the state's population. In spite of being the second smallest as well as the least populated state of India, Arunachal Pradesh is a heaven for nature lovers, aspirators and inventors. Itanagar is the capital as well as the largest city of Arunachal Pradesh and is located at the height of 5,500 feet on the hills of Shivalik. The beautiful Kanchenjunga, which is the third tallest mountain of the world, can be viewed from Itanagar. The total area of Arunachal Pradesh is roughly 7,000 Square Kilometers with a total population of more than 6 lakhs.

Arunachal Pradesh is a land – locked Indian state located in the Himalayan Mountains. The state is bordered by Nepal to the West, China's Tibet Autonomous Region to the North and East, and Bhutan to the East. The Indian state of West Bengal lies to the South. With 6,07,688 inhabitants as of the 2011 census Arunachal Pradesh is the least populous state in India and the second-smallest state after Goa in total area, covering approximately 7,096 Km^2 (2,740 Square Mile). Arunachal Pradesh is nonetheless geographically diverse due to its location in the Himalayas; the climate ranges from subtropical to high alpine, and Kangchenjunga, the world's third – highest peak, is located on Arunachal Pradesh's border with Nepal. Arunachal Pradesh is a popular tourist destination, owing to its culture, scenery and biodiversity. It also has the only open land border between India and China. Arunachal Pradesh's capital and largest city is Itanagar.

The consultancy services for carrying out preparation of **"Initial Environmental Examination" (IEE)**/ Detailed Project Report (DPR) and bid documents. In order to fulfil the traffic needs and road safety requirement, **"Border Road Organisation" (BRO)** has appointed the **M/s HIGHWAY ENGINEERING CONSULTANT BHOPAL (MP),** for Survey, Investigation and Preparation of Detailed Project Report for improvement of Road and Bridges etc. for construction of High Altitude Hill Roads to Border Road Organization under Phase – I in the state of Arunachal using **"Satellite Imagery"** and **"Geographical Information System" (GIS)**. The report brings out the project background, mobilization and staffing, approach and methodology relating to surveys/ investigations and detailed design. A broad conceptualization of the project essentially based on study of available data/ reports and a detailed reconnaissance survey has been provided. ***"Arunachal Pradesh, 105 – RCC/ HQ – 761 BRTF/ HQ CE (P) Brahmank, Border Road Organisation" (BRO) Division has been entrusted preparation of "Initial Environmental Examination" (IEE) of Moying to Migging from 92.250 Km to 189.100 Km (189.100 Kms) from CL – 9 to NHDL Specification in 21 – BRTF area under PROJECT – BRAHMANK in Arunachal"***. Through Consultancy Services As Specified By MORT & H and Provisions of IRC – SP – 19 for Improvement/ Development of Road **Moying to Migging** from **142+020** Km to 189.100 Km to NH double lane specifications in East and Upper Siang District in State of Arunachal Pradesh area under Project **BRAHMANK** the assignment for **"Consultancy Letter No.: HEC/ BRO/ BRAHMANK/ BID – VAL/ 2017 – 18/ 753 27 JAN. 2018"**. The report also makes proposals on issues requiring discussions with the **"Border Road Organisation" (BRO) by "Ministry of Home Affairs, Department of Border Management, and Government of India"** and decisions necessary for detailing of the project.

As per the letter from **105 – RCC, Vide Letter No. 8147/ BMK/ 08/ 17 – 18/ 12/ E8** the Project road has been prepared into two stages *i.e.*, (from 92.250 Km to 93.000 Km and 93.000 Km to 189.100 Km). As per topographic survey which are given below.

- ***Part – I***: ***Starts*** *from* ***Moying*** *(Chainage 92+250) and* ***Ends*** *at* ***Migging*** *(Chainage 189+100).*
- ***Part – II***: ***Starts*** *from* ***Ditte – Dimme*** *(Chainage 00+000) and* ***Ends*** *at* ***Moying*** *(Chainage 92+250).*

The report covers the following major aspects and prospects are as discussed below one by one:

(i) *Project Background;*
(ii) *Mobilization and Progress;*
(iii) *Project Appreciation and Conceptualization;*
(iv) *Proposed Approach and Methodology;*

Alignment Deciding Criteria and Significant Factors

(v) *Connectivity to* ***"Indo – Tibetan Border Police" (ITBP)*** *Posts* ***"Authorities of 11th and 13th Battalion",*** *Raised on* ***24th October 1962,*** *under the* ***"Central Reserve Police Force" (CRPF)*** *Act;*
(vi) *Stable Side of Hilly Areas;*
(vii) *Avoiding of S – Bends to the Extent Possible;*
(viii) *Gradient Limits;*
(ix) *Availability of Road Construction Materials;*
(x) *Minimum Number of Cross Drainage Structures;*
(xi) *Connectivity to Intermediate Village, If Any;*
(xii) *Avoiding Acquisition of Private Land;*
(xiii) Keeping the Alignment 25 – 30 m above **"Normal Water Level" (NWL)** of River, If Any;

The consultancy services for the same have included design of best possible alignment and pavement composition, culverts and other structures in addition to analysis of costs, determining project feasibility and **"Initial Environmental Examination" (IEE)** Report for the Project **Moying to Migging** Road **Starts** from **Moying Road** and **Terminates** at **Migging Road** in the "**Arunachal Pradesh**".

Figure 1 (a): Arunachal Pradesh' Birds, Animals and Cumulative Impact Assessment (CIA) Supporting Wealthy and Rich Diversity OR Species.

Figure 1 (b): Traditional Arunachal Pradesh' Food Culture and Cumulative Impact Assessment (CIA) Supporting Wealthy and Rich Assortment OR Collection.

Figure 1 (c): Mountain Ranges, Meandering Rivers and Miles of Forests Supporting Wealthy and Rich Biodiversity.

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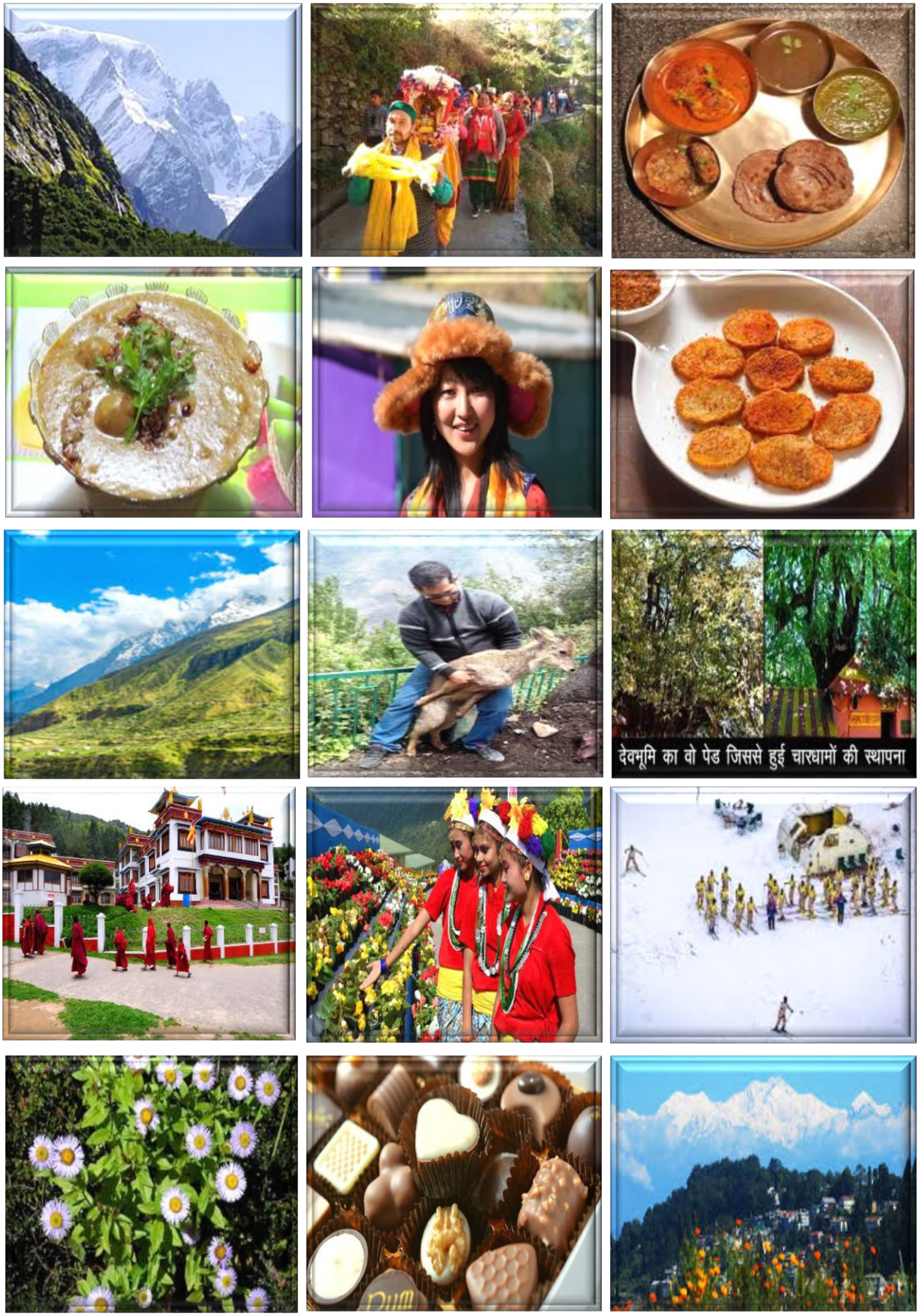


Figure 1 (e): Mountain Ranges, Meandering Rivers and Miles of Forests Supporting Wealthy and Rich Biodiversity.

Most of the areas being hilly, summers in Arunachal Pradesh are soothing as the temperature hardly crosses 30°C (about 86°F), whereas the summers are exceedingly hot with temperatures crossing the 40°C mark and considerable humidity. Winters can be chilly with temperatures going below 5°C at times. The **climate** in the Northern part of Arunachal is typically Himalayan. This mountain range itself exerts an appreciable extent of influence on monsoon and rainfall patterns. Within the Himalayas, **climate** differs depending on altitude and position. **Climate** ranges from subtropical in the southern foothills, averaging summer temperatures of about 30°C (about 86°F) and winter temperatures of about 18°C (about 64°F). Warm temperate conditions prevail in the Middle Himalayan valleys, with summer temperatures usually hovering about the mark of 25°C (about 77°F) and cooler winters. It lies between **"Latitude 28°57'52"° N and Longitude 91°50'57"° E"**. Located in the North – Eastern part of the country, Arunachal is surrounded by West Bengal on its South and shares international borders with Bhutan on its South – East, Nepal on its West and the **"Tibet Autonomous Region" (TAR)** of China on its North – East and it is often referred to as the **"Smart and Beautiful – Heritage of Himalayas"**. The beautiful mountains, the deep valleys and the biodiversity make Arunachal a favourite spot for tourists like **Mountain Ranges, Meandering Rivers and Miles of Forests Supporting Wealthy and Rich Biodiversity** as shown above in **Figures 1 (a), (b), (c), (d) and (e)**. The **"Initial Environmental Examination" (IEE)** Report for improvement of ***"Arunachal Pradesh, 105 – RCC/ HQ – 761 BRTF/ HQ CE (P) Brahmank, Border Road Organisation" (BRO) has been entrusted preparation of "Initial Environmental Examination" (IEE) of Moying to Migging from 92.250 Km to 189.100 Km (189.100 Kms) from CL – 9 to NHDL Specification in 21 – BRTF area under PROJECT – BRAHMANK in Arunachal"***. Through Consultancy Services As Specified By MORT & H and Provisions of IRC – SP – 19 for Improvement/ Development of Road **Moying to Migging** from 92.250 Km to 189.100 Km (189.100 Kms) to NH double lane specifications in East and Upper Siang District in State of Arunachal Pradesh area under Project **BRAHMANK** the assignment for **"The Project Assignment/ Task for Consultancy Letter No.: HEC/ BRO/ BRAHMANK/ BID – VAL/ 2017 – 18/ 753 27 JAN. 2018"**. The Projected Road **Moying to Migging Starts** at **Moying** and **Terminates** at **Migging**. The design length of proposed alignment is **191.00 Km.** and the route plan of **Moying to Migging Road** is given in **Table 1**.

Table 1: The Route Plan of Moying to Migging Road.
Road Direction and Route Plan

Place Name		Distance	Approximate Time for Journey	Mode of Vehicle
From	To			
Moying	Migging	*189.100 Km.*	*20.57 Hrs*	By Road with 4 Wheeler Drive
	Total	189.100 Km.		

Physiographic Index

Arunachal is the second – smallest Indian state and is geographically located at **"Latitude 28°57'52" N and Longitude 91°50'57" E**. Landlocked in the Himalayan range, the state is bordered by Tibet on its North – East, Nepal on its west, Bhutan on its South – East and West Bengal on its South. The residents of Arunachal experience two kinds of climate. The Northern part of the state experiences tundra type of climate, whereas, the Southern part observes sub – tropical climatic conditions. Because of the tundra type of climate, the Northern part of the state remains covered with snow for almost 4 months in a year, when the night temperature goes below the level of 0°C. The weather condition of the state is mainly divided into 5 seasons, which are depicted below:

- *Spring;*
- *Summer;*
- *Autumn;*
- *Monsoon;*
- *Winter.*

Arunachalis subdivided into following units as Noteworthy and Remarkable Facts on Arunachal Pradesh are shown in the **Table 2** with worth mentioning and incredible Index of Arunachal Pradesh.

Table 2: Noteworthy and Remarkable Facts on Arunachal Pradesh.

Facts on Arunachal Pradesh	
Official Website	***www.arunachalpradesh.gov.in/***
Date of Formation	***"Arunachal Pradesh"*** *was established as a state in 20th February, 1987 and was known as the* ***"North East Frontier Agency" (NEFA)*** *during British India and the Republic of India until 1972.*
Area	*83,743 Km²*
Density	*The population density of the state is 189 People/ Km² and population is on 27th position having a 2001 – 2011 decadal growth rate of 18.81%.*
Total Population (2012 and 2019)	*1.01 Crores OR* ***"10.3932 Million"*** *Approximately.*
Males Population (2011)	*579,941*
Females Population (2011)	*518,027*
Number of District	*29*
Capital	*Itanagar*
Rivers	*Brahmaputra, Lohit, Yarlung, Dibang, Kameng, Subansiri, Tirap and Dihing etc.*
Forests and National Park	*Around* ***"Five National Parks"*** *in Arunachal Pradesh. Namdapha National Park. Photo (cropped) by Travelling Slacker, Mouling National Park. Kane Wildlife Sanctuary. Mehao Wildlife Sanctuary. Daying Erring Memorial Wildlife Sanctuary etc.*
Languages	*Nyishi (208,337), Adi (193,379), Bengali (97,149), Nepali (94,919), Hindi (81,186), Monpa (55,428), Assamese (51,551), Wancho (48,544), Tangsa (34,231), Mishmi (33,522), Mishing (33,381), Nocte (32,591), and Others (64,711).*
Neighbours State	*Assam and Nagaland to the South and shares international borders with Bhutan in the West, Myanmar in the East and is separated from China in the North by the McMahon Line.*
State Animal	***"Gayal"*** *(Official Animal) – Mithun – Bos Frontalis.*   
State Bird	***"Great Hornbill"*** *(Official Bird).*   
State Tree	***"Dipterocarpus Macrocarpus"*** *(Official Tree).*   
State Flower	***"Rhynchostylis Retusa"*** *(Official Flower); Orchidaceae is in the Major Group Angiosperms (Flowering Plants).*

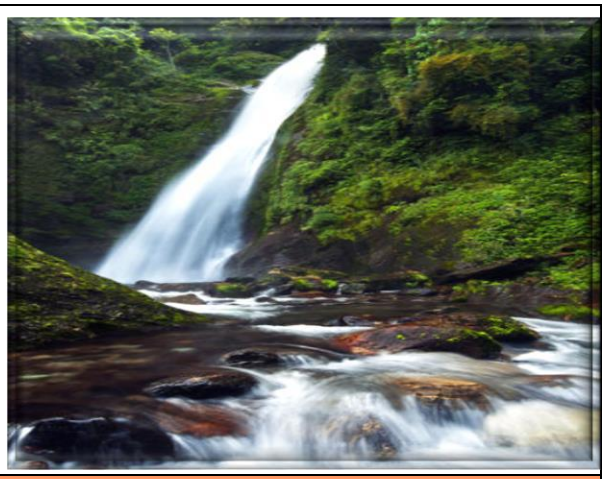
	  
State Fish	*To Protect the Endangered **"Mahaseer" Fish,** Arunachal.*   
Net State Domestic Product (2011 – 12 To 2015 – 16)	*16,761 (₹ Crore)*
Literacy Rate (2011)	*66.95%*
Females per 1,000 Males {Sex Ratio Females (Rural)}	*890 {1,000}*
Assembly Constituency	*Total Seats 30.*
Parliamentary Constituency	*01 (This Constituency Covers the Entire Upper Siang, East Siang, Dibang Valley, Lower Dibang Valley, Lohit, Anjaw, Changlang and Tirap Districts).*

Waterfalls

Arunachal Pradesh is primarily a land of sky scraping mountains and hills. The lush green vegetation on the mountain sides presents an **"Eye – Soothing View"** and this sight is made more panoramic by the waterfalls in Arunachal Pradesh. Mostly perennial in nature, waterfalls abound in Arunachal Pradesh, especially in the Northern region. The Dzongu area and the road between Lachung and Mangan are blessed with the maximum numbers of waterfalls in Arunachal Pradesh State. Most of the waterfalls of Arunachal Pradesh are snow fed and ultimately meets either Teesta or Rangeet River. The local inhabitants of Arunachal Pradesh consider some of the waterfalls to be sacred place. The waterfalls of Arunachal Pradesh are ideal sites for setting trekking base camps, since they fall from high altitudes and are perennial in nature; these waterfalls are also conducive for setting up hydro power projects. The important waterfalls in Arunachal Pradesh are:

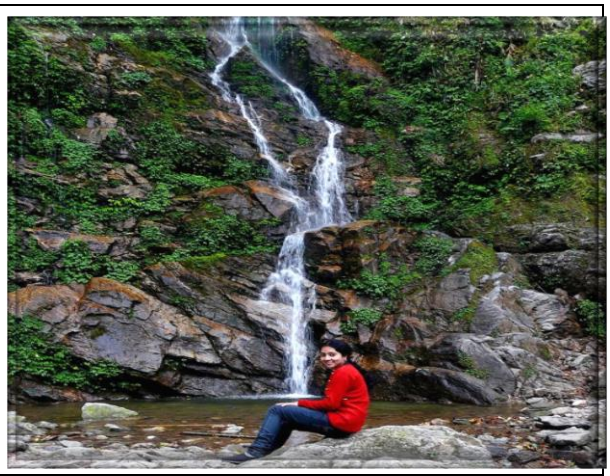
- ***Kanchendzonga Waterfalls:*** *This is the largest waterfall in Arunachal Pradesh and it is located 15 Km. away from Pelling. Water splashes out from granite rocks in plumes of white in Kanchendzonga waterfalls. The sound produced in this voluminous and swift waterfall engulfs all surrounding noises.*



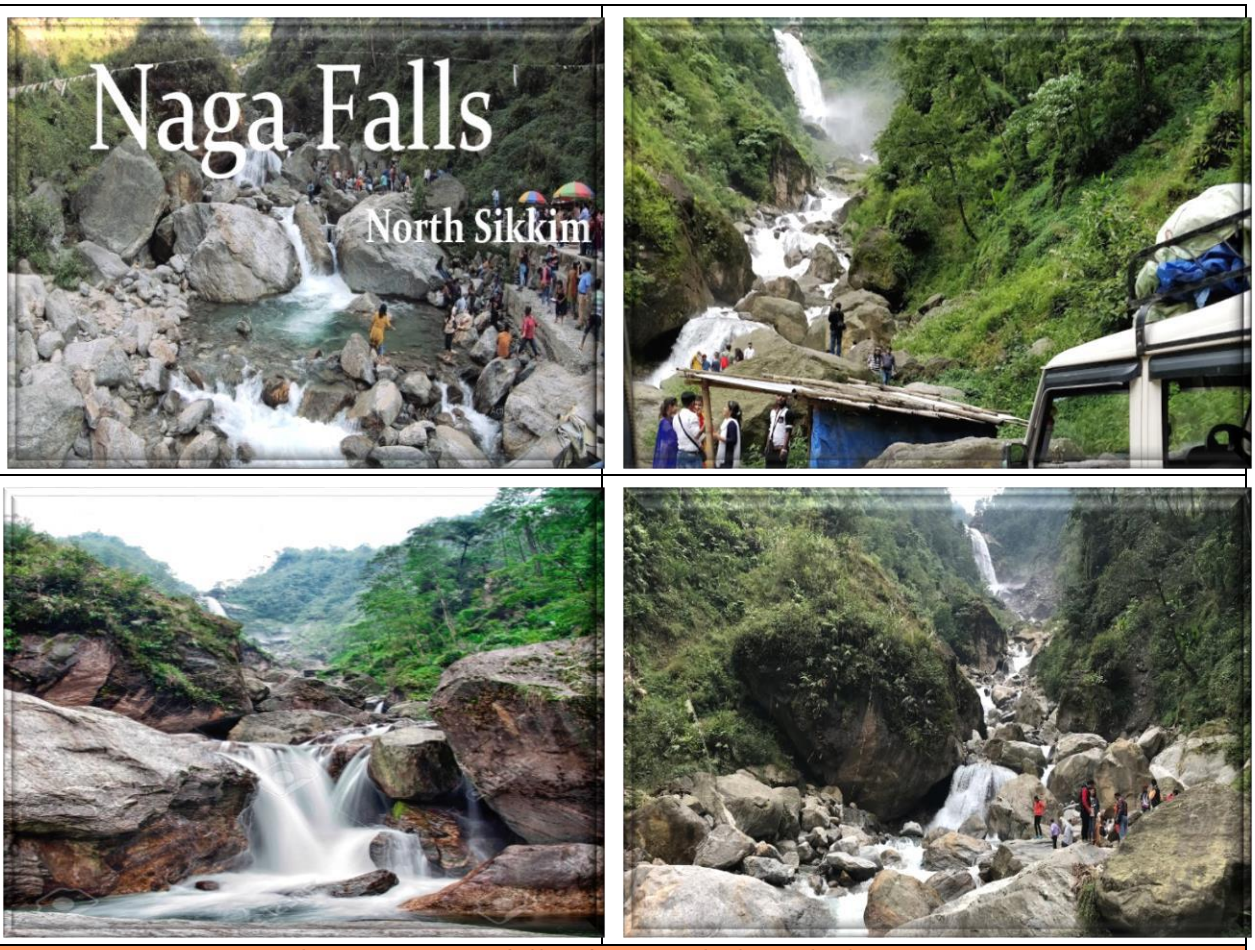
The Kanchendzonga Waterfalls of Arunachal Pradesh State.

- ***Rimbi Waterfalls:*** *Flowing in the outskirts of Pelling, this waterfall forms an important sight scene to the tourists in Pelling.*



The Rimbi Waterfalls of Arunachal Pradesh State.

- ***Naga Waterfalls:*** *Along with Kabi Lungstok and Tashi Viewpoint, this waterfall is a popular tourist spot on way to Lachen from Itanagar.*



The Naga Waterfalls of Arunachal Pradesh State.

- ***Rukshyot Waterfalls:*** *Rukshyot waterfalls, in the outskirt of Bay Village and in close proximity to Lingzya monastic school, are the highest waterfall in Arunachal Pradesh State.*


The Naga Waterfalls of Arunachal Pradesh State.

- ***Bhim Nala Waterfalls:*** *Bhim Nala Waterfalls and the Twin Waterfalls are the other two waterfalls of Arunachal Pradesh en – route to Lachung.*



The Bhim Nala Waterfalls of Arunachal Pradesh State.

2. BACKGROUND – Scope and Study

The construction of high altitude hilly/ mountainous roads to Indo – China Border road under phase – II in the state of Arunachal has been entrusted to **"Border Road Organisation" (BRO)** by Ministry of Home Affairs, Department of Border Management, and Government of India. The work is of National importance having strategic in nature from Border security aspect. The consultancy work for Preparation of Detailed Project Report has been awarded to **M/s HIGHWAY ENGINEERING CONSULTANT BHOPAL (MP)**. The **"Border Road Organisation" (BRO)** has been entrusted with the assignment of Consultancy Services for preparation of Detailed Project Report of National Highways/ State Roads (approved as National Highway) in many States for up gradation to Two/ Four Lanes with paved shoulder configuration. **BRO** now invites proposal from Technical Consultants for

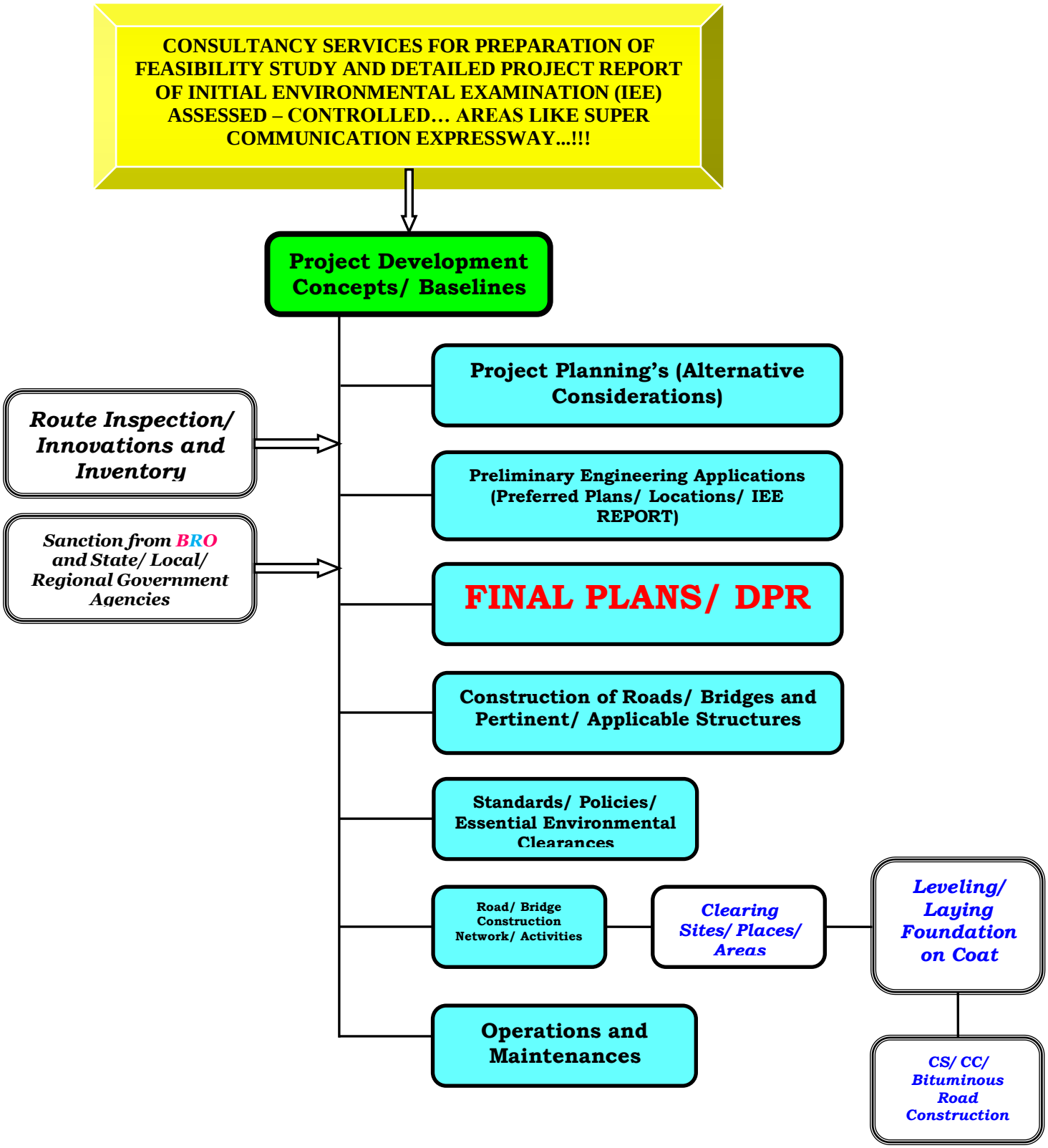
carrying out detailed project report for proper structuring and implementation of projects on Engineering, Procurement, and Construction (EPC)/ Public Private Partnership (PPP) mode on **Moying to Migging Road in the North Arunachal Pradesh**. In order to fulfill the traffic needs and road safety requirement, **BRO** has appointed the **M/s HIGHWAY ENGINEERING CONSULTANT BHOPAL (MP)** as consultants to Providing Consultancy Services for Preparation of Detailed Project Report of **Moying to Migging Road** for Management and Construction of High Altitude Hill Roads to Indo – China Border Road under **Part – 1** in the State of Arunachal, **Package No.: 00,** using **"Satellite Imagery/ Global Positioning System"**.

The **"Ministry of Home Affairs" (MHA)**, Govt. of India has decided to take up the development of High Altitude Hill Roads to Indo – China Border. The **"Border Road Organisation" (BRO)** has been entrusted with the construction of High Altitude Hill Roads to Indo – China Border road in the State of Arunachal. This project section is from Moying to Migging in the State of Arunachal and the **"Total Length of Proposed Road is 189.100 Km".** The Coordinates of Project roads at **Starting Point, Moying** are **Latitude of 28°38'45.60" (North) and Longitude of 94°59'58.62" (East)**. Coordinates at the **End Point, Migging** are **Latitude of 28°51'03.46" (North) and Longitude of 94°46'21.54" (East)**. ***"Length provide by ITBP for the road is 16.00 Km., whereas the designed length is from 92+250 Km to 189+100 Km" in the State of Arunachal Pradesh.***

The project study consists of preparation of the following as shown in **Figure 2**:

Stage 1 –: Inception Report and Quality Assurance Plan;
Stage 2 –: Reconnaissance/ Feasibility/ Strip Plan / Investigation/ Survey Report;
Stage 3 –: Land Acquisition and Clearances: Ist – Report;
Stage 4 –: Detailed Project Report (DPR);
Stage 5 –: Technical Schedules and Strategies (TSS);
Stage 6 –: Land Acquisition and Clearances: IInd – Report;
Stage 7 –: Final Detailed Project Report (FDPR);

Figure 2: Detailed Project Description Process (Schematic Diagram OR Flowchart Showing Project Layouts and Concluding Components).



Natural Resources

The state is gifted with abundant natural resources and the resources can be grouped into biotic or a – biotic, both of which can be renewable. Biotic resources include agriculture crops fodder and forests. The entire Himalayan region is endowed with natural flora and fauna, and is a natural paradise for nature lovers, conservationists, botanists, zoologists and environmentalists etc. There are 4,000 species of flowering plants, 300 species of ferns and its allies, 11 species of Oaks, 8 species of tree ferns, and 30 to 40 species of Primulas 20 species of bamboos. In Fauna, the state is also very rich 144 species of mammals and 500 to 600 species of birds, over 400 species of butterflies and moths. Many species of reptiles etc. are available and many medicinal plants/ herbs/ and important shrubs are found in low and high altitude areas. Other resources are water resources, human resources, livestock resources, hydro – electric potential, tourism, agricultural, horticulture etc. In forest, non – wood forest produce has a vast potential like sand, boulders and other materials. Under economic geology the minerals like copper, iron, lime, dolomite/ limestone, coal, quartzite and tale, silicate and graphite are available in the state. Garnet is abundant in the gneiss and mica schist's at places. Large cardamoms production is very high in the state. The basic information on various natural resources is either not available or if available it is not adequate and up to date. There is a vast potential for hydro – electric power generation and tourism development deserves consideration to add to the economy of the region/ state.

Socio – Economic Profile Index

The Projected Road is located in the district of **"Upper Siang",** which in turn is located in the **"State of Arunachal Pradesh"**. Population of Arunachal Pradesh is predominantly tribal; the main tribes include the Adi, Nyishi Apatani, Bugun, Galo, Hrusso, Koro, Meyor, Monpa and Tagin. Broadly the people divided into three cultural groups on the basis of their socio – religious affinities. The first group consists of the Monpas and Sherdukpens of Tawangand West Kameng districts following the lama tradition of **"Mahayana Buddhism"**. The second group includes the Adis, Akas, Apatanis, Bangnis, Nishis, Mishmis, Mijis, Thongsas etc. who worship **"Sun and Moon Gods"**. Their religious rituals largely coincide with phases of agricultural cycles. The third group comprises Noctes and Wanchos adjoining Nagaland in the Tirap District and these are hardy people known for their strictly structured village society in which hereditary system of village chief still has a vital role. The Noctes also practice elementary form of Vaishnavism and about 64% of the population is tribal Arunachal Pradesh has the lowest average population density in India, at 17 per Sq. Km. Papum Pare has highest population density, at 51 per Sq. Km. Dibang Valley has lowest density at, 1 per Sq. Km and Majority of the population lives in the rural areas about 55% of Arunachal Pradesh's population fall in the working age group. Another 40% fall in the 0 to 14 year age group and is expected to join the workforce in the coming 10 years. About 36% of Arunachal Pradesh working population is concentrated in Lohit, Papum Pare and Changlang districts. Upper Siang has 3% population in the working age group. In 2001, Arunachal Pradesh had a total of 482,902 workers, of which 57.8% are cultivators as compared to national level aggregate of 31.7%. There were 37% other workers in Arunachal Pradesh and the category of **"Other Workers"** included government employees, teachers, factory and plantation workers, those engaged in trade, commerce, business, transport, banking, mining, construction, political or social work, priests, entertainment artists, etc. Nearly 35% of the main workers are concentrated in **"Changlang, Tirap and Lohit"**. **"Tawang and Upper Siang"** Districts have over 50% of total population as the working population. About 44% of the total population in Arunachal is working population. The **Figure 3** Showing Index Map of Projected Road.

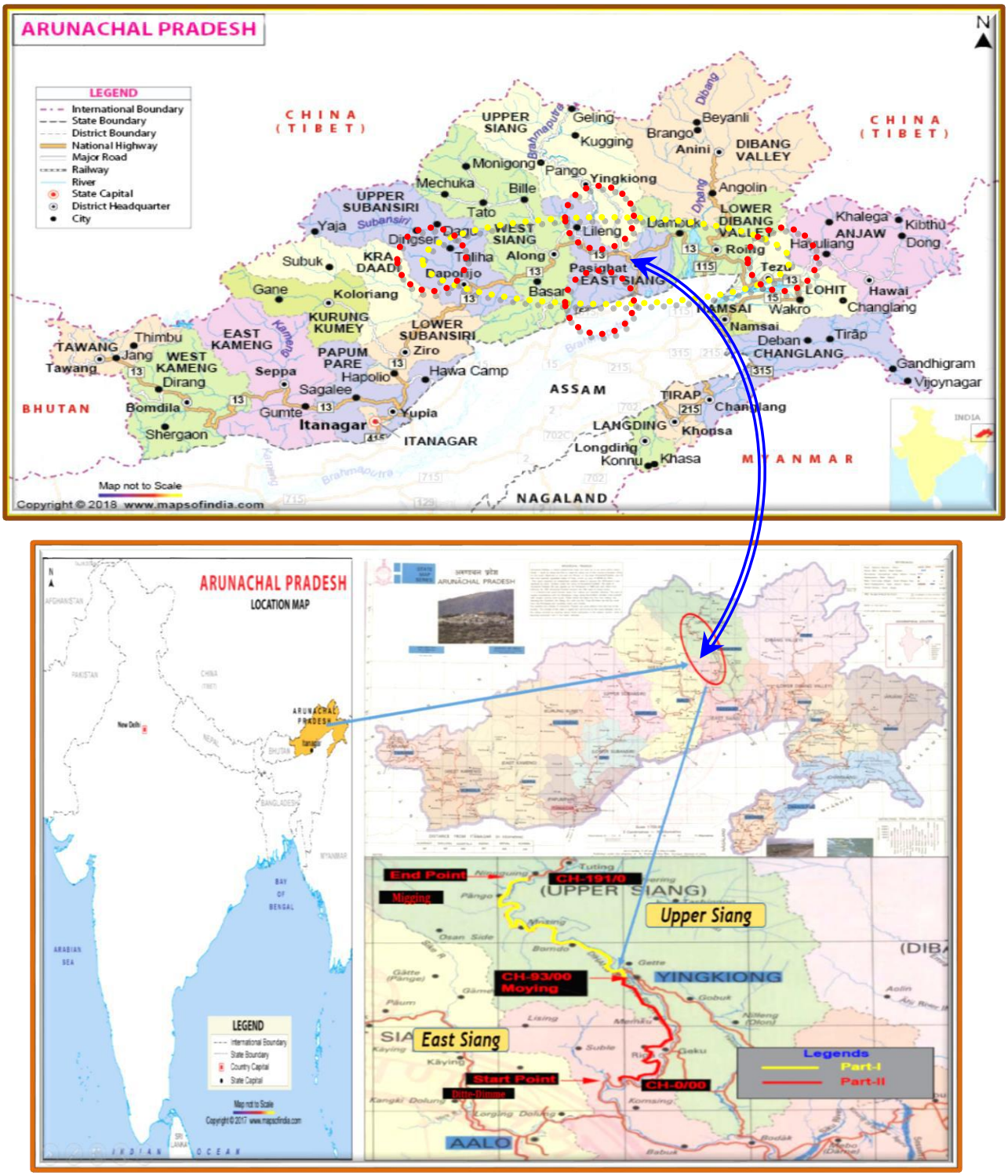
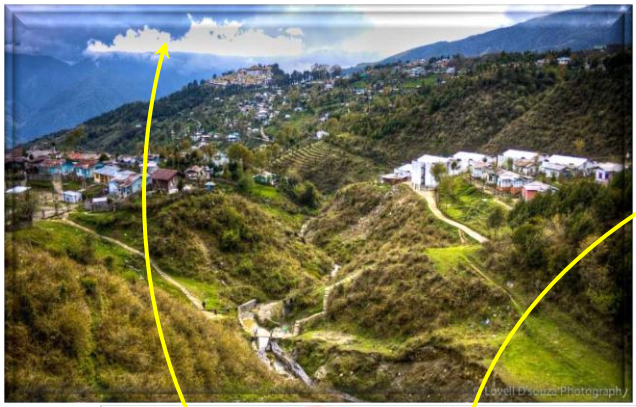


Figure 3: Index Map Showing Projected Road.

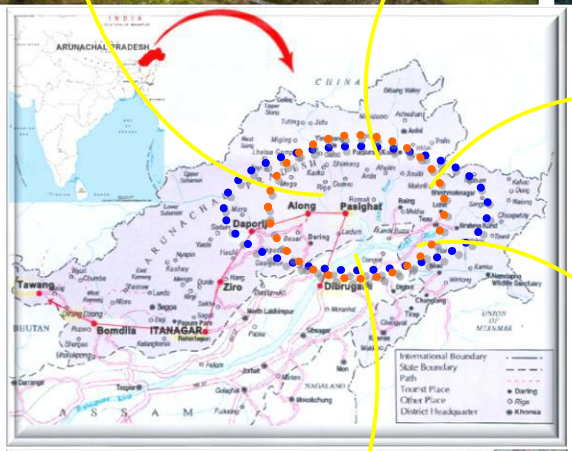
Arunachal Pradesh Demographic Index

"Arunachal" is a **"Multi – Ethnic State"** and broadly, the population can be divided into tribal and non – tribal groups. Lepchas, Bhutias, Sherpas are categorized as Scheduled Tribes. The Lepchas are the original inhabitants of the state and compared to other ethnic groups, the Lepchas still maintain many of their traditional ways. The Bhutias comprise the Arunachal Pradeshese Bhutia and Bhutia from Bhutan and Tibet. The Sherpas are a marginal ethnic group in the state and over 70% populations consist of Nepalese. They are dominant ethnic group in the state and the people from the plain mostly involved in trade and services represent a marginal group. The **Digital Terrain Model (DTM)/ DEM Generation of Geo – Tiff – Format of Projected Road, Vetting/ Geology and Slope Stability by Environmental Team**

Experts is as shown in the **Figure 4**. As per the 1991 census of India, the total population of the state is 4, 06,457, whereas in 1981 it was 3, 16,385 only. Decennial growth has come down, as in 1971 to 81 and it was 50.77% whereas for the years 1981 to 91 and it was found 28.47% only. The overall density of population in the **"Arunachal Pradesh is 83,743 Km²"** and population is on 27th position. East district is the most populated whereas North's density only 7, is least populated. Sex ratio (females per thousand male) in 1981 was 835, where as it has improved and now is 878. There are only eight urban towns and urban population is 9.10% of total population. Schedule caste and schedule tribe population is 5.93% and 22.36% respectively, North district is a tribal district and it has about 55.38% tribal population. Literacy rate is 56.94% (19th position), higher than the all India average literacy rate are of 52.11%. **Figure 4: The Tentative Prototype – Paradigm – Digital Sample/ Example of Terrain Model (DTM)/ DEM Generation of Geo – Tiff – Format of *Moying to Migging (189.100 Km)* Projected New Road at *Moying* Latitude of *28°38'45.60"* (North) and Longitude of *94°59'58.62"* (East); *Migging* Latitude of *28°51'03.46"* (North) and Longitude of *94°46'21.54"* (East). Vetting/ Geology and Slope Stability are observed by Environmental Team Experts. (Part – I)**




TAWANG MONASTERY


ARUNACHAL PRADESH
CHINA
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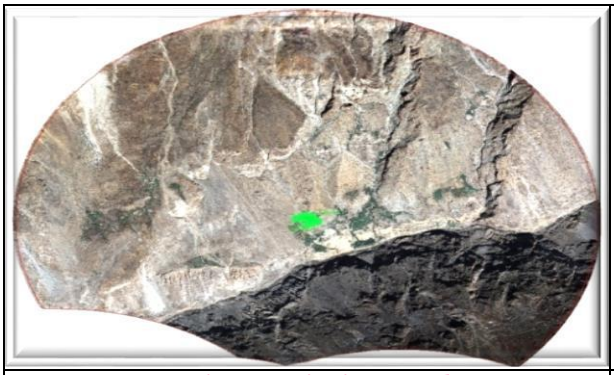
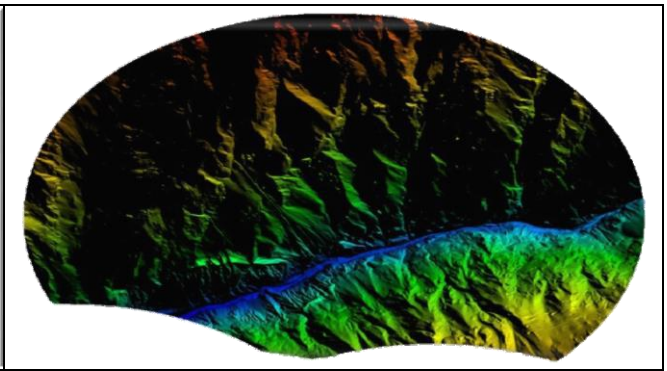
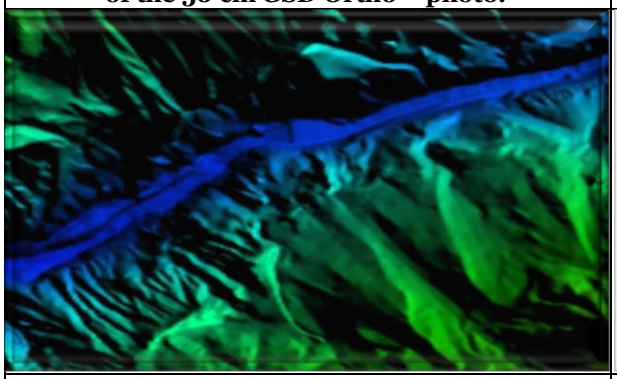
BHUTAN
NAGALAND
A S S A M
International Boundary
State Boundary
Path
Tourist Place
Other Place
District Headquarter



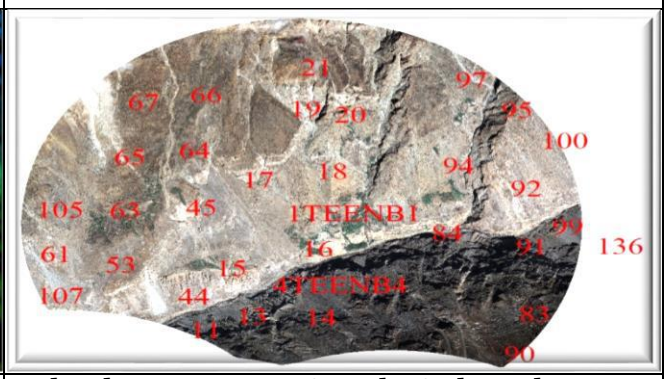
Moying to Migging Road, Village (UK) Area – 37.625 Sq. Km. Overview of the 50 cm GSD Ortho – photo.



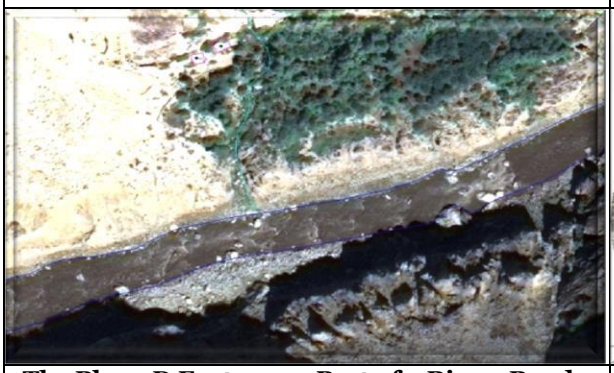
The 5 m Grid DEM a Relief View (An Overview for the Whole Area of Interest).



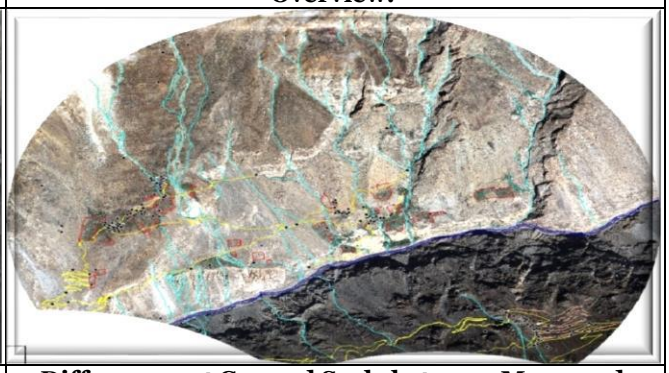
The DEM in Relief View for a Part of a River.



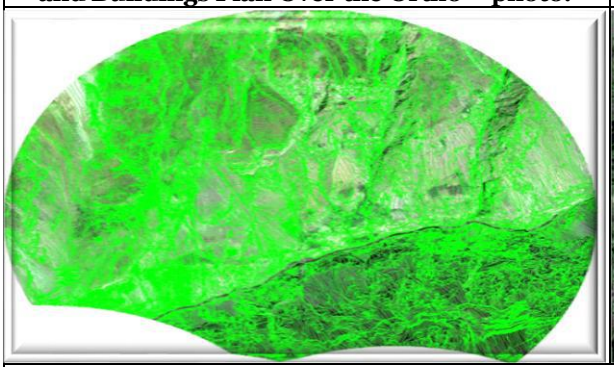
The Plan 3D Features Over the Ortho – photo an Overview.

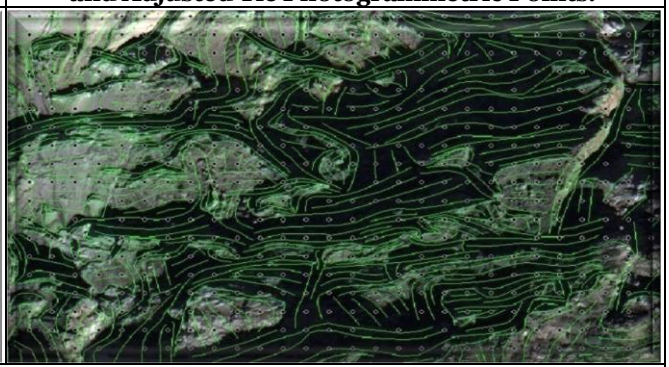


The Plan 3D Features – Part of a River; Roads and Buildings Plan Over the Ortho – photo.



Differences at Ground Scale between Measured and Adjusted Tie Photogrammetric Points.





Compilation of Break Lines (A Line Portrays the Sudden Changes in the Elevation) and Mass Points Using Stereo Images.

State:	**Arunachal Pradesh**
Name:	**Moying to Migging, Road (UK) Part – I**
Total Length of the Road as per Remote Sensing:	**189.100 Km**
Total Sq. Km. Area as per 5 Km Buffer Boundary:	**37.625 Sq. Km.**

Dr. A.K. Keshari
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016

Figure 4: The Tentative Prototype – Paradigm – Digital Sample/ Example of Digital Terrain Model (DTM)/ DEM Generation of Geo – Tiff – Format of *Moying to Migging Road, Village (189.100 Km)* Projected New Road at *Moying* Latitude of 28°38'45.60" (North) and Longitude of 94°59'58.62" (East); *Migging* Latitude of 28°51'03.46" (North) and Longitude of 94°46'21.54" (East). Vetting/ Geology and Slope Stability are observed by IIT Delhi/ Roorkee Team Experts. (Part – I)

Climatic Projection Index

The climate of Arunachal varies with elevation. The low altitudes 100 m to 1,500 m have a **"Humid Subtropical Climate"**. High altitude and very high altitude areas (3,500 m to 5,500 m) have a subtropical highland climate and alpine climate. Arunachal receives 2,000 to 5,000 millimeters (79 in to 197 in) of rainfall annually, 70% to 80% obtained between May and October, snowfall annually, obtained between November and March. The **"Climate of Arunachal"** is sharply demarcated in case of its two distinct divisions: the predominant hilly terrain and the smaller plain region. The most favorable time to visit Arunachal happens to be in the course of the summers when the weather is very clement and mild. Certain areas of the hills even become inaccessible in winter due to extremities of **"Climate"** causing prolonged snowfall. The plain region seems to be at its best in terms of **"Climate"** in winter, when the weather is pleasant. The type of **"Climate"** that is mainly to be found in the plains closely resembles the corresponding state in the Gangetic plain. Summers are exceedingly hot with temperatures crossing the 40°C mark and considerable humidity. Winters can be chilly with temperatures going below 5°C at times. The **"Climate"** in the Northern part of Arunachal is typically Himalayan. This mountain range itself exerts an appreciable extent of influence on monsoon and rainfall patterns. Within the Himalayas, **"Climate"** differs depending on altitude and position. **"Climate"** ranges from subtropical in the Southern foothills, averaging summer temperatures of about 30°C (about 86°F) and winter temperatures of about 18°C (about 64°F). Warm temperate conditions prevail in the Middle Himalayan valleys, with summer temperatures usually hovering about the mark of 25°C (about 77°F) and cooler winters.

Cool temperate conditions dominate the higher areas of the Middle Himalayas, where the summer temperatures are usually around 15°C to 18°C (59°F to 64°F) and winters drop below the freezing point. You will encounter a cold alpine **"Climate"** at higher reaches where summers are cool and winters are harsh. At altitudes over 4,880 Meters (16,000 Feet), the climate is bitterly cold with temperatures consistently below the freezing point and the area perennially shrouded in snow and ice. The Eastern flanks of the Himalayan ranges are subject to heavy rainfall while the Western section is relatively dry. Arunachal is characterized by two types of **"Climate",** sharply differentiated in the plains and the mountainous regions. The climate of the Arunachal Pradesh has been roughly divided into the tropical, temperature and alpine zones. For most of the period in a year, the climate is cold and humid as rainfall occurs in each month. The area experiences a heavy rainfall due to its proximity to the Bay of Bengal. The rainfall in North district is comparatively less than of the other districts. The general trend of decrease in temperature with increase in altitude holds good everywhere. Pre – monsoon rain occurs in April – May and monsoon (South – West) operates normally from the month of May and continues up to early October.

Temperature Profile Index

The mean temperature in the lower altitudinal zone, it varies from 1.5°C to 9.5°C. Temperature varies with altitude and slope. The maximum temperature is recorded usually during July and August and minimum during December and January. Fog is a common feature in the entire state from May to September. Biting cold is experienced at high altitude places in the winter months and snowfall is also not uncommon during this period.

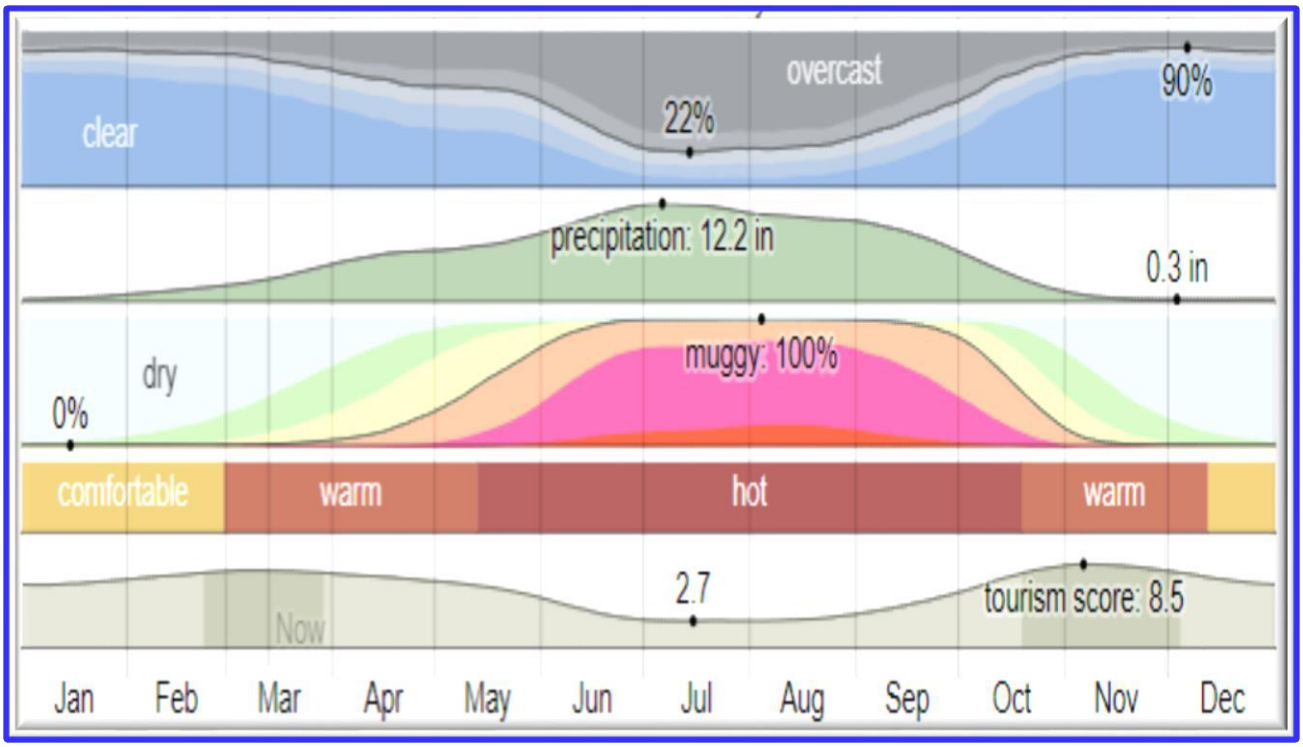
The average temperature for the year in Arunachal is 23.5°C or 74.3°F. The warmest month, on average, is June with an average temperature of 31.1°C or 88.0°F. The coolest month on average is January, with an average temperature of 13.3°C or 55.9°F. The average amount of precipitation for the year in Arunachal is 1,132.5 mille meters or 44.59 inches. The month with the most precipitation on average is August with 330.3 mille meters or 13.00 inches of precipitation. The month with the least precipitation on average is November with an average of 4.8 mille meters or 0.19 inches. There is an average of 46.8 days of precipitation, with the most precipitation occurring in August with 11.9 days and the least precipitation occurring in November with 0.6 days in the **Table 3**.

Table 3: Average Temperature Climate Data for the Year in Arunachal Pradesh.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	15.2	17.2	20.7	23.1	24.9	26.9	27.4	27.5	26.7	24.2	20	16.3
Min. Temperature (°C)	8.7	11.3	14.6	17.9	20.7	23.2	23.8	23.9	23	19.8	14.2	9.9
Max. Temperature (°C)	21.7	23.2	26.8	28.4	29.1	30.6	31.1	31.1	30.4	28.7	25.8	22.8
Avg. Temperature (°F)	59.4	63.0	69.3	73.6	76.8	80.4	81.3	81.5	80.1	75.6	68.0	61.3
Min. Temperature (°F)	47.7	52.3	58.3	64.2	69.3	73.8	74.8	75.0	73.4	67.6	57.6	49.8
Max. Temperature (°F)	71.1	73.8	80.2	83.1	84.4	87.1	88.0	88.0	86.7	83.7	78.4	73.0
Precipitation / Rainfall (mm)	28	32	104	164	436	482	499	438	325	156	27	13

Source: India Meteorological Department Weather Base.

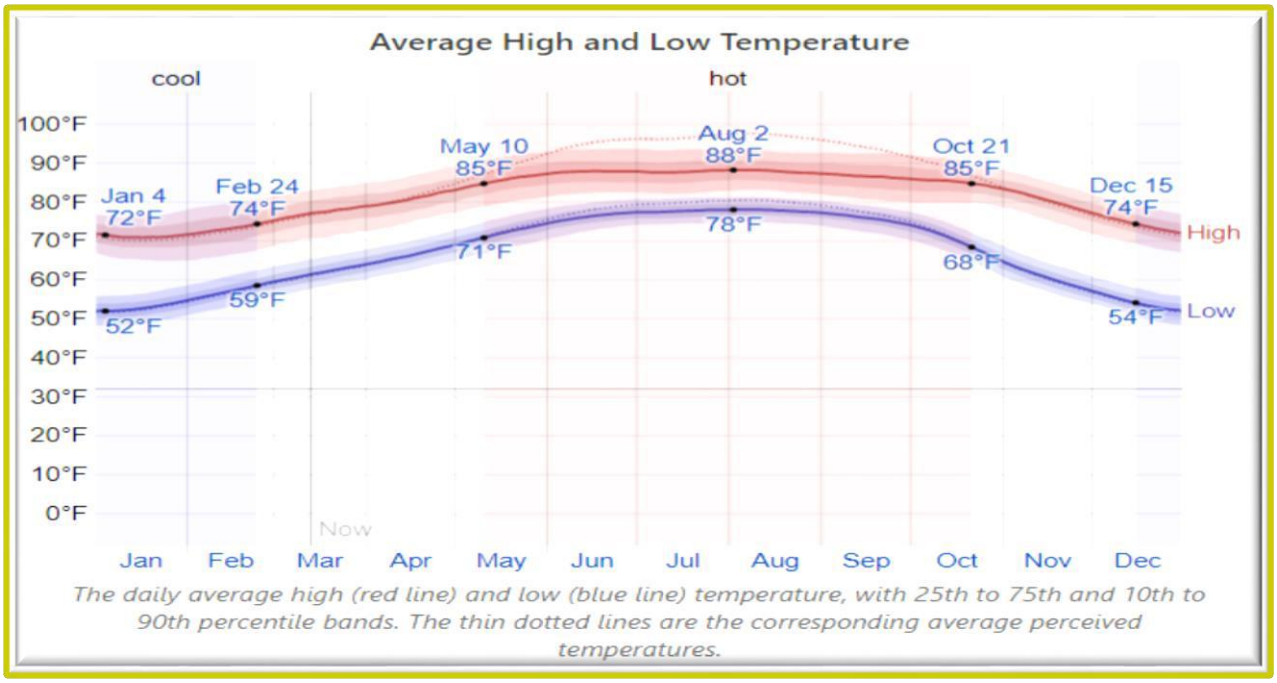
Figure 5 (a): Climate Summary Data for Arunachal Pradesh.



Average Weather Index in Tezu

In Tezu, the wet season is hot, muggy, and partly cloudy and the dry season is warm and mostly clear. Over the course of the year, the temperature typically varies from *52°F* to *88°F* and is rarely below *48°F* or above *94°F*. Based on the tourism score, the best times of year to visit Tezu for warm – weather activities are from *late February* to *late March* and from *mid October* to *early December* in the **Figure 5 (b)**.

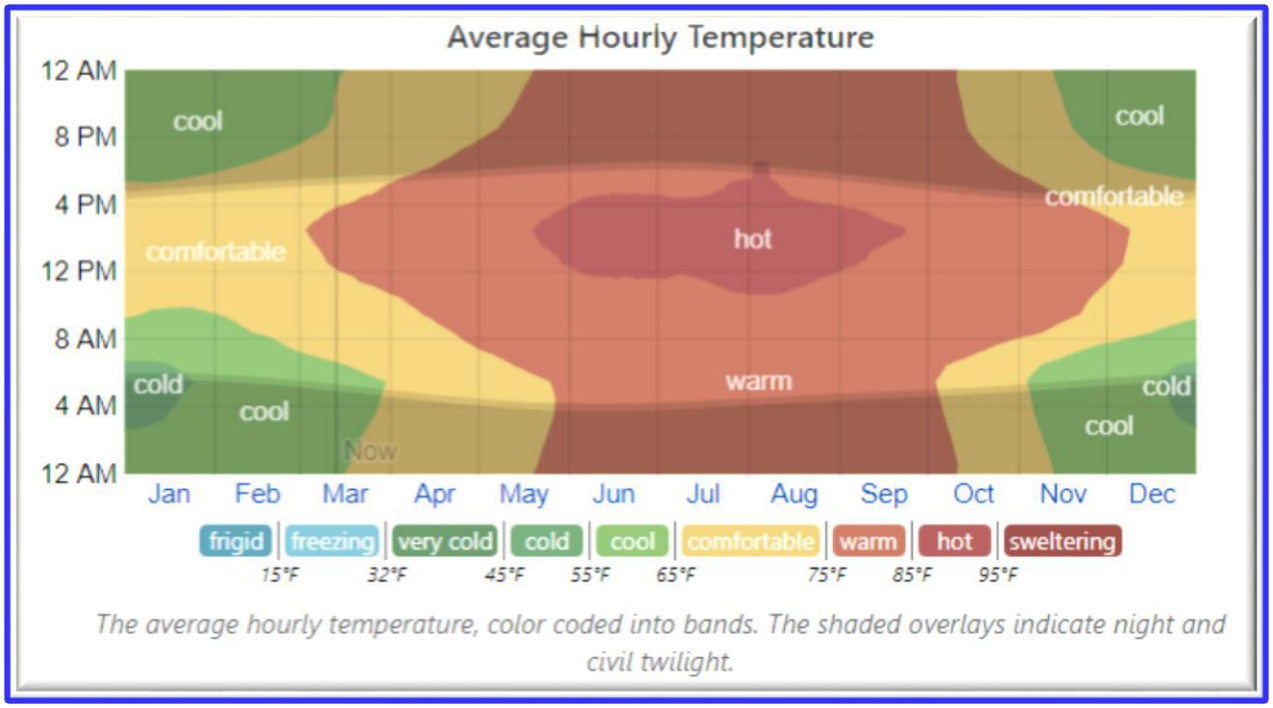
Figure 5 (b): Average High and Low Temperature Summary for Arunachal Pradesh.



The *hot season* lasts for *5.3 months*, from *May 10* to *October 21*, with an average daily high temperature above *85°F*. The hottest day of the year is *August 2*, with an average high of *88°F* and low of *78°F*. The *cool season* lasts for *2.3 months*, from *December 15* to *February 24*, with an average daily high temperature below *74°F*. The coldest day of the year is *January 4*, with an average low of *52°F* and high of *72°F*.

The below **Figure 5 (c)** shows a compact characterization of the entire year of hourly average temperatures. The horizontal axis is the day of the year, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day.

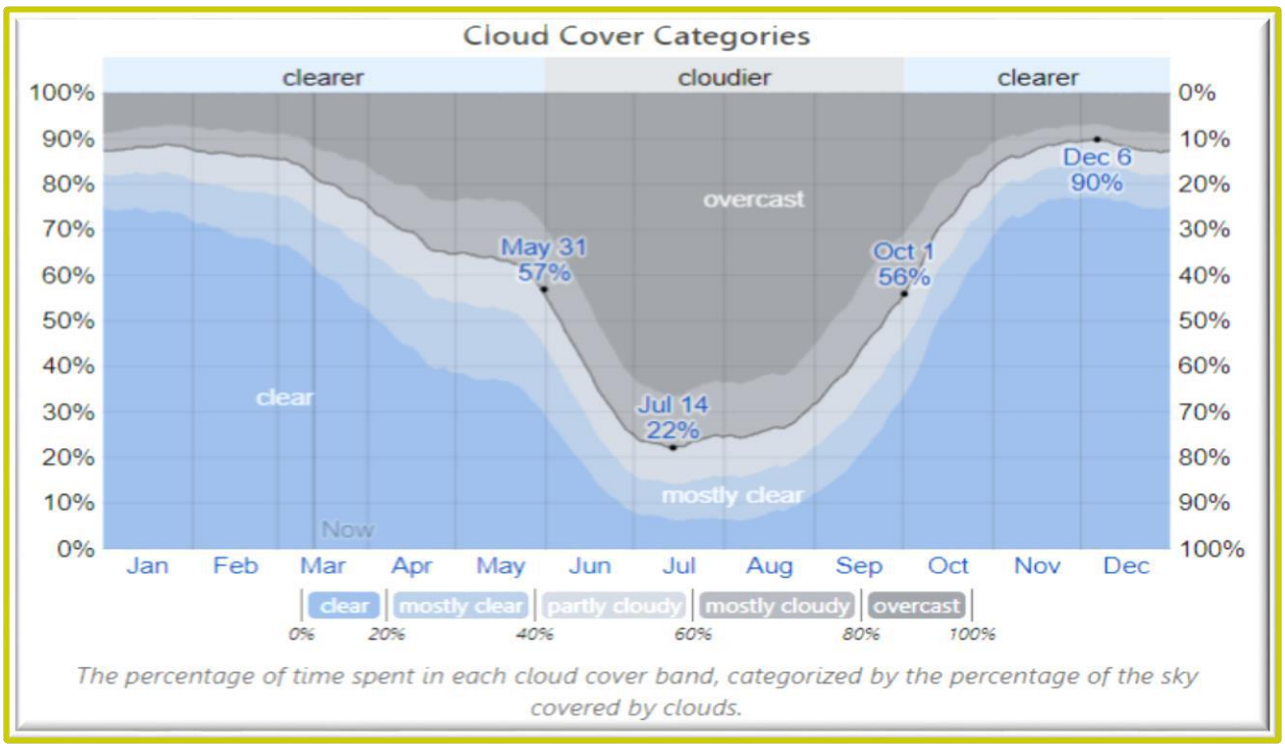
Figure 5 (c): Average Hourly Temperature Summary for Arunachal Pradesh.



Clouds Index

In Tezu, the average percentage of the sky covered by clouds experiences *extreme* seasonal variation over the course of the year. The *clearer* part of the year in Tezu begins around *October 1* and lasts for *7.9 months*, ending around *May 31*. On *December 6*, the *clearest day* of the year, the sky is *clear*, *mostly clear*, or *partly cloudy 90%* of the time, and *overcast* or *mostly cloudy 10%* of the time. The *cloudier* part of the year begins around *May 31* and lasts for *4.1 months*, ending around *October 1*. On *July 14*, the *cloudiest day* of the year, the sky is *overcast* or *mostly cloudy 78%* of the time, and *clear*, *mostly clear*, or *partly cloudy 22%* of the time in the **Figure 5 (d)**.

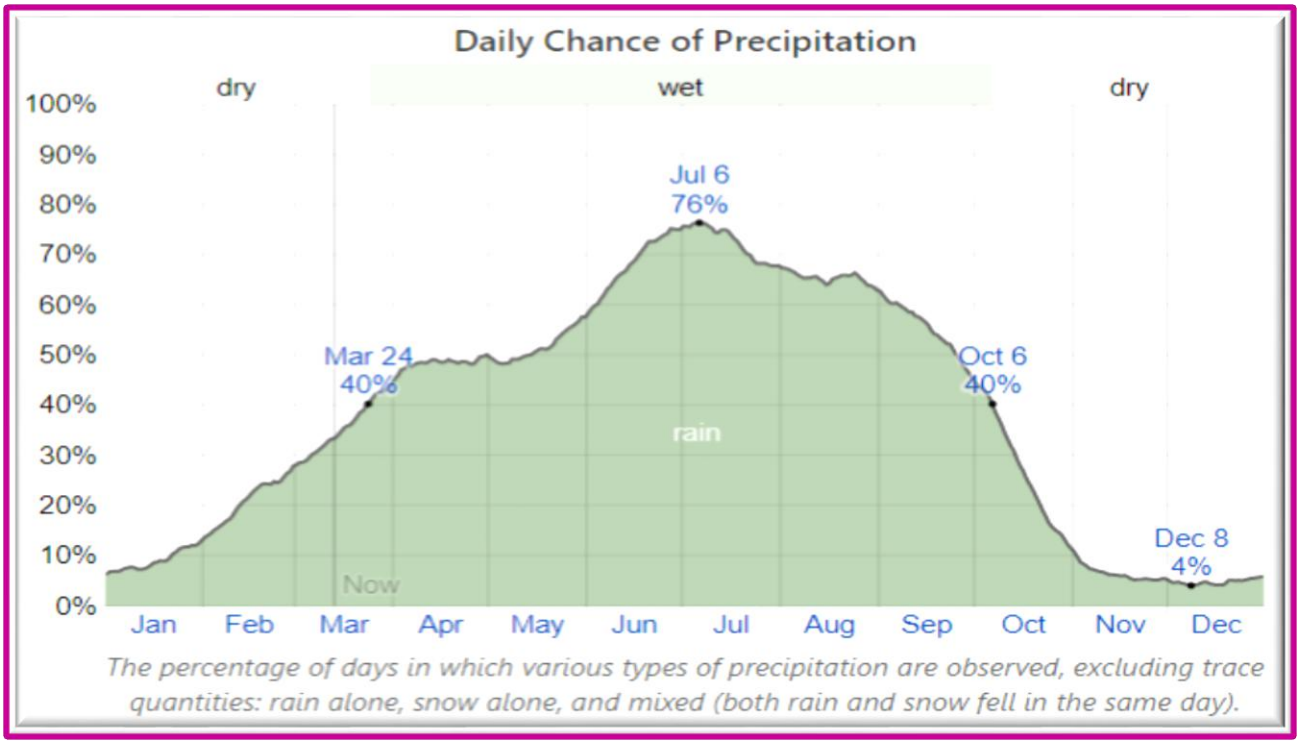
Figure 5 (d): Cloud Cover Categories for Arunachal Pradesh.



Precipitation Index

A wet day is one with at least 0.04 inches of liquid or liquid – equivalent precipitation. The chance of wet days in Tezu varies very significantly throughout the year as shown in the **Figure 5 (e)**. The wetter season lasts 6.5 months, from March 24 to October 6, with a greater than 40% chance of a given day being a wet day. The chance of a wet day peaks at 76% on July 6. The drier season lasts 5.5 months, from October 6 to March 24. The smallest chance of a wet day is 4% on December 8. Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 76% on July 6.

Figure 5 (e): Daily Chance of Precipitation for Arunachal Pradesh.

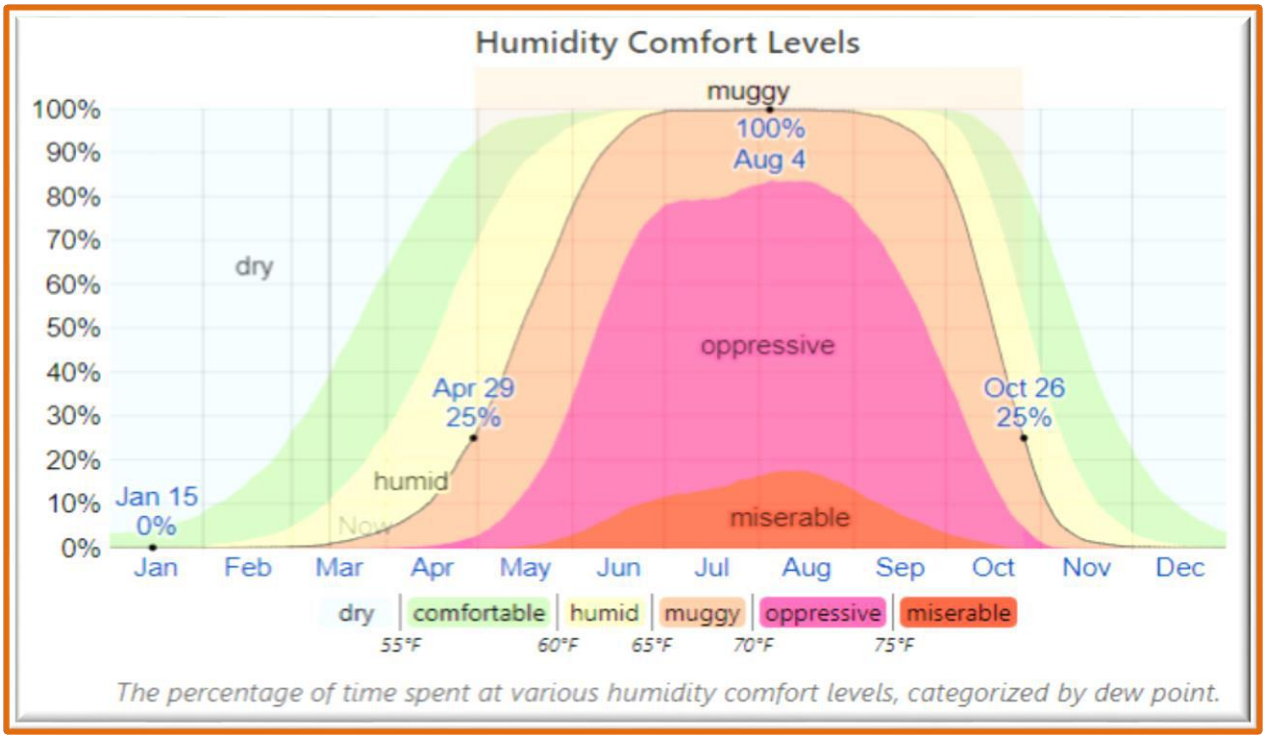


Humidity Index

Basic Information: Meteorological Data at 03, 06, 09 and 12 **"Universal Time Coordinated" (UTC)** and also upper air data through pilot balloon observation manually at 01/ 02 and 11/ 12 UTC daily. Thermometers namely **"Maximum, Minimum, Dry Bulb"** and **"Wet Bulb"** thermometers are kept inside a **"Singles Stevenson Screen" ("Dry Bulb"** gives the air temperature at an instant and **"Relative Humidity"** and **"Dew Point Temperature"** of air is determined from the **"Hygrometric Table"** corresponding to the **"Dry Bulb"** and **"Wet Bulb"** temperatures at the instant). The "**Self – Recording Instruments"** Namely **"Thermograph"** to record air temperature and **Hygrograph"** to record **"Relative Humidity"** of air on daily basis is kept in **"Double Stevenson Screen"**. Ordinary **"Rain Gauge"** to record daily total rainfall and the **"Self – Recoding Rain Gauge"** are installed inside the observatory, besides **"Open Pan Evapori – Meters"** to record the evaporation of air. Charts for all the Self – Recording Instruments are changed at 0820 Hrs 1st daily. The Wind Instruments Namely **"Wind Vane"** to record the direction of air, "**Anemometers"** to record the wind speed and **"Sunshine Recorder"** is installed on the Pilot Balloon Observation Tower. From this tower, Upper Air Circulation over **"Arunachal of Moying to Migging Road"** is observed manually from instrument known as **"Optical Theodo – lite"**. **"Upper Data"** are analyzed digitally through **"Hand Held Data Logger"**. Both the **"Kew Pattern (K. P.) Barometers"** and **"Self – Recording Barograph"** installed in the **"Observatory Office"** records the **"Atmospheric Pressure"** at any instant.

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. Tezu experiences extreme seasonal variation in the perceived humidity. The muggier period of the year lasts for 5.9 months, from April 29 to October 26, during which time the comfort level is muggy, oppressive, or miserable at least 25% of the time. The muggiest day of the year is August 4, with muggy conditions 100% of the time. The *least muggy* day of the year is *January 15*, when muggy conditions are essentially unheard of as shown in the **Figure 5 (f)**.

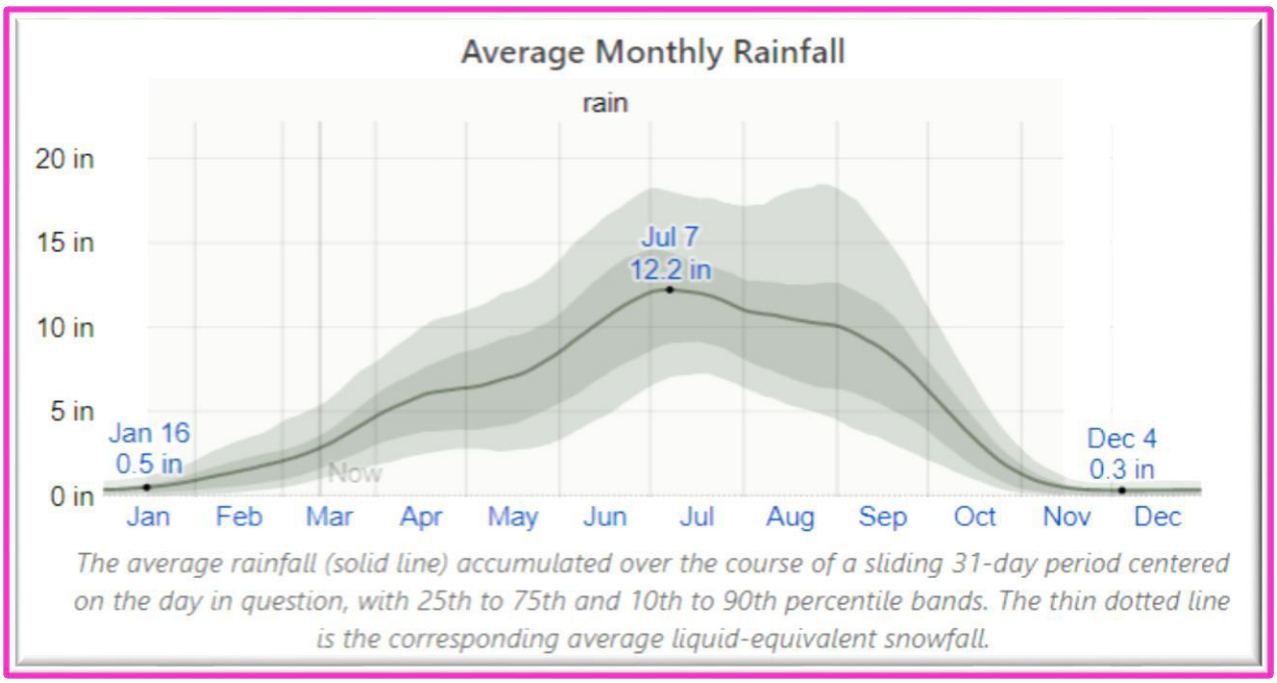
Figure 5 (f): Humidity Comfort Levels for Arunachal Pradesh.



Rainfall Index

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31 – day period centered on each day of the year. Tezu experiences *extreme* seasonal variation in monthly rainfall. The *rainy* period of the year lasts for *10 months*, from *January 16* to *November 15*, with a sliding 31 – day rainfall of at least *0.5 inches*. The *most rain* falls during the 31 days centered on *July 7*, with an average total accumulation of *12.2 inches*. The *rainless* period of the year lasts for *2.0 months*, from *November 15* to *January 16*. The *least rain* falls around *December 4*, with an average total accumulation of *0.3 inches* in the **Figure 5 (g)**.

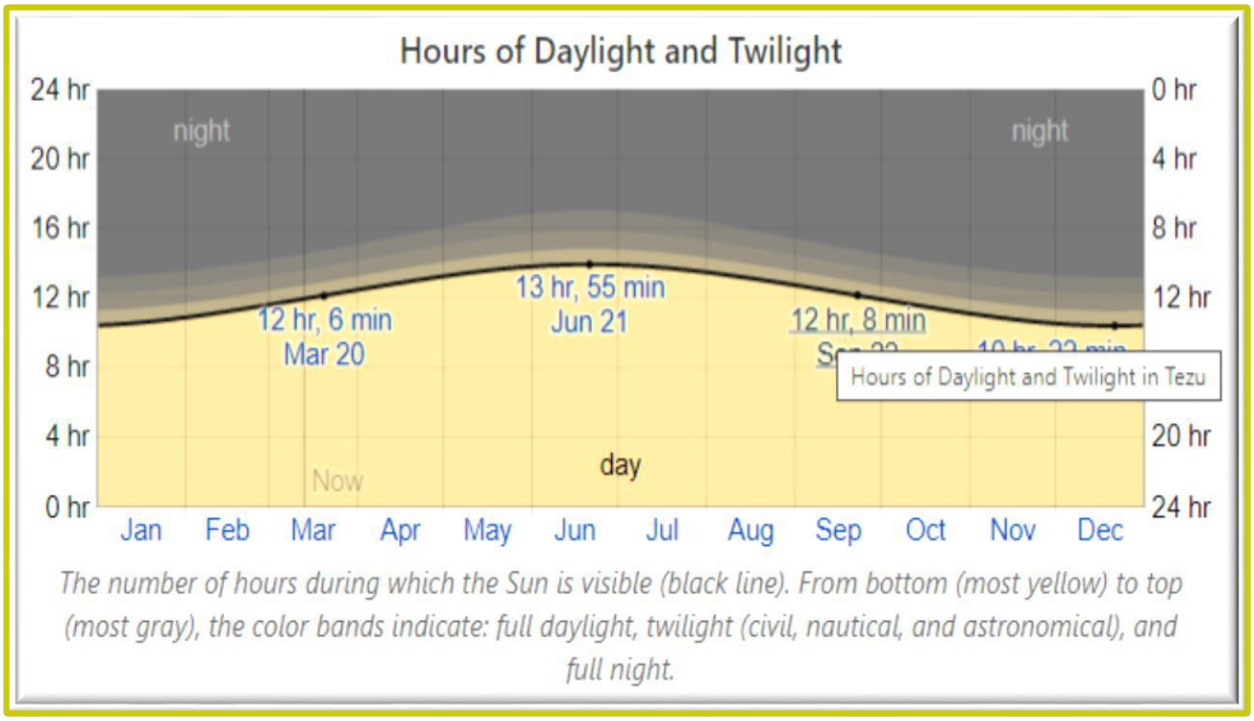
Figure 5 (g): Extreme Seasonal Variation in Monthly Rainfall for Arunachal Pradesh.



Sun Shine Index

The length of the day in Tezu varies over the course of the year. In 2020, the shortest day is December 21, with 10 hours, 22 minutes of daylight; the longest day is June 21, with 13 hours, 55 minutes of daylight in the **Figure 5 (h)**. The *earliest sunrise* is at *4:08 AM* on *June 9*, and the *latest sunrise* is *1 hour, 49 minutes* later at *5:58 AM* on *January 12*. The *earliest sunset* is at *4:09 PM* on *December 1*, and the *latest sunset* is *1 hour, 56 minutes* later at *6:05 PM* on *July 1*. **"Daylight Saving Time" (DST)** is not observed in Tezu during 2020.

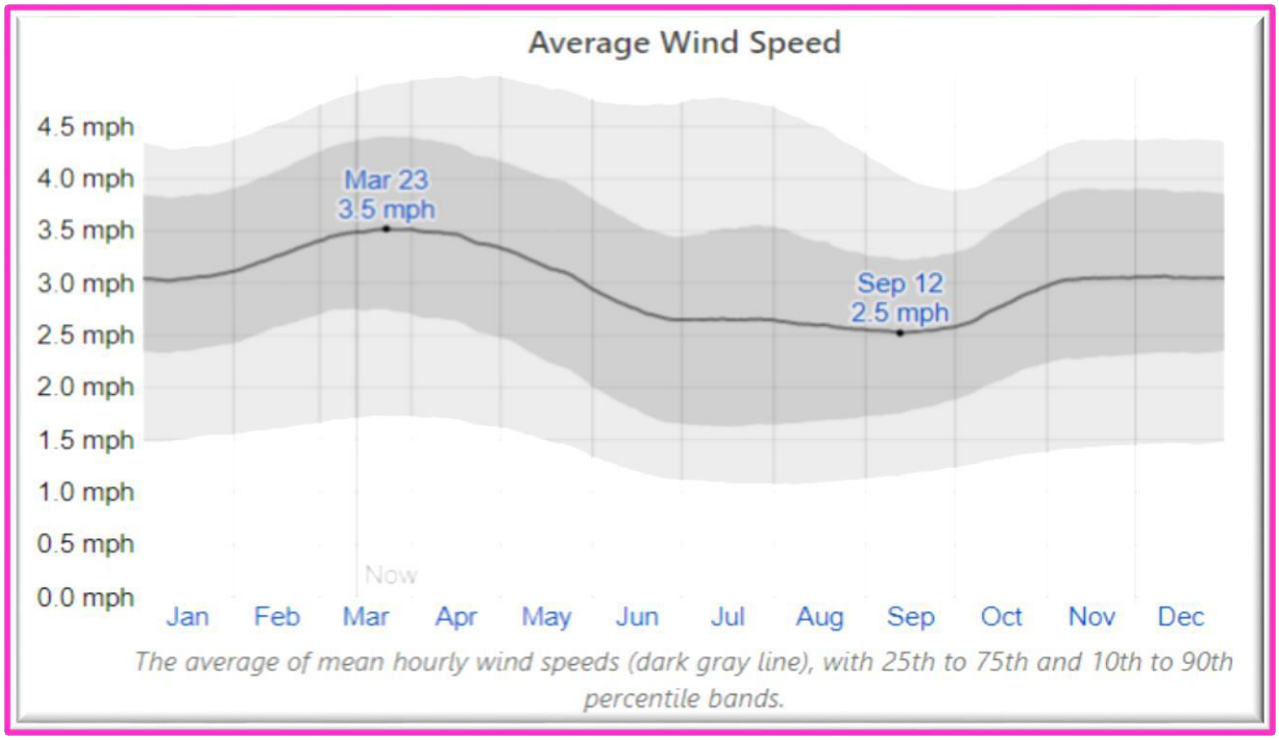
Figure 5 (h): Hours of Daylight and Twilight for Arunachal Pradesh.



Wind Pattern Index

The wind intensity is not high except when accompanied by Pre – monsoon thunderstorms. However, in the afternoon they are comparatively more severe. Their direction is generally South Easterly in the mornings and sometimes changes to North Westerly in the evenings. This section discusses the wide-area hourly average wind vector (speed and direction) at *10 meters* above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Tezu does not vary significantly over the course of the year, remaining within *0.5 miles per hour* of *3.0 miles per hour* throughout in the **Figure 5 (i)**.

Figure 5 (i): Average Wind Speed for Arunachal Pradesh.

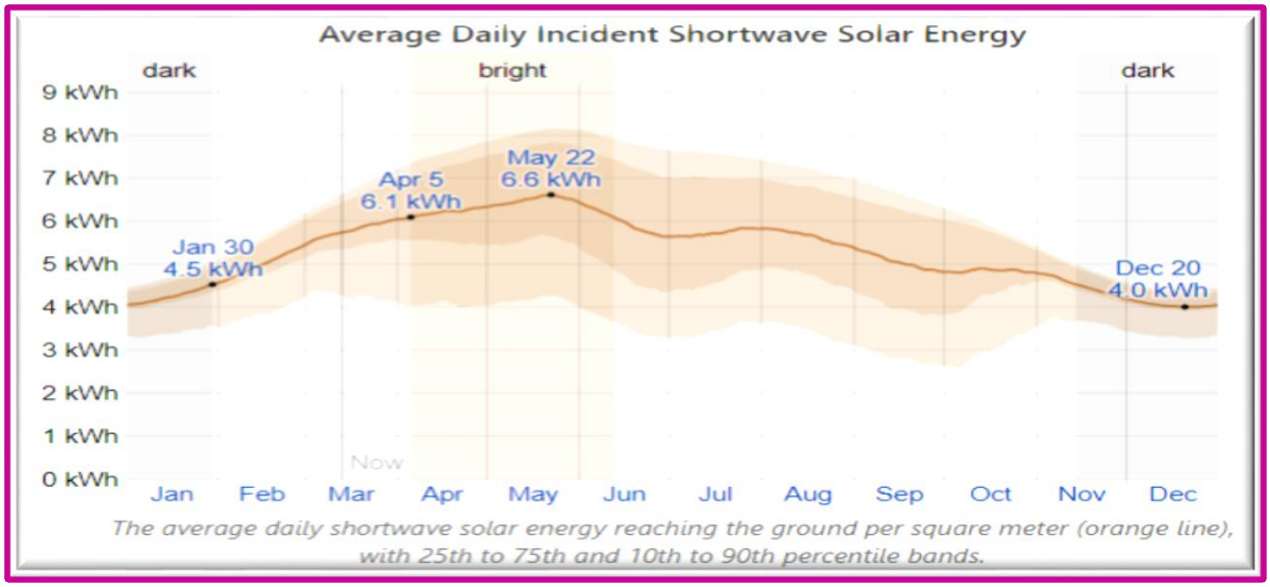


Topography and Solar Energy Index

This section discusses the total daily incident shortwave solar energy reaching the surface of the ground over a wide area, taking full account of seasonal variations in the length of the day, the elevation of the Sun above the horizon, and absorption by clouds and other atmospheric constituents. Shortwave radiation includes visible light and ultraviolet radiation. The average daily incident shortwave solar energy experiences *some* seasonal variation over the course of the year as shown in the **Figure 5 (j)**. The brighter period of the year lasts for 2.2 months, from April 5 to June 12, with an average daily incident shortwave energy per square meter above 6.1 kWh. The brightest day of the year is May 22, with an average of 6.6 kWh. The darker period of the year lasts for 2.5 months, from November 14 to January 30, with an average daily incident shortwave energy per square meter below 4.5 kWh. The darkest day of the year is December 20, with an average of 4.0 kWh. For the purposes of this report, the geographical coordinates of Tezu are 27.913 degree latitude, 96.129 degree longitude, and 663 feet elevation.

The topography within *2 miles* of Tezu contains only *modest* variations in elevation, with a maximum elevation change of *194 feet* and an average elevation above sea level of *660 feet*. Within *10 miles* contains only *modest* variations in elevation (*4,843 feet*). Within *50 miles* also contains *extreme* variations in elevation (*16,601 feet*). The area within *2 miles* of Tezu is covered by *cropland* (*46%*), *shrubs* (*27%*), and *trees* (*25%*), within *10 miles* by *trees* (*47%*) and *cropland* (*30%*), and within *50 miles* by *trees* (*62%*) and *cropland* (*19%*).

Figure 5 (j): Average Daily Incident Shortwave Solar Energy for Arunachal Pradesh.



Extra Widening/ Improvement Index

- The Project road is proposed as two lanes with shoulder, drain, and extra widening (7.0 m + 2 × 0.9 m + 0.6 m + 0.6 m) as shown in the **Table 4**.

Table 4: Extra Widening/ Improvement and Land Acquisition Index.

Sr. No.	Feature	Description
1.	*Extra Widening/ Land Acquisition (7.0 m + 2 × 0.9 m + 0.6 m + 0.6 m)*	**24 m Wide Strip of Land is Required**

The aim of reconnaissance survey was to assess the scope of land acquisition and resettlement study and accordingly the detailed plan of action was prepared for the preparation of land acquisition planning and resettlement plan. The transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization with the least disturbance to the owners of the land and other affected families and provide just fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make adequate provisions for such affected persons for their rehabilitation and resettlement and for ensuring that the cumulative outcome of compulsory acquisition should be that affected persons become partners in development leading to an improvement in their post – acquisition social and economic status and for matters connected therewith or incidental thereto.

Methodology for Social Impact Assessment

Project Road if traverses through hilly/ mountainous and steepas well as plain terrain. The proposed alignment improvement design is based on various parameters. The design principles for alignment selection have been evolved based on discussions with the expertise in Highway Engineers, Bridge Design Specialists, Environmentalist, Transport and other key personnel. The selection of the alignment is broadly based on the following criteria:

- *Technical soundness and economic viability;*
- *Least social and environmental adverse impact;*
- *Least displacements and loss of public property;*
- *Avoiding adverse impact to water bodies and other environmental features;*
- *Locations of required causeways;*

3. PROJECT DESCRIPTION AND ALIGNMENT

Projected Road Description: The Project Section of **Moying to Migging, Road** is located in the district of Siang, which in turn is located in the State of Arunachal length as per topography survey is **189.100**

Km and as per design is 21.400 Km. The alignment of the project road is connecting Moying (Defence Check Post) and Migging Pass (Near China Border). The project road Moying to Migging having length of ***189.100 Km*** and the project stretch is traversing in hilly terrain from ***Moying at (28°38'45.60" N Latitude and 94°59'58.62" E Longitudes)*** and ***Ends*** at ***Migging Village (28°51'03.46" N Latitude and 94°46'21.54" E Longitudes)*** in the State of Arunachal. The RL difference between two locations is 203 m. ***"The Proposed designed alignment/ corridor between these stations comes out to be from 92+250 Km to 189+100 Km"***.

Start/ End Points, Terrain and Land Form

The roads are ***Moying to Migging*** in the state of Arunachal. The starting point of the Project road is **Moying** and ***Ends*** at **Migging**. The Place Moying is spread in valley which is surrounded by high hills on East and West side. It is situated in **"District Dibang Valley"**.

Migging: This is the last point of project stretch and is spread on a wide flat ground (plateau) surrounded by high hills. It is 20.0 Km from ***Migging*** and since the place is on a high altitude, it is experienced that the oxygen level is low. There is no existing road except foot track from ***Moying*** towards **Migging** for most of the length except some isolated sections where the conditions are badly damaged. The remaining portion of the project stretch is traversing in hilly terrain starting at ***Migging*** and ***Ends*** at **Migging**. This stretch is for an approximate length of **189.100 Km** and the place ***Moying*** is spread in valley which is surrounded by high hills on East and West side. It is situated in **"District Dibang Valley"** and the project road is passing through in hilly terrain throughout the stretch.

Shoulder and Road Width

The reconnaissance and alignment of project road survey, no boundary stones were found. Further, it was confirmed that land for the proposed alignment is yet to be acquired depending upon the design of the alignment, hence no existing ROW. ***Moying to Migging,*** starts from Moying and terminates at Migging. The actual design length of the proposed alignment is **21.400 Km**. On the project road (***Moying to Migging***), as it is entirely new alignment and there is only a foot track, there is no traffic plying on this section comprises Single lane (3.75 wide for entire length), with 1.25 m wide shoulders on either side and the terrain is mountainous and has steep gradients. The proposed alignment is a link for ***Moying to Migging***. The pattern on both side of road is barren land. The details of land use pattern along the project road are **(Figure 6)**:

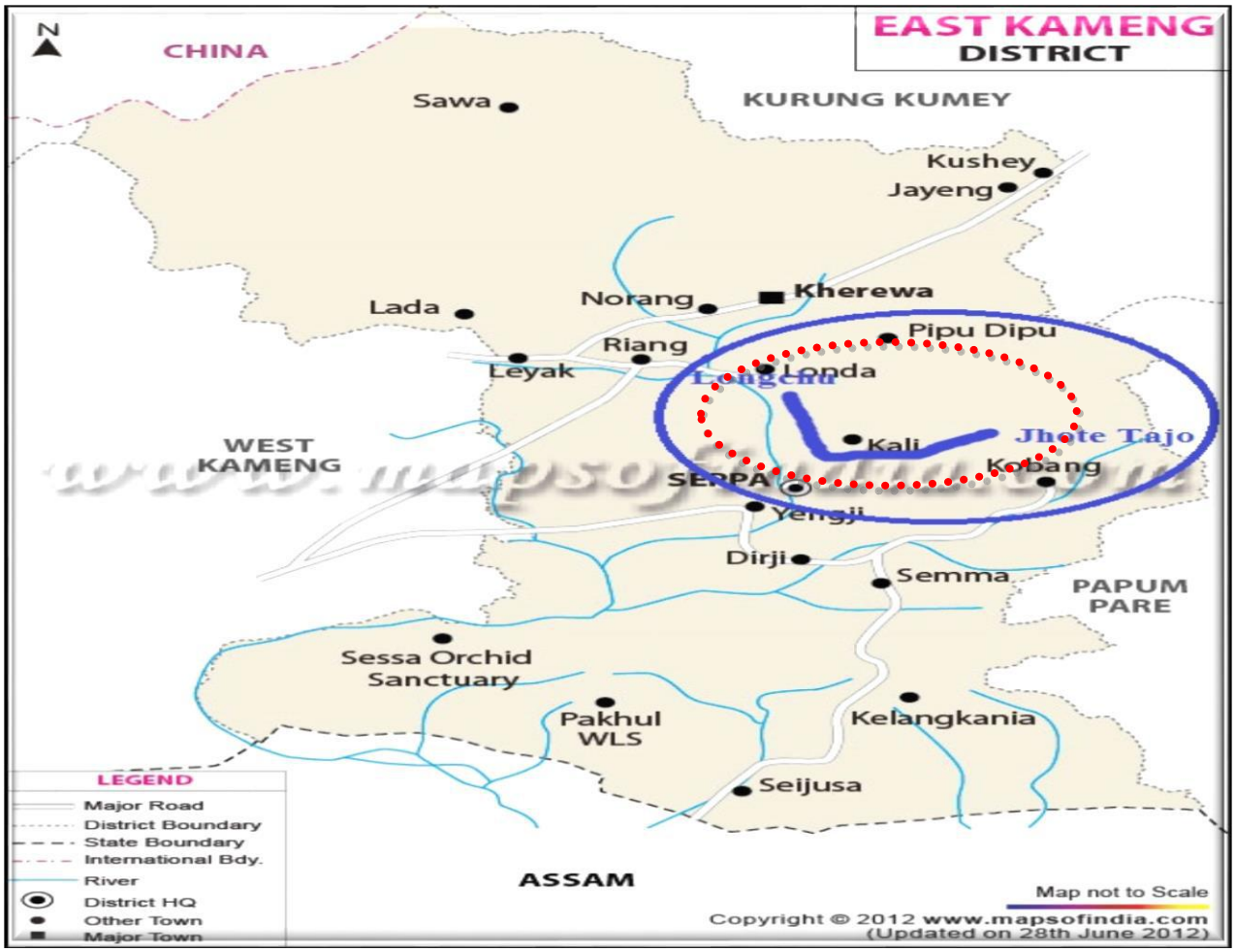


Figure 6: Approved Project Alignment of Moying to Migging Road Projected as per Inception Report by IIT Delhi/ Roorkee Team Experts.

Traffic Survey Overview: Traffic surveyors comprehend the gratitude of existing traffic and travel distinctiveness is immensely important to boost wide – ranging traffic and transportation plan. With tremendous years of knowledge in survey services viz. Traffic survey, Pedestrian Count, Vehicle Parking, Origin – Destination Survey and Connected Services, Traffic surveyors brings a wealth of acquaintance/ knowledge and practice to any proposed projects. The proposed alignment is a link between ***Moying to Migging*** in the state of Arunachal and the total length of the proposed alignment is **189.100 Km**. As the entire proposed alignment is a new alignment, there is no traffic survey have been conducted on the same study report.

Road Description: The project road **Moying to Migging** is having length of ***189.100 Km.*** The project stretch is traversing in hilly terrain from **Moying (3,139 m or 10,298.56 Feet in Height)** and ends at **Migging (5,070 m or 16,633.86 Feet in Height)**. The Reduced Level (RL) difference between two locations is **5,632 m (18,478 Feet)**. The Proposed designed alignment between these station comes out to be ***189.100 Km.*** (As shown above in yellow colour) given in **Figure 6**. The Projected Corridor **Moying to Migging, Road** in North Arunachal is a newly declared under **Part: 1,** connecting link NH/ SH in the Arunachal Pradesh.

Moying (मोईंग) Overview

It has enough spices to ensure a better living for its residents, but no road to take them forward. Enter Sissen Village in East Siang district of Arunachal Pradesh. The tiny village, perched atop a hillock on the right bank of Siang river, has earned laurels for record production of organic spices but still lacks a motorable road connecting it with the rest of the world. The only means of communication for the few hundred villagers is a bamboo hanging bridge over the river. Adults as well as children cross the river risking their lives everyday. The village has farming enthusiasts from each household growing spices such as cardamom, ginger, red chilli, turmeric, medicinal and aromatic plants, and many other agriculture and horticulture products. Every native

of the village has turned into organic spices growers' to sustain themselves without depending on contract works or government jobs. The villagers sold more than two tonnes of large Cardamom (Golsey) in the nearest market in Kekar Moying (near Sisen Hanging Bridge), Pasighat and Assam's Dibrugarh District last year at Rs. 800 – 950 per Kg. ***"Villagers carry their produces by head load from their respective farms to the nearest motorable road by covering around five to six km after crossing the hanging bridge. A person used to carry more than 35 Kg of cardamom in local made basket that is worth around Rs. 30,000 (per basket),"*** said Bakin Siram, a young farmer. He said due to suitable soil and climatic condition, each household in the village earns minimum Rs. 1.00 lakh annually from cardamom, orange and ginger cultivations. "Apart from spices cultivation, women from the village sell vegetables, red chilli, fruits, etc." Earlier, the villagers hardly earned Rs. 10,000 per year before opting for horticulture and agriculture farming. "Earlier, our people could hardly earn even Rs. 10,000 per annum. Now we have admitted our children to various private schools in Pangin, Pasighat, Aalo and Itanagar".

Witnessing handsome returns, the villagers have started cultivating rubber and medicinal plants to supplement their annual income. If things go in right direction, the villagers could earn minimum Rs. 5 lakh per annum. ***"Sisen has been one of the successful farming centres of the state. Despite communication bottleneck, the villagers scripted a success story through various schemes of the state horticulture department,"*** East Siang DHO Balom Apum said. "We provide seedlings, barbed wires and construct water tanks from government scheme for them. They identify areas for community farming near their village and utilise it judiciously," Apum said. To encourage spices farming, the state government and the Spice Board of India had on October 26th last year signed a memorandum of understanding here. According to the MoU, the Spice Board of India would set up two auction centres at Namsai and Kimin, besides model nursery at the Eastern, Western and Central Zones of the State. The Board would provide 30% share on subsidy to the cultivators and 20% shares would be provided by the state. The Board would also document the indigenous spices of the state. The state government would facilitate marketing of the spices through **"Buy Back Policy",** and had decided to include spices in the flagship programmes of the state. ***"Arunachal Pradesh has huge potential for organic spices especially large cardamom, ginger, turmeric and star anise, and will assist farmers towards its production through various schemes,"*** Spice Board Director (Development). Sissen village is also historically significant as the British troops had launched an attack on the Adi warriors during the 1911 Anglo – Abor War here. Despite having all the potentials to be among the front – runners, the villagers are lagging far behind and still depending on porter tracks and ramshackle hanging bridge for all purposes. The light of development would only reach the people once the unconnected villages, including Pongging, are linked with the Trans – Arunachal Highway from Moying – Dimme to Pasighat – Mariyang Road.

About Moying (मोईंग)

Arunachal Pradesh is the largest among the seven states located in the North – East of India, with an area of 83,743 square kilometers. It shares its borders with the neighbouring countries of Bhutan in the West, China (Tibet) in the North and North – East, Myanmar in the East and South – East and the Indian states of Assam and Nagaland in the South. The geographic location of the state provides immense opportunities for international trade with South Asian countries such as Myanmar, Bhutan and China.

At current prices, the Gross State Domestic Product of Arunachal Pradesh reached Rs. 293.51 lakh crore (US$ 4.19 Billion) in 2018 – 19 and Rs. 280.52 lakh crore (US$ 4.01 Billion) in 2019 – 20. The state's GSDP (in Rs.) increased at a compound annual growth rate of 12.33% between 2011 – 12 and 2019 – 20. The land is mostly mountainous with the Himalayan ranges running North – South. The state is divided into five river valleys – the Kameng, the Subansiri, the Siang, the Lohit and the Tirap. These river valleys have immense hydropower potential, currently estimated at 50,328 MW, or approximately 22% of India's current power generating capacity. As of November 30th, 2019, the installed hydropower capacity in the state stood at 116.55 MW.

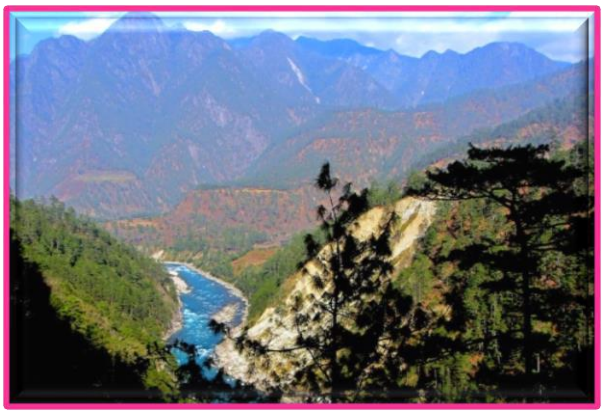
The state's economy is largely agrarian, based on the terraced farming of rice and the cultivation of crops such as maize, millet, wheat, pulses, sugarcane, ginger, oilseeds, cereals, potato, and pineapple. In 2018 – 19* total horticulture production reached 213.87 thousand metric tonnes. Some of the other key industries of the state include art and crafts, weaving, cane and bamboo, horticulture, power and mineral based industry. Due to its topography, the state has varied agro – climatic conditions suitable for horticulture of flowers and aromatic and medicinal plants. Arunachal Pradesh is home to 601 species of orchids, or 52% of the species of orchids known in India, indicating a huge potential for attracting tourists, especially foreign ones. The state and central governments have both offered huge fiscal and policy incentives for the development of thrust sectors in the state. Some of these policies include **"Public Private Partnership Policy" (PPPP)** 2011, the State Industrial Policy 2008 and the Hydro Power Policy 2008. In October 2014,

the According to the **"Department for Promotion of Industry and Internal Trade" (DPIIT),** FDI inflows to the Northeast states totaled to US$ 122 million from April 2000 to June 2019.

Key Sectors:

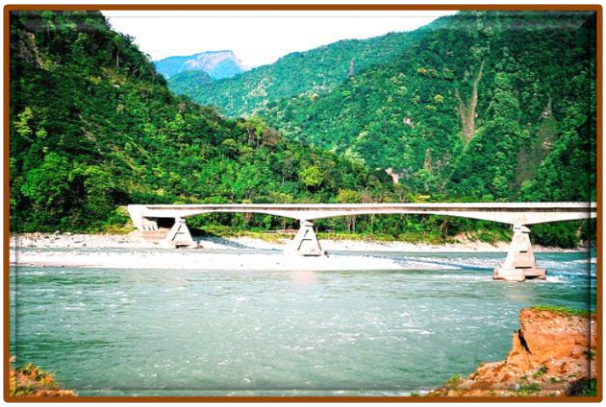
- ***Power:*** *As of November 2019, Arunachal Pradesh had a total installed power generation capacity of 337.14 MW, comprising 116.55 MW from hydro, 136.72 MW from* ***"Renewable Energy Sources" (RES)*** *and 83.87 MW from thermal.*
- ***Agriculture and Forest – Based Industries:*** *The state is largest producer of kiwis in India and the second largest producer of large cardamom. The state also has various inland fisheries resources.*
- ***Tourism:*** *Tourist arrivals in the state reached 451,152 in 2017 with 444,005 domestic visitors and 7,147 foreign visitors.*
- ***Textiles:*** *Under the* ***"North East Region Textile Promotion Scheme",*** *24 sericulture projects are being implemented in for holistic development of sericulture in the state. The projects have been approved for implementation from FY15 – 19 with a cost of Rs. 920.78 crore (US $ 127.4 Million). Raw silk production in the state reached 54 metric tonnes in 2017 – 18 and 59 MT in FY19.*
- ***"Tomo Riba Institute of Health and Medical Sciences" (TRIHMS):*** *Which is the first medical college in the state was made operationalised and college received its first batch of fifty MBBS students in 2018. In State Budget 2019 – 20, Rs. 90 crore (US $ 12.88 Million) and Rs. 40 crore (US $ 5.72 Million) is proposed to provide as Grants – in – Aid for smooth running of the Hospital and Medical College.*

Rivers in the Study Area



Lohit River or Zayü River of Arunachal Pradesh.

Niti Aayog Plan to Build India's Biggest Dam along the River Site in Arunachal Pradesh.



The Lohit River entering the Brahmaputra Valley Plains at Parshuram Kund.

Dihing River at Namsai in Arunachal Pradesh.

Tracing the Mcmohan Line with tunes of Siang.

Brahmaputra Rafting Expedition in Assam.

The **"Lohit River"** or **"Zayü River"** is a river in India and China. It is a tributary to the Brahmaputra River. The river rises in Tibet Autonomous Region, in the Kangri Garpo range, where it is known as the **"Zayü River"** ***(Chinese: 察隅河; Pinyin: Cháyú Hé).*** It descends through this mountainous region and surges through Arunachal Pradesh in India for 200 Kilometres (120 Miles) before entering the plains of Assam where it is known as the Lohit River. Tempestuous and turbulent, and known as the river of blood partly attributable to the lateritic soil, it flows through the Mishmi Hills, to meet the **"Siang" (Brahmaputra)** at the head of the Brahmaputra Valley. Thickly forested for the most part, alpine vegetation gives way to subtropical forests, and then to some of the densest tropical jungles in all of India. Rhododendrons bloom in many hues in the upper reaches, orchids reveal themselves in the lower groves. This is indeed a treasure house of medicinal plant and herbs, and the home of Mishmi Teeta, the Coptis Plant, prized the world over for its medicinal properties.

The **"Mishmis"** hold sway in the hills and in the plains are the **"Khamptis"** and the **"Singphos",** fervent Buddhists and migrants from across **"Patkai"** hills from **"Burma"**. As the Lohit journeys through, Tibetan theology gives way to animist belief, in turn replaced by Theravada Buddhism and then by Hindu temples. This region experiences a mix of many cultures near the tripoint between Tibet, Southeast Asia, and South Asia. The Lohit River comes into India from China and flows near India's Eastern most inhabited tip, at a place called **"Kibithu"**. The Indian Army uses this river for various expeditions, rafting and training programmes. The **"Dhola – Sadiya Bridge",** also referred to as the **"Bhupen Hazarika Setu",** is a beam bridge and longest in India, connecting the Northeast States of Assam and Arunachal Pradesh. The bridge spans the **"Lohit River"** or **"Zayü River",** from the Village of **"Dhola"** in the South to **"Sadiya"** to the North.

Fauna in the Study Area

Yaks in Indian Himalayas Facing Threat of Climate Change Study Report.

Ornate Narrow – Mouthed Frog ***(Microhyla fissipes).***

	
Rare Tortoise Species Sighted for Second Time in Arunachal Pradesh.	**Unique New Species of Pit Viper, with Heat – Sensing System.**
	
Butterfly Scarlet Peacock *(Anartia amathea)*.	**Arunachal Pradesh flags "Spectacular Bird" (Bugun Liocichla) for Tourists and to Curb Poaching.**

Migging (मिगगिंग) Overview

Upper Siang District came into being as a new District in the year 1994 carving out from East Siang District under the notification by the Govt. of Arunachal Pradesh dated 23rd November, 1994. After the formation of Upper Siang District the following administrative Units have come under its control.

1. Yingkiong; 2. Gelling; 3. Singa; 4. Mariyang; 5. Palling; 6. Jengging; 7. Tuting; 8. Geku; 9. Miging; 10. Katan;

Three Sub – divisions were created under Upper Siang District. The subdivisions are Yingkiong, Mariyang and Tuting. The entire district is under the charge of the Deputy Commissioner, who happens to be the administrative and judicial head so far as the district is concerned. He is assisted by number of Additional Deputy Commissioners, Sub – divisional Officers, Extra Assistant Commissioners and Circle Officers. The sub – divisions are headed by Sub – divisional Officer, who are directly responsible to the Deputy Commissioner. The lowest administrative unit is a Circle, which is looked after by a Circle Officer. A Circle can be defined as a group of villages and not as a territorial unit. These villages have their own customary administrative systems in the form of traditional village councils. The Panchayat Raj System was introduced in the district with the North East Frontier Agency (Panchayat Raj) Regulation, 1967 and continued till 1998. At present this system is not in operation. At the time of conducting the 2011 Census, following administrative setup was in operation in the district **(Table 5)**:

Table 5: Migging (मिगगिंग) Overview.

Sr. No.	Sub – Division	Circle		Village
UPPER SIANG DISTRICT	*Yingkiong Sub – Division.*	1.	*Jengging*	13
		2.	*Yingkiong*	07
	Tuting Sub – Division.	1.	*Tuting*	20
		2.	*Gelling*	06

		3.	Singa	14
		4.	Migging	05
		5.	Paling	05
	Mariyang Sub – Division.	1.	Mariang	17
		2.	Geku	13
		3.	Katan	08
		4.	Mopom (Adi Pasi)	04
	3	11		112

Migging 2011 Census Details

The district ranked 14th in terms of population and 3rd in terms of work participation during 2011 Census. Tuting and Singa – Gelling are the two border blocks in Upper Siang District which falls under the Indo China Border. The famous Mac Mohan Line touches Gelling Circle. River Tsangpo enters the district from Tibet and is locally named Tsang Chu which is further named river Siang in the South and Brahmaputra in Assam. River Tsangpo enters the district from Tibet and is locally named Tsang Chu which is further named river Siang in the South and Brahmaputra in Assam. The main agricultural products of the district are paddy, maize, millets, etc. Chilli and fruits are also grown here. In the presence of beautiful landscape, diverse cultural background, large number of Buddhist pilgrimages, Upper Siang is a right place for religious, cultural, ecological and adventure tourism **Figure 7**. The Mouling National Park is a reserve house for diverse flora and fauna and many endangered species are also spotted in the park. Adventure sports like trekking, water rafting, and angling have immense scope for development in this area **(Table 6)**.

Table 6: Migging Village Population and Literacy Rate.

Important Statistics and Census Parameters (Particulars) Data						
State				District		
Number of Villages		*Total*	5,589	112		
		Inhabited	5,258	98		
		Uninhabited	331	14		
Number of Towns		*Statutory*	26	01		
		Census	01	-------		
		Total	27	01		
Number of Households		*Normal*	266,645	7,291		
		Institutional	3,618	33		
		Houseless	314	-------		
Population	Total	*Persons*	1,383,727	35,320		
		Males	713,912	18,699		
		Females	669,815	16,621		
	Rural	*Persons*	1,066,358	28,780		
		Males	546,011	15,335		
		Females	520,347	13,445		
	Urban	*Persons*	317,369	6,540		
		Males	167,901	3,364		
		Females	149,468	3,176		

Percentage Urban Population				22.94	18.52		
Decadal Population Growth (2001 – 2011)							
				Number	**Percentage**	**Number**	**Percentage**
			Persons	285,759	26.03	1,957	5.87
			Males	133,971	23.10	642	3.56
			Females	151,788	29.30	1,315	8.59
Area (in Sq. Km.)				83,743	-------	6,590.00	
Density of Population (Persons per Sq. Km.)							
				17	-------	05	
Sex Ratio *(Number of Females per 1,000 Males)*			***Total***	938	-------	889	
			Rura	953	-------	877	
			Urban	890	-------	944	
Literates			***Persons***	766,005	65.38	18,195	59.99
			Males	439,868	72.55	10,723	66.45
			Females	326,137	57.7	7,472	52.63
Scheduled Castes			***Persons***	-------	0.00	-------	0.00
			Males	-------	0.00	-------	0.00
			Females	-------	0.00	-------	0.00
Scheduled Tribes			***Persons***	951,821	68.79	28,468	80.60
			Males	468,390	65.61	14,413	77.08
			Females	483,431	72.17	14,055	84.56
Workers and Non – Workers *Total Workers (Main and Marginal)*			***Persons***	587,657	42.47	17,644	49.95
			Males	350,273	49.06	9,968	53.31
			Females	237,384	35.44	7,676	46.18
(i) Main Workers			***Persons***	478,721	34.6	14,524	41.12
			Males	301,109	42.18	8,521	45.57
			Females	177,612	26.52	6,003	36.12
(ii) Marginal Workers			***Persons***	108,936	7.87	3,120	8.83
			Males	49,164	6.89	1,447	7.74
			Females	59,772	8.92	1,673	10.07
Non – Workers			***Persons***	796,070	57.53	17,676	50.05
			Males	363,639	50.94	8,731	46.69
			Females	432,431	64.56	8,945	53.82

Category of Workers (Main and Marginal)					
(i) Cultivators	***Persons***	302,723	51.51	9,976	56.54
	Males	302,723	43.64	4,824	48.39
	Females	149,860	63.13	5,152	67.12
(ii) Agricultural Labourers	***Persons***	36,171	6.16	804	4.56
	Males	18,377	5.25	434	4.35
	Females	17,794	7.5	370	4.82
(iii) Workers in Household Industry	***Persons***	8,365	1.42	591	3.35
	Males	4,148	1.18	280	2.81
	Females	4,217	1.78	311	4.05
(iv) Other Workers	***Persons***	240,398	40.91	6,273	35.55
	Males	174,885	49.93	4,430	44.44
	Females	65,513	27.6	1,843	24.01



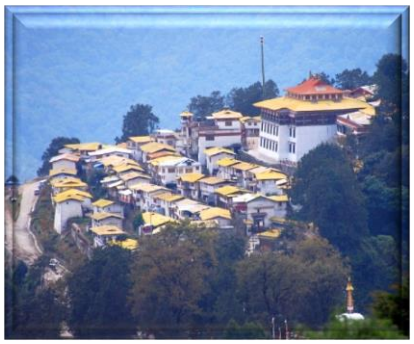




Figure 7: Tawang Landscape and Sage Parshuram Kund Landscape Reflection of Himalayas' Highaltitude Highland.

- *The Existing Alignment of **Moying to Migging, Road** is Newly Declared as NH/ SH; is connecting to Newly Declare Road. The Total Existing Length of the Projected Road is approximately **189.100 Km.***
- *The Actual Design Length of the Project Road is around **21.400 Km.***
- *The project road section between **Moying to Migging, Road** has been divided into following homogeneous section in the **Table 7**:*

Report Purpose

- ✓ *To Identify Existing Traffic Data in the Region/ State;*
- ✓ *To Describe New Data Collection Requirements;*
- ✓ *To Presents the Findings of Data Collection Undertaken;*
- ✓ *To Determine if the Data Collection is Fit for Use;*

Table 7: The Inventory of Moying to Migging Project Road.

ROAD INVENTORY																			
Road Name: Moying to Migging																			
Section : From Km 92+250 To 189+100 Km.											District: Siang Arunachal								
Chainage		Type of Terrain	Land Use Pattern	Name of Village/ Town	Right of Way (m)	Roadway Width (m)	Carriageway			Shoulders		Average Height of Embankment or Depth of Cutting (m)	Road Side Drainage		Service Road, If Any	Details of Cross Roads			Remarks
Km	Km						Type	Width (m)	Condition	Type	Width (m)		Exists (F/NF)	Does not Exist		Location	Destination	C/W (m)	
92+250	189+100	Hilly Terrain	Barren and No Use of Forest Land	Moying to Migging	Right of Way = 24 m	24 m (7.0 m + 2 × 0.9 m + 0.6 m + 0.6 m)	Dense Bituminous Macadam and Bituminous Concrete	Width = 5.5 m	Very Good; But Not Found Horrific OR Dreadful	Unpaved Shoulders	Width = 2 × 1.25 m (7.0 m + 2 × 0.9 m + 0.6 m + 0.6 m)	Cutting = 3.75 m to 5.5 m	As per Design (Not Final)	Drainage Road Area Network Association	Migging – Moying – Moying	Moying, Arunachal	Moying to Migging, Arunachal	C/ W Width – Varying = b/ w 7 m	Foot Track

- *The Existing road **Starts from 92+250 Km Moying Village** of Latitude and Longitude **(28°38'45.60" N Latitude and 94°59'58.62" E Longitudes)** and the road **Terminates at 189+100 Km of Migging Village** with Latitude and Longitude **(28°51'03.46" N Latitude and 94°46'21.54" E Longitudes)**. The Project Road **Moying to Migging** is situated in the State of Arunachal Pradesh. Project corridor is from Km 92+250 to Km 189+100.*

- *The consultancy services for the same is to include design of best possible alignment and pavement composition, design of bridges, culverts and other structures in addition to analysis of costs, determining project feasibility, preparation of **"Land – Acquisition – Plan" (LAP),** if applicable in any area, and obtaining of all requisite clearances as per need or suitability in the projected areas.*

- *The index map illustrates the **"Approved Project Alignment of Moying to Migging Road Projected"** are presented in the **Figure 8** below:*

Start Point at Moying Village Chainage = 92+250 Km.

End Point at Migging Village Chainage = 189+100 Km.

Figure 8: Approved Project Alignment of Moying to Migging Road Projected as per Inception Report by Environmental Team Experts.

Meticulous/ Particular TOR for Satellite Imagery

The coordinates of the origin and destination points of the proposed roads provided in the TOR were tentative. These have been checked on ground by us in concurrence of ITBP posts at the particular stations by GPS to ensure the accuracy of the coordinates.

4. OBJECTIVE OF CONSULTANCY SERVICES

Objective of Consultancy Services: The main objectives of the consultancy services are to prepare **"Initial Environmental Examination" (IEE)**/ DPR Report and bid documents for the length of **"189.100 Km of Moying to Migging Road"** and to establish the techno, economical, viability of the project and prepare detailed project reports for design of roads and bridges. An important requirement with regard to improving the Project Road is that the development of work shall be within the **"Right of Way" (ROW)** of **"24 Meters"** and avoiding additional land acquisition as far as possible. All these means that the development schemes for the Project Road should be as economical as possible consistent with the functional requirements and that it should amenable for quick implementation without delays.

To serve the environmental aspects and adopt good **"Road Construction Practices" (Sustainable Environmental Development Practices)** under this project are being considered. The present research methodology aims to use the waste of some industries like polypropylene, polyester (as waste of backing and carpet industries respectively) in the preparation of a special type of asphalt to be used in the production of **"Hot Mix Asphalt" (HMA)** for roads, bridges, structures and dams construction during the civil work. The solid materials in paving mix were low quality aggregates of high absorptive type and waste marble filler with the final objective to provide added value, to reduce the production costs and keep the virgin solid materials especially aggregates for a longer period of time. The produced mixes are of similar or of better performance compared to the conventional asphalt mixtures. And there is an urgent need to address the great challenges of our times: climate change, resource depletion, pollution, and peak oil. These issues are all accelerating rapidly, and all have strong links with the road as well as building industry as shown below in **Project Execution Objectives and Decision Making Work – Life Cycle (Figure 9)**.

- *Ground Control Point Survey by using "Differential Global Positioning System" (DGPS);*
- *Procurement of 0.5 m Resolution of Satellite Imagery from "National Remote Sensing Centre" (NRSC), Hyderabad, India;*
- *Development of "Geographical Information System" (GIS) Layers and "Digital Elevation Model" (DEM) of Finalized Alignment of Border Roads;*
- *Contours Creation at 2.5 m Interval;*
- *Ortho – photo Generation at 0.5 m "Ground Sample Distance" (GSD);*

Major Tasks and Scope of Consultancy Services

1) Engineering Surveys and Investigations

- *Topographic Surveys;*
- *Hydraulic and Hydrological Investigations;*
- *Traffic Surveys;*
- *Material Investigations;*

2) Engineering Designs

- *Geometric Designs;*
- *Pavement and Road Designs;*
- *Design of Bridge and Structures;*
- *Drainage Designs;*

3) Project Cost Estimations

4) Detailed Project Report; "Initial Environmental Examination" and Bid Documents

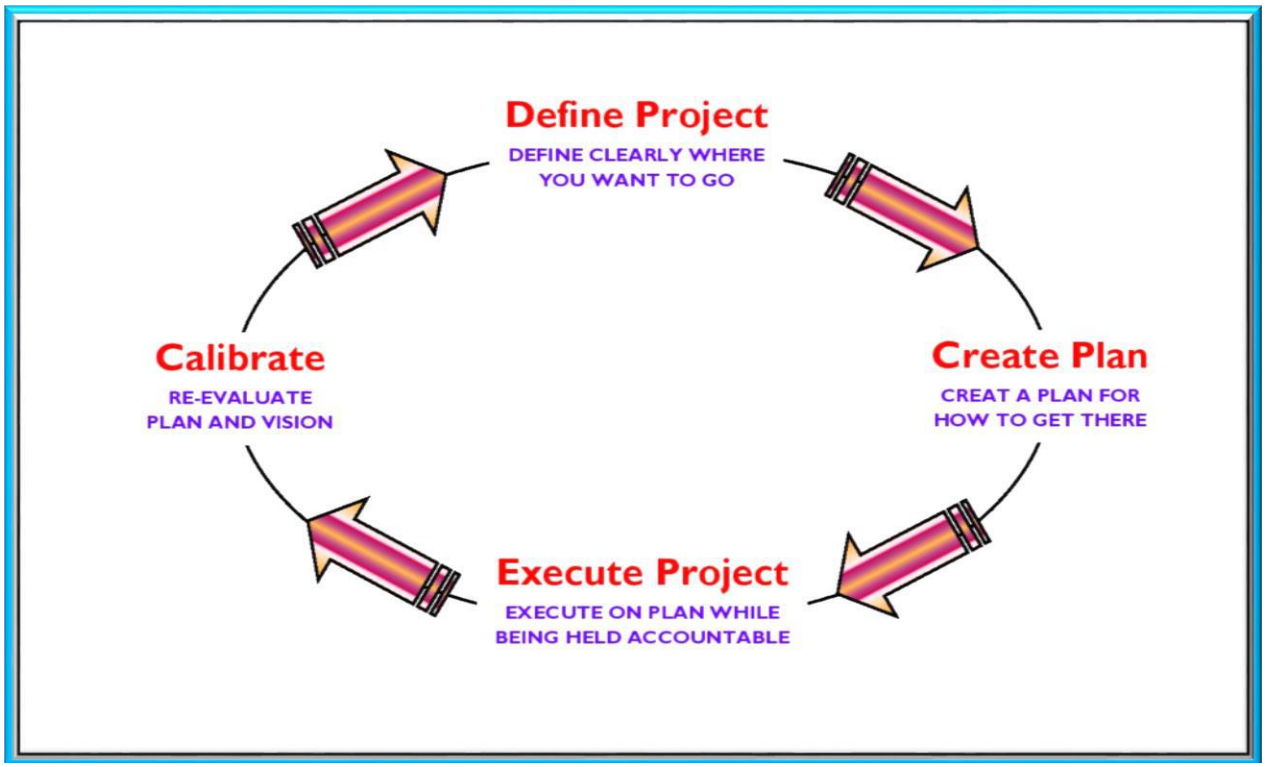
5) General Topographical Features of the Area/ Region/ State

6) Proposed Drainage Facilities/ Structures of the Area/ Region/ State

❖ **Establishing the Most Suitable Alignment of the Projected Road;**

❖ **Minimal Adverse/ Unfavourable/ Unpleasant Impact on the Surrounding Environment.**

HAMARA SANDESH...!!! HARA BHARA "ARUNACHAL" PRADESH...!!!



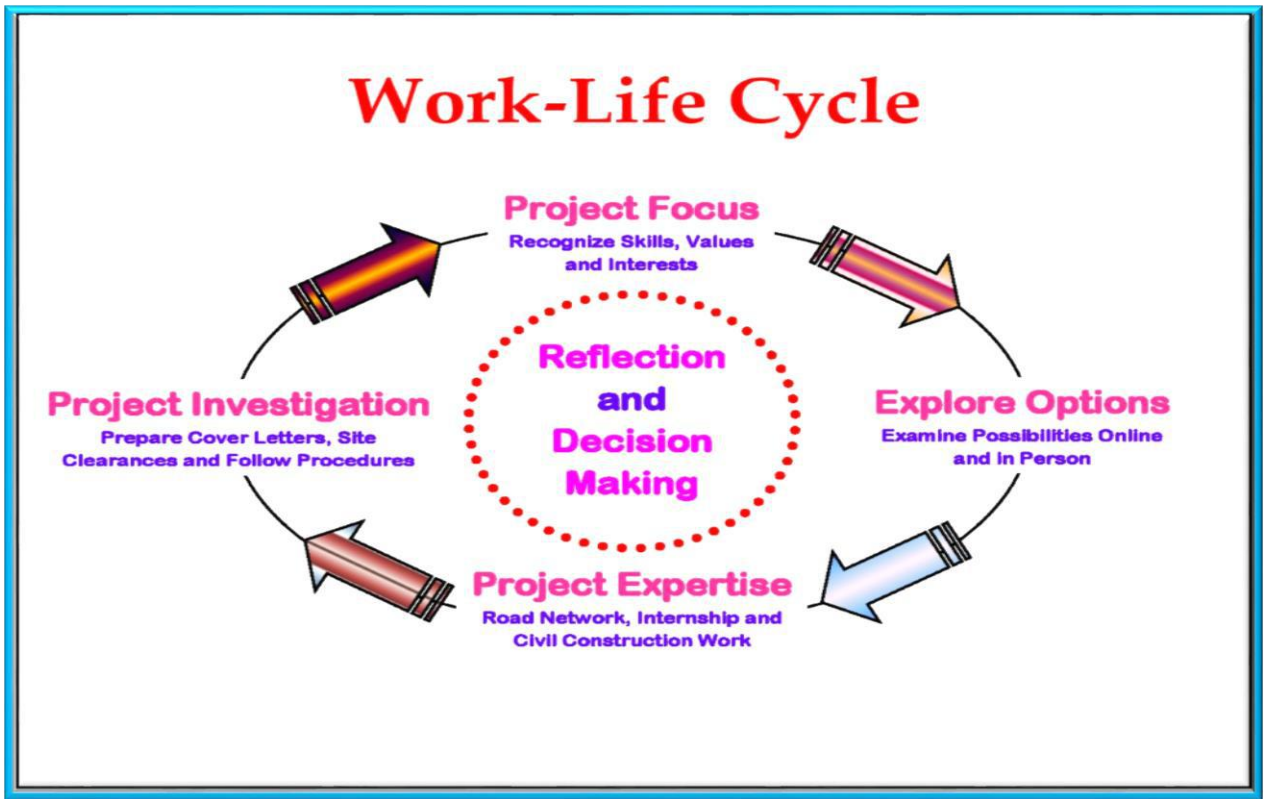


Figure 9: Project Execution Objectives and Decision Making Work – Life Cycle.

There is a growing consensus from scientists and the industry that, we are going to reach peak for construction in the next twenty years, and that we might have reached this point already. Global demand is soaring, whilst global production is declining, and oil is set to become increasingly expensive and scarce. The road and building industry is hugely dependent on cheap resources from the manufacture and transportation of its materials, to the machinery and tools used in demolition and construction. Not only in India, but also in other countries, they use vast quantities of fossil fuels, accounting for over half of total carbon emissions that lead to increase in temperature, global warming and climate change. The built environment is also responsible for significant amounts of air, soil and water pollution, and millions of tons of landfill waste and this is a situation that clearly needs to change. Strategic value of these always occur, because our roads, belongs to some very important and informative objectives, which makes our country strong against another country as whole around the **"World OR Globe OR Precious Earth Sphere"**.

5. PROPOSED APPROACH AND METHODOLOGY: Eco – Friendly OR Environmental Friendly Road Construction Methods and Materials

General Approach: The general approach of the Consultants would be to comprehensively address the various issues involved in the project, to carry out all the field and design office activities as set out in the Scope of Services of the ***"Term of Reference" (TOR)*** and finally to develop improvement proposals satisfying the objectives of the project.

Methodology: The project involves a series of inter – related activities, both in the field and in the design office. Methodology for carrying out these activities is described in the following paragraphs.

Topographical Surveys: The topographical surveys by means of ***"Global Positioning System (GPS)",*** for fixing of ground control points for the entire length of the corridor. Further, the survey has been completed with the 0.5 m high resolution satellite imagery.

Soil and Material Investigations: Prospective sources of construction materials have been located by the Consultants to add in list of sources of materials. To estimate the quantities of available suitable materials; the Consultants have prepared quarry/ material source charts including lead distances etc. This shall form an input in Rate Analysis of borrow/ quarry materials, following which recommendations for the use of the materials from different sources can be made. Material investigation done for engineering properties

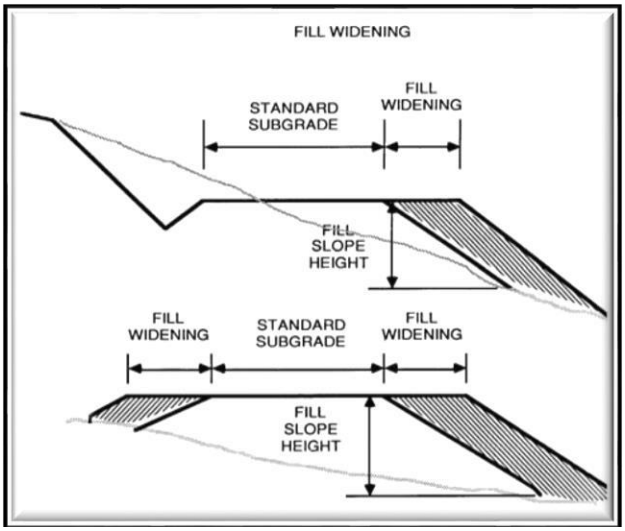
reveals that the material available at site is fit for use in protection, drainage and surfacing works aggregate and no quarry outside the site is required. The material can be used for crust layer execution by processing the available material by stone crusher and rotary screen. Only local transportation is the need for transporting the aggregates for preparation of bituminous mix preparation and laying at respective chainages.

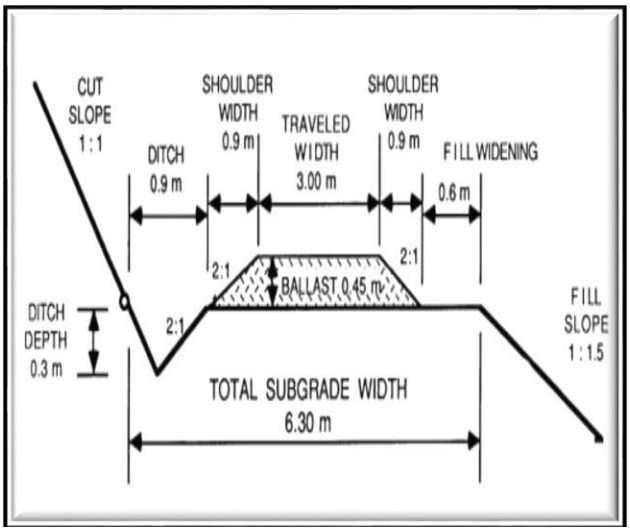
For the completion of this environmental report the data was collected from different sources including government department and our DPR as well as **"Initial Environmental Examination" (IEE) "Report, Expert/ Specialist Team"**. The main aim of this report is to produce a smart; innovative/ informative/ adaptive/ applicable guideline for good construction practices. Eco – friendly design methodologies and technologies can further reduce energy consumption by minimizing energy inputs for heating, cooling and light, and incorporating energy efficient appliances and applications. Saving energy for the occupant also saves money – an issue that will become increasingly important as the cost of fossil fuels and materials for road, bridges, and structure are used inevitably rises in the near future. High absorptive aggregate and waste polymer must play a very important role in road paving to decrease the cost of construction and maintenance. With the inevitability of declining fossil fuels, and the threat of global climate change, reducing our energy consumption is an essential survival strategy. ***"Choosing to Build – Green...!!! And Go – Green...!!! To Save Energy Consumptions and its Valuable Resources to Achieve Significant Prospective Goals in the Projected Area Study"***. The low embodied energy of green products ensures that very little energy went into their manufacture and production, with a direct reduction in carbon emissions. The best modifier of asphalt must contain high percentages of Iso and Cyclo – Paraffins and lower percentage of asphaltenes similar to asphalt composition itself and the waste polymer from other industries can be used in future work.

The report mainly contains environmental points regarding different stages of the Designing; Construction and Operational Phases like three as depicted below for **Moying to Migging Road,** which is situated in the Northern part of Arunachal Pradesh to achieve projected goals and mainly these are in:

- *Designing Phase;*
- *Construction Phase;*
- *Operational Phase.*

Bitumen, as a residue from crude oil distillation, is the complex mixture of four main families of compounds, referred to as **"SARA" Fractions (Saturates, Aromatics, Resins and Asphaltenes)**. The behaviour of bitumen depended on the relative concentration and the chemical features of asphaltenes and maltenes; thus, variation in its composition strongly affects its mechanical properties. Methodological Perspective Over – View of Road Date Base Construction Photographs is given in **Figure 10**.





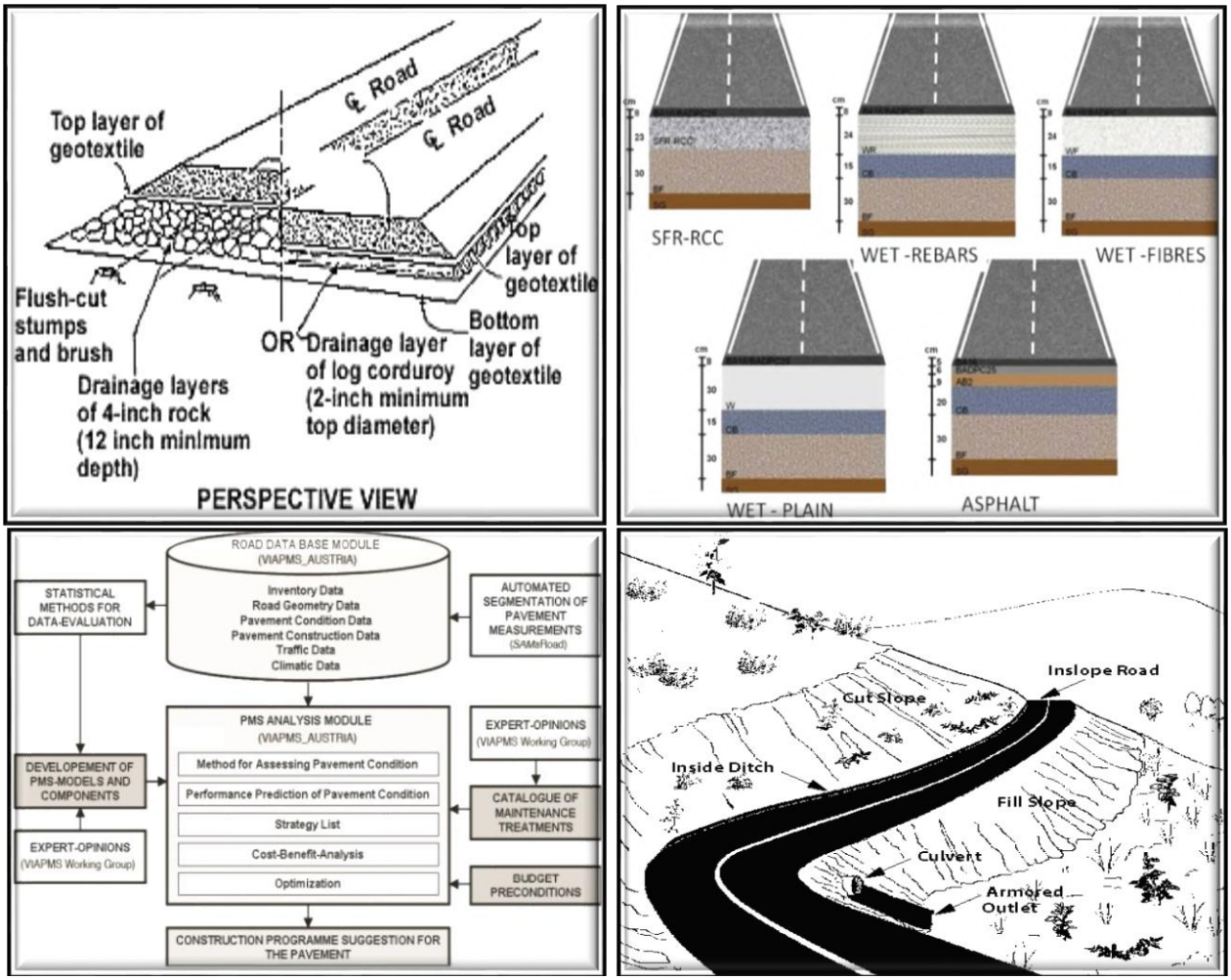


Figure 10: Methodological Perspective Over – View of Road Date Base Construction Photographs.

It presents a large set of interesting potential properties: impermeability, ductility, adhesivity and resistance to the effect of weathering and chemicals, etc. In the last 20 years, a wide spectrum of modifying polymeric materials has been tested with bitumens for their use in road construction. For a polymer to be effective it must blend with bitumen and improve its resistance at high temperatures without making the bitumen too viscous at mixing temperatures or too brittle at low temperatures. It should be capable of being processed by conventional equipment, available, not expensive and physically and chemically stable during storage, application and service. In actual modified bitumens, thermoplastic rubbers, as well as some thermoplastic polymers, were mainly used. The use of secondary (recycled) aggregates, instead of primary (virgin) materials helped in easing landfill pressures, reducing the need for extraction, protecting environment and minimizing the consumption of original resources. Polyester polymer, thermoplastic **"Poly – Ethylene Tere – phthalate" (PET)** and mineral fibres are the additives, which are mostly used to produce strong and durable reinforcement bitumen. Also, different industrial wastes such as waste polymers, spent toner, marble quarry waste and fibres ...etc. can be used as asphalt modifiers for civil construction work. Carpet waste fibres were used recently in asphalt mixtures and in **"Fibre Reinforced Concrete" (FRC)**. Such reinforcement improved effectively the shatter resistance, toughness, and ductility of concrete. One of the major waste generating industries is the construction and marble production, and, it was reported that the potentials to use this type of waste in low to medium traffic urban as well as rural areas roads and as binder courses were very beneficial. There are some literatures that discussed the use of fillers such as limestone powders, rubber silica and carbon black as modifiers for asphalt mixture. In Egypt, the use of waste materials in HMA is not applied yet, in addition to the presence of a large amount of low quality aggregate not suitable for use in paving or other purposes.

Preparation of Hot Mix Asphalt and Properties

Hot mix asphalt samples were prepared using virgin asphalt and modified binders and were evaluated using the **"Marshall Test Method" (ASTM: D – 6927)**. The mixes were designed according to the

standard limits of surface (wearing) course. The job mix was formulated (% Wt.) using coarse and fine aggregates, sand and filler as 33, 30, 32 and 5 Wt. %, respectively. The mixes were tested for maximum load and flow along with density and air voids in mixes and solid materials were determined.

- *HMA are hot mixes asphalt consisted of normal absorptive aggregate type, primary (virgin) asphalt samples and limestone filler;*
- *HMA are hot mixes asphalt consisted of high absorptive aggregate type, virgin (primary) asphalt samples and limestone filler;*
- *HMA are hot mixes asphalt consisted of high absorptive aggregate type, marble dust, modified asphalt through using 5% of waste polypropylene and waste polyester respectively.*

Conclusion and Recommendation

This research aimed to prepare and use special types of HMA consisting of unordinary materials with the final objective of decreasing the cost of paving and maintenance, keeping the premium aggregate for the longest period of time and decreasing the land space needed for land filling of un – degradable pollutants. To achieve this aim, 5 to 15% of each of waste polypropylene and polyester were used in asphalt modifying. High absorptive aggregate and marble fillers were used in mixes preparation instead of ordering materials such as normal absorptive aggregate and limestone filler. The obtained results showed that all the types of waste polymers and solid materials used in the study are suitable in road paving and construction activities. The mixes comply with the standards and have reduced temperature susceptibility. The best modifier was polypropylene waste and the polyester waste was found to be very tough. The mix can be used as base course or other purpose in any type of construction and civil work.

6. ENVIRONMENTAL INDEX OR FEATURES OF THE PROJECT

Environment and Economy Status of Arunachal

The Land of Dawnlit Mountains

Arunachal Pradesh is one of the 29 states of India holding the most North – Eastern position among the other states in the North – East region of India. Arunachal Pradesh borders the states of Assam and Nagaland to the South, and shares international borders with Bhutan in the West, Myanmar in the East and China in the North. Itanagar is the capital of the State. Arunachal Pradesh, which translates to **"Land of the Dawn – lit Mountains",** is also known as the Orchid State of India or the Paradise of the Botanists. Geographically, it is the largest among the North – East Indian States. As in other parts of Northeast India, the people native to the state trace their origins from the Tibeto – Burman people.

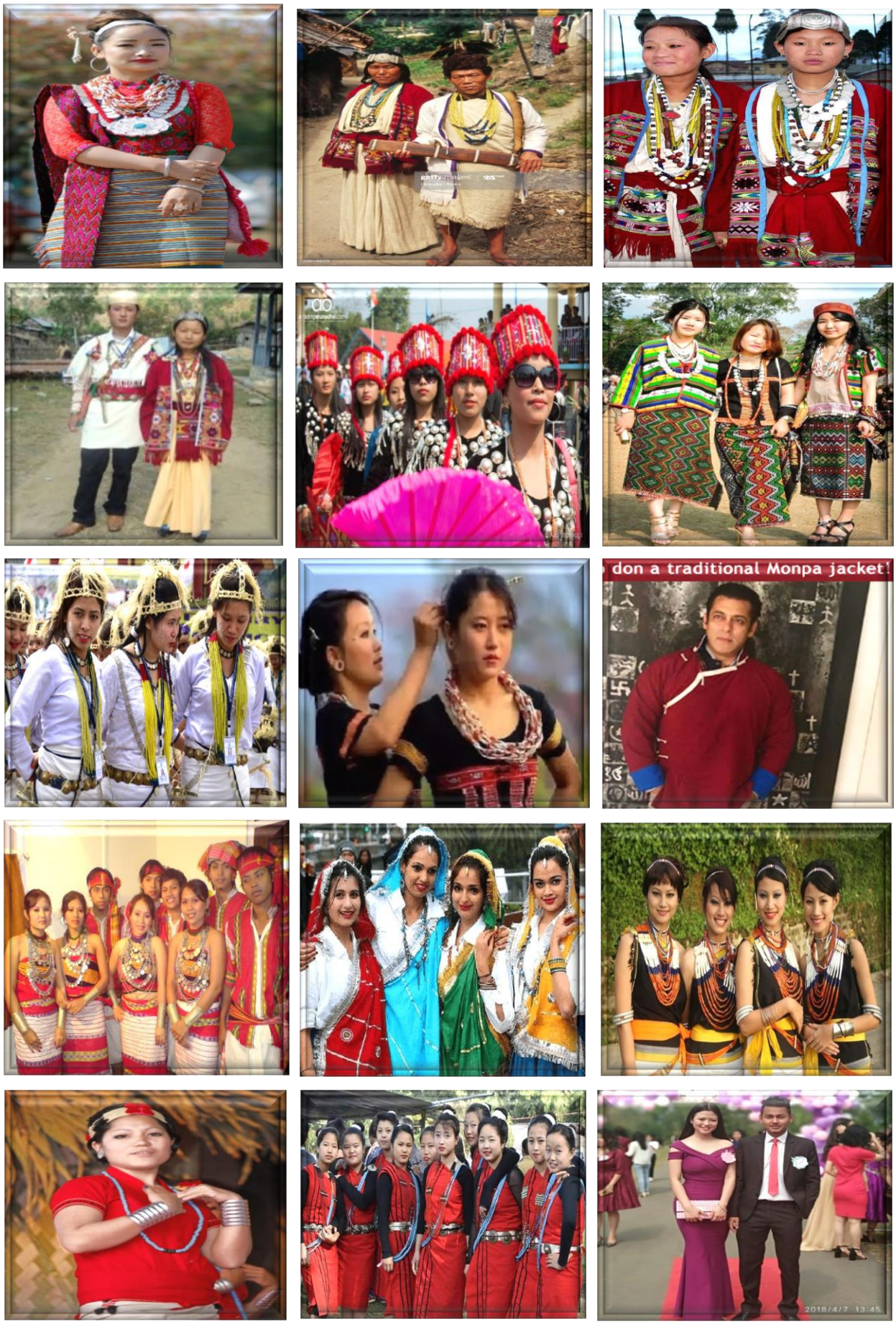


Figure 11: Arunachal Pradesh' Traditional Dress Supporting Healthy and Wealthy Posture.

Arunachal Pradesh finds its mention in the literature of **"Kalika Purana"** and the great **"Hindu Epic of Mahabharata"**. It is believed to be the **"Prabhu Mountains"** of the **"Puranas"**. According to a Hindu mythological legend, Arunachal Pradesh was the place where sage **"Parshuram"** washed away his sin, sage **"Vyasa"** meditated, King Bhishmaka founded his kingdom and **"Lord Krishna"** married his consort **"Rukmini"**. Ruled by many powerful dynasties and kingdoms, Arunachal Pradesh India is dotted with innumerable historical monuments and archeological remains, which bear testimony to its rich cultural heritage.

- ✓ ***Population (2011):*** *1,382,611;*
- ✓ ***Literacy:*** *66.95%;*
- ✓ ***Official Language:*** *English;*
- ✓ ***Established:*** *20th February 1987;*

The Traditions, Customs and Culture of Arunachal Pradesh

Arunachal Pradesh is well known for its ancient culture. Known as the **"The Land of Dawnlit Mountains",** Arunachal Pradesh finds mention in prominent scriptures of India, such as the Kalika Purana and Mahabharata. Sage Parashurama washed away his sins in Arunachal which was then known as Prabhu Mountains. Sage Vyasa meditated in the forests of this region and Lord Krishna married Rukmini at this legendary site of India.

The Cultural Elements of Arunachal Pradesh are highlighted below:

- *Tribes of Arunachal Pradesh;*
- *Religions of Arunachal Pradesh;*
- *Art and Craft of Arunachal Pradesh;*
- *Food of Arunachal Pradesh;*
- *Festivals and Celebrations in Arunachal Pradesh;*
- *Famous Dance Forms of Arunachal Pradesh;*
- *Languages Spoken in Arunachal Pradesh;*
- *Wedding Celebrations;*
- *Beliefs;*
- *Main Occupation;*

Tribes of Arunachal Pradesh

The culture of Arunachal Pradesh is truly distinctive as it comprises of 26 different tribes including various sub – tribes. Each tribe follows its own traditions and customs. There are mainly three cultural groups in Arunachal.

- *The first group is made of Monpas and Sherdukpens of Tawang and West Kameng districts. They are the followers of the Lamaistic tradition of Mahayana Buddhism;*
- *The second group comprises of Adis, Akas, Apatanis, Bangnis, Mijis, Mishmis, Nishis and Thongsas, the worshipers of Sun and Moon God;*
- *The third group comprises of Octes and Wanchos tribal communities of the Tirap district. They follow basic Vaishnavism and maintain a strict village society which is ruled by a hereditary chief;*

One of the Indigenous Tribal People of Arunachal Pradesh (Source);

Religions of Arunachal Pradesh

A Group of Tibetan Monks in Arunachal Pradesh (Source);

Mostly, the residents of Arunachal follow their own indigenous religions which are highly inclined towards nature. However, around 30% of the population of Arunachal practice Christianity. Some small communities of the region have traditionally been Hindu. Tibetan Buddhism is the dominant religion in the districts of West Kameng, Tawang and regions adjacent to Tibet. Near the Burmese border, Theravada Buddhism is the central faith.

Art and Craft of Arunachal Pradesh

Arunachal Pradesh is gifted with traditional craftsmen skills that have been passed on from generations to generations. Local men are skilled in weaving, carpet making, wood carving, painting, pottery, ornament making, cane and bamboo work, smithy work, basketry and many others. The women are expert in making handicrafts and handlooms.

Food of Arunachal Pradesh

The Traditional Feast of Arunachal Pradesh (Source);

Arunachal Pradesh is situated in the farthermost North – Eastern border of India. The influence of tribal communities and nearby Himalayan civilisations is quite evident in the local cuisine of this area. **"Rice and meat are the staple food of Arunachal"**. Lettuce is quite popular among locals and it is cooked using green chilies, coriander and ginger. Boiled rice cakes, Thukpa and momos are the traditional dishes devoured by people. The food is less on spices and is generally mild. Various forms of rice beers are prepared by local communities, one of them being Apang which is prepared by fermenting rice and millet. Due to the high amount of variedness among local communities, the food preparation methods differ slightly from district to district.

Festivals and Celebrations in Arunachal Pradesh

People of Arunachal celebrate various occasions and for various reasons, be it religious, socio – cultural or agricultural. The tribal people are simple living people and derive happiness out of small things in life. Since agriculture is the main occupation, there are various festivals where people pray and thank god for a good harvest. Some of the prominent festivals celebrated in Arunachal Pradesh are Losar, Solung, Boori – Boot, Mopin, Dree, Nyokum, Reh, Si – Donyi, etc.

Famous Dance Forms of Arunachal Pradesh

Dance and music are an essential part of the life of Arunachali tribes. They dance and sing on important occasions and during the time of festivities and weddings. Various dance forms are seen in different

parts of Arunachal. From elaborate religious dance dramas of the Buddhists to the martial arts and colourful dance performances of the Noctes and Wanchos, dance forms of Arunachal come in various formats. They can broadly be divided into four categories – **"Festive Dances, Ritual Dances, Recreational Dances and Dance Dramas"**. Some popular folk dances in Arunachal Pradesh are Aji Lamu, Chalo, Hiirii Khaniing, Popir, Ponung, Pasi Kongki, Rekham Pada, Roppi, Lion and Peacock dance. Most of the dance forms are accompanied by chorus songs.

Languages Spoken in Arunachal Pradesh

Arunachal Pradesh is perhaps one of the most linguistically diverse states in Asia. **"More than 50 dialects of the Tibeto – Burman language structure can be observed here"**. Nyishi, Apatani, Bokar, Galo, Tagin, Adi are common languages which fall under the Tani dialect. Mishmi language is popular in the eastern part of the state. Digaru, Idu and Miju fall under mishmi and have been recognised as endangered languages. In the western and the northern districts, Bodic language is commonly spoken which is sub-divided into Dakpa and Tshangla.

Wedding Celebrations

Arunachali Wedding (Source);

Arunachal Pradesh being a tribal – state has unique social customs. These include the many rituals performed during a wedding celebration. These rituals continue for a time span of four to five days and are meant to invoke love and trust in the relationship of not just the couple, but the two families involved.

- *The marriages can be of two types, either an arranged marriage, known as Aaw Lang Aaw or a situation of eloping known as Thok No Chaii. In the latter case, the groom is allowed to enter the village only after performing the sacrifice of the native fauna, which is conducted by a priest;*
- *The wedding celebrations start with the groom's family gearing and packing up for spending four nights at the bride's home. As per the customs, they move to the hilltop on their way and shout 'Ho' to indicate their arrival. They are welcomed with a grand treat;*
- *A grand luncheon is arranged by the bride's family, on the first day. Night boogie and the party follow this luncheon. There are women in disguise of men, in these parties;*
- *On the second day, it is the groom's family who arranges a grand treat, as a reciprocation of love;*
- *The third day, which is the day of the wedding, they splash coloured paints on each other as a way to celebrate the marriage;*
- *After these three days, the groom departs with his family, with the hope of a long-lasting relationship and the bride goes to the groom after a year;*

- *Some of the rituals include the groom adorning the bride with a yellow coloured chain, mostly made of bamboo which is considered sacred. The bride is welcomed by the groom's family with an offering of sugar (Hopha) and a plate full of blooms (Ban Moya). The groom's parents have to present before the bride smoked fish (Pha) and cooked sticky rice (Khaw Tom);*

Beliefs

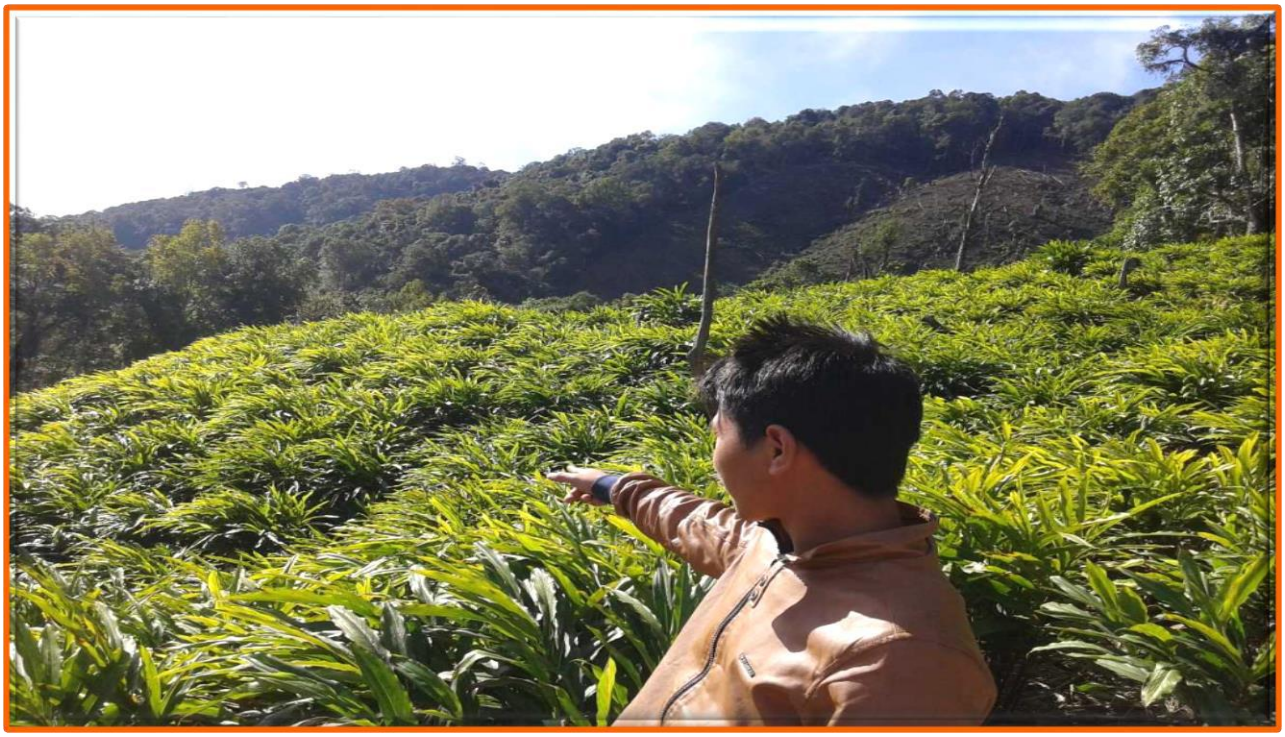
A Donyi Polo Flag in Arunachal Pradesh;

The state is home to **26 major tribes and 100 distinct sub – tribes**, which brings into the picture a plethora of religious and superstitious beliefs. 40% of the population in Arunachal Pradesh follow Donyi Polo and Rangfrah religions, while the remainder is a majority of Buddhists.

- ***Donyi Polo*** *is based on the beliefs that Sun and Moon are the greatest deities of all. The tribes that follow Donyi Polo believe in nature – worshipping and in maintaining harmony with the natural world. They believe that every man has a role to play and a purpose to live. The role is relative to use by the man. They believe in some mythical deities like Kine Nane, Doying Bote, Gumin Soyin, Dadi Bote and Pedong Nane;*
- *The common belief among all these is that life evolved out of nothingness. The nothingness got transitioned into creating* ***Sedi Melo****, the origin of all living and non-living things in the world. They follow highly complex rituals that have been passed down by the earlier generations;*
- ***Endogamy*** *between tribes and exogamy between clans is practiced in societies. Polygamy is also accepted and followed;*
- *Next, to Donyi Polo, another popular belief is Buddhism, which is again categorised into distinct subforms. The West Kameng and Taiwan District are mainly inhabited by the Tibetan influenced Monpa and Sherdukpen tribe;*
- *In Lohti, it is Khampti and Singhpo tribes. Other tribes in the state predominantly believe in animal worship and many such ancient beliefs. It is also known that 80 odd tribes of Arunachal Pradesh still hold to some superstitious beliefs such as the fact that the life of human beings are governed by spirits which can be malevolent or benevolent and the only person who can mediate with these spirits is the dandai. Every disease, every misfortune is due to a particular evil spirit. Dandai's services are sought in every case of misfortune, even when someone falls ill. The dandai determines the evil spirit and then decides which animal to sacrifice to propitiate it;*

Main Occupation

- ***Agriculture*** *is the main occupation of people in Arunachal Pradesh. Jhum cultivation is the major occupation practiced by the farmers. Jhuming involves cleaning a portion of the forest by cutting down and burning the trees and then sowing seeds on those areas with the help of poker;*
- *Many farmers have been relying on this form of agriculture for their livelihood for years now;*
- *Majority of the land in the state is covered with dense forest and lands. These forests provide products and industries are based on processing them, which gives employment and income to a large number of population. Most of the industries in the state are based on natural products from forests like* ***timber and plywood****;*
- *Other industries also include* ***tea, petrochemical and cement****. Fruit cultivation is also practiced in some parts of Arunachal. It has become a significant sector for fruit cultivation and horticulture. This sector has been providing income to many farmers too;*



Cardamom Plantation in Arunachal Pradesh (Source);

Starkly different from the commercial tourist destinations of the country, Arunachal Pradesh is just the right place for travellers looking for rejuvenation and peace in the lap of Himalayas. Apart from its breathtaking natural beauty, what makes this land truly magical is its vibrant and distinct culture. In a highly westernised world today, Arunachal Pradesh is a proud state in India, still preserving its ancient culture and traditions.

Flora and Fauna

The wide variety of altitudinal and climatic conditions have given rise to different forest types, which create corresponding natural shelter, food etc. to varieties of wildlife accomplishments. It is perhaps the only state which harbors four major cats *i.e.,* Tiger, Leopard, Clouded Leopard and Snow Leopard and also rare lesser Feline Species like the Golden Cat and Marbled Cat. Seven species of primates *i.e.,* Hoolock Gibbon, Slow Loris, Assemese Macaque, Stumptailed Macaque and Capped Langur have been reported from Arunachal Pradesh.

All the three goat antelopes occurring in India *i.e.,* Serow, Goral and Takin occur in Arunachal Pradesh. Arunachal Pradesh is the only place in India where takin is found and highly endangered species like hispid hare have been reported from the low latitudinal grassy areas of Arunachal Pradesh. Among the large mammals mittan, which is a cross between the wild gaur and domestic cattle, buffalo and elephant are found in the plains and adjoining hills. The other high altitude animals include Musk Deer, Bharal, Himalayan Black Bear, and Red Panda etc. The Musk Deer occurs at high altitudes throughout the state, whereas the Bharal has been reported occurring in the Western part of the state. Among the lesser mammals large number of Rodents

(Squirrels, Porcupine and Rats), Civet, Mongoose, Linsang, Shrew and Bat Species occur here. More than 500 bird species have been recorded in Arunachal Pradesh, many of which are highly endangered and restricted to this state *e.g.,* White Winged Duck, Sclater Monal, Temminck's Tragopan, Bengal Florican. This is the richest state in pheasants with some 10 species occupying different levels from plains to snow clad mountains.

Weather and Rainfall

Rainy Season: May – September (about 2,000 to 4,000 mm); **Summer:** March – May, maximum temperature recorded in the **Foothills:** 40°C; **Winters:** 15°C to 21°C. The areas sited at high altitude become immensely cold during winters. **Best time to Visit:** October to March.

How to Reach

By Air: The nearest airport is Lilabari (North Lakhimpur) Tezpur Airport in Assam, which is connected to Kolkata. Few low cost airlines and full service carriers operate regular flights to these airports from all prime cities of India.

By Rail: The nearest railway station is Harmuty, which is only 33 Km from Itanagar. North Lakhimpur in Assam is the most convenient railhead.

By Road: At a distance of 10 Km from Itanagar is the Naharlagun bus station. The excellent network of roads links Naharlagun with other important places like Shillong, Guwahati, Ziro, North Lakhimpur and Bomdila.

Humidity, Weather and Climate Index

Humidity is found to be 47% along with North – Northwest (NNW) wind flow at 00 to 9.00 Km/ Hr and Wind Gusts is 11 Km/ Hr. Arunachal Pradesh' current Weather and Temperature on an average is 14°C and Weather Forecast for next 3 days may varies between 26.9°C to 29.0°C and temperatures seldom exceeding (30°C × 9/ 5) + 32 = 86°F in summer. Elevation/ Altitude/ Ceiling are found to be 5,639 Meters above the **"Mean Sea Level" (MSL)** in the State of Arunachal. The temperature in the region reaches and varies maximum to minimum level in – between 15°C to 16°C on an average in **"Arunachal Pradesh"**. **"Atmospheric Pressure"** found to be 1,008.00 mb and **"Ultraviolet Index"** is found to be 2 (Low) and similarly "**Dew Point**" is nearly 14°C. Cloud cover in the Arunachal Pradesh is approximately 42% with Visibility Status 15 Km and around 16 – wind compass rose are formed for the study. The eight half – winds are the points obtained by bisecting the angles between the principal winds. The half – winds are North – Northeast (NNE), East – Northeast (ENE), East – Southeast (ESE), South – Southeast (SSE), South – Southwest (SSW), West – Southwest (WSW), West – Northwest (WNW) and North – Northwest (NNW).

Homogeneous Section

The entire Projected Road Starts from Moying Chainage 92+250 and Ends at Migging Chainage 189+100 has divided into 4 homogenous packages are considering sections based on **"Traffic Volume"** and its characteristics in the below **{Table 8 on Page No. 63 and Figure 20 (a) on Page No. 86}**. And **Table 9** shows the **"Existing – Proposed Chainage Wise Villages".**

Table 8: Homogeneous Section based on Traffic Volume Tehsil/ District Wise Villages.

Sr. No.	Homogenous Section	Design Section Chainage		Design Length (Km)	Lane Widening	Existing Section Length (Km)
		From (Km)	To (Km)			
1.	Package No. – I	92+250	113+650	92+250 to 113+650	*Bothways*	21.400
2.	Package No. – II	113+650	142+020	113+650 to 142+020	*Bothways*	28.370
3.	Package No. – III	142+020	167+100	142+020 to 167+100	*Bothways*	25.080
4.	Package No. – IV	167+100	189+100	167+100 to 189+100	*Bothways*	22.000
				Total Length in Km		96.850

Table 9: Existing – Proposed Chainage Wise Villages.

Sr. No.	Homogenous Section	Existing Chainage Section		Proposed Chainage Section	
		From (Km)	To (Km)	From (Km)	To (Km)
1.	Moying to Migging Road	92+250	189+100	92+250	189+100

7. DEMOGRAPHIC INFRASTRUCTURE INDEX OF THE PROJECT DISTRICT/ STATE

Infrastructure

Arunachal Pradesh's roads are maintained by the **"Border Roads Organization" (BRO),** an offshoot of the Indian Army. The roads in Southern Arunachal Pradesh are in relatively good condition, landslides being less frequent in this region. The state government maintains 1,857 Kilometers (1,154 miles) of roadways that do not fall under the BRO's jurisdiction. Arunachal Pradesh receives most of its electricity from 19 hydroelectric power stations. Power is also obtained from the National Thermal Power Corporation and Power Grid Corporation of India. By 2006 the state had achieved 100% rural electrification. However, the voltage remains unstable and voltage stabilizers are needed. Per capita consumption of electricity in Arunachal Pradesh was approximately 182 kWh in 2006. The state government has promoted biogas and solar power for cooking, but these have received a poor response and are used mostly for lighting purposes. ***In 2005, 73.2% of Arunachal Pradesh's households were reported to have access to safe drinking water, and the state's large number of mountain streams assures a sufficient water supply***.

On 8th December 2008, it was announced that Arunachal Pradesh had become the first state in India to achieve 100% sanitation coverage, becoming completely free of public defecation, thus attaining the status of ***"Nirmal State OR Swachh State",*** like Swachh Bharta Abhiyan/ Mission in India. ***"A clean India would be the best tribute India could pay to Mahatma Gandhi on his 150 birth anniversary in 2019," said Shri Narendra Modi as he launched the Swachh Bharat Mission at Rajpath in New Delhi.*** **Figure 12** shows **Nathu La Pass – Indo – China Border and Kirateshwar Mahadev Temple in Legship**.

Nathu La Pass – Indo – China Border at East Sikkim State.

Kailash Mansarovar Yatra through Nathu La Pass – Indo – China Border at East Sikkim State.

Nathu La Pass – Indo – China Border.

Kirateshwar Mahadev Temple in Legship is Dedicated to Hindu God Shiva.

Figure 12: Nathu La Pass – Indo – China Border and Kirateshwar Mahadev Temple in Legship.

Arunachal Pradesh is India's least populous state, with 6, 10,577 inhabitants according to the 2011 census. Arunachal Pradesh is also one of the least densely populated Indian states, with only 86 persons per square Kilometers. However, it has a high population growth rate, averaging 12.36% between 2001 and 2011. The sex ratio is 889 females per 1,000 males, with a total of 3, 21,661 males and 2, 86,027 females recorded in 2011. With around 98,000 inhabitants as of 2011, the capital Itanagaris the most significant urban area in the mostly rural state; in 2005, the urban population in Arunachal Pradesh constituted around 11.06% of the total. In 2011, the average per capita income in Arunachal Pradesh stood at ₹ 81,159 (US $ 1,305) and languages of Arunachal Pradesh State are as given below in the **Table 10**.

Table 10: Conversation/ Speaking Percentage Languages of Arunachal Pradesh, 2011 (Itanagar).

Sr. No.	Languages	Conversation/ Speaking Percentage	Remarks
1.	Nepali	*62.6%*	Up to Mark
2.	Arunachal Pradeshese (Bhutia)	*07.6%*	Low Level
3.	Hindi	*06.6%*	Low Level
4.	Lepcha	*06.5%*	Low Level
5.	Limbu	*06.3%*	Low Level
6.	Sherpa	*02.4%*	Low Level
7.	Other	*06.2%*	Low Level

Nepali is the lingua Franca of Arunachal Pradesh, while Arunachal Pradeshese (Bhutia) and Lepcha are spoken in certain areas. English is also spoken and understood in most of Arunachal Pradesh. Other languages include Dzongkha, Groma, Gurung, Limbu, Magar, Majhi, Majhwar, Nepal – Bhasa, Rai, Sherpa, Sunwar, Tamang, Thulung, Tibetan and Yakha. The major languages spoken as per census 2001 are Nepali (3, 38,606), Arunachal Pradeshese (41,825), Hindi (36,072), Lepcha (35,728), Limbu (34,292), Sherpa (13,922), Tamang (10,089) etc.

Ethnicity

The majority of Arunachal Pradesh's residents are of Nepali ethnic origin. The native Arunachal Pradeshese consists of the Bhutias, who migrated from the Kham district of Tibet in the 14th century, and the Lepchas, who are believed to have migrated from the Far East. Tibetans reside mostly in the Northern and Eastern reaches of the state. Migrant resident communities include Biharis, Bengalis and Marwaris, who are prominent in commerce in South Arunachal Pradesh and Itanagar.

Religion

Hinduism is the state's major religion and is practiced mainly by ethnic Nepalis; an estimated 57.8% of the total populations are adherents of the religion. There exist many Hindu temples. Kirateshwar Mahadev Temple is very popular, since it consists of the Chardham altogether. Vajrayana Buddhism, which accounts for 27.3% of the population, is Arunachal Pradesh's second – largest, yet most prominent religion. Prior to

Arunachal Pradesh's becoming a part of the Indian Union, Vajrayana Buddhism was the state religion under the Chogyal. Arunachal Pradesh has 75 Buddhist monasteries, the oldest dating back to the 1700s the public and visual aesthetics of Arunachal Pradesh are executed in shades of Vajrayana Buddhism and Buddhism plays a significant role in public life, even among Arunachal Pradesh's majority Nepali Hindu population. The **Table 11** shows Religious Conviction Percentage in Arunachal Pradesh State.

Table 11: Religious Conviction Percentage in Arunachal Pradesh State.

Sr. No.	Religion	Religious Conviction Percentage	Remarks
1.	Hinduism	*57.8%*	Up to Mark
2.	Buddhism	*27.3%*	Low Level
3.	Christianity	*09.9%*	Low Level
4.	Islam	*01.4%*	Very Low Level
5.	Others	*03.7%*	Slightly Low Level

Baba Ji ka Bankar – Baba Harbhajan Singh Memorial Temple.

New Baba Mandir – Baba Harbhajan Singh Memorial Temple, Gangtok.

The Rumtek Monastery is among most Famous Religious Monuments.

Figure 13: Rumtek Monastery is most Famous Religious Monuments.

Hinduism is the state's major religion and is practiced mainly by ethnic Nepalis; an estimated 57.8% of the total populations are adherents of the religion. There exist many Hindu temples. Kirateshwar Mahadev Temple is very popular, since it consists of the chardham altogether. Vajrayana Buddhism, which accounts for 27.3% of the population, is Arunachal Pradesh's second – largest, yet most prominent religion. Prior to Arunachal Pradesh's becoming a part of the Indian Union, Vajrayana Buddhism was the state religion under the Chogyal. Arunachal Pradesh has 75 Buddhist monasteries, the oldest dating back to the 1700s. The public and visual aesthetics of Arunachal Pradesh are executed in shades of Vajrayana Buddhism and Buddhism plays a significant role in public life, even among Arunachal Pradesh's majority Nepali Hindu population. The **Figure 13** shows **Rumtek Monastery is most Famous Religious Monuments**.

Christians in Arunachal Pradesh are mostly descendants of Lepcha people who were converted by British missionaries in the late 19th century, and constitute around 10% of the population. As of 2014, the **Evangelical Presbyterian Church of Arunachal Pradesh** is the largest Christian denomination in

Arunachal Pradesh. Other religious minorities include Muslims of Bihari ethnicity and Jains, who each account for roughly one per cent of the population. ***The traditional religions of the native Arunachal Pradeshese account for much of the remainder of the population. Although tensions between the Lepchas and the Nepalese escalated during the merger of Arunachal Pradesh with India in the 1970s, there has never been any major degree of communal religious violence, unlike in other Indian states. The traditional religion of the Lepcha people is Mun, an animist practice which co-exists with Buddhism and Christianity***.

Culture

<table>
<tr><td>  </td><td> 
</td></tr>
<tr><td>Arunachal: Week – Long Gumkum Gumpa Festival of Puroik Community.</td><td>Puroik Girls Dancing on the Occasion of 35th Gumkum Gumpa, Seppa.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>The Traditional Gumpa Dance being performed in Lachung during the Buddhist Festival of Losar.</td><td>The Traditional Buddha – New Dance being Performed in Lachung during the Buddhist Festival of Losar.</td></tr>
</table>

Figure 14: Arunachal Pradesh's Traditional Gumpa Dance in Lachung during the Buddhist Festival of Losar.

Arunachal Pradesh's Nepalese majority celebrate all major Hindu festivals, including Diwali and Dussera. Traditional local festivals, such as Maghe Sankranti and Bhimsen Puja, are also popular. The **Figure 14** shows **Arunachal Pradesh's Traditional Gumpa Dance in Lachung during the Buddhist Festival of Losar**. The Losar, Loosong, Saga Dawa, Lhabab Duechen, Drupka Teshi and Bhumchu are among the Buddhist festivals celebrated in Arunachal Pradesh. During the Losar (Tibetan New Year), most offices and educational institutions are closed for a week. Arunachal Pradeshese Muslims celebrate Eid ul – Fitr and Muharram. Christmas has also been promoted in Itanagar to attract tourists during the off – season. Western rock music and Indian pop have gained a wide following in Arunachal Pradesh. Indigenous Nepali rock and Lepcha music are also popular. Arunachal Pradesh's most popular sports are football and cricket, although hang gliding and river rafting have also grown popular as part of the tourism industry.

Cuisine

Noodle – based dishes such as Thukpa, Chow – Mein, Thanthuk, Fakthu, Gyathuk and Wonton are common in Arunachal Pradesh. Momos – steamed dump lings filled with vegetables, buffalo meat or pork and

served with soup – are a popular snack. Beer, whiskey, rum and brandy are widely consumed in Arunachal Pradesh, as is Tongba, a millet – based alcoholic beverage, which is also popular in Nepal and Darjeeling. Arunachal Pradesh has the third – highest per capita alcoholism rate amongst all Indian states, behind Punjab and Haryana. The **Figure 15** shows **Arunachal Pradesh's Traditional Noodle – based Dishes like Thukpa, Chow – Mein, Thanthuk, Fakthu, Gyathuk, Wonton and Momos**.

Noodle – based Dishes such as Thukpa, Chow – Mein, Thanthuk, Fakthu, Gyathuk and Wonton are Common in Arunachal Pradesh. Momos – Steamed Dump Lings filled with Vegetables, Buffalo Meat or Pork.

Figure 15: Arunachal Pradesh's Traditional Noodle – based Dishes like Thukpa, Chow – Mein, Thanthuk, Fakthu, Gyathuk, Wonton and Momos.

Media

The Southern urban areas of **Arunachal Pradesh** have English, Nepali and Hindi daily newspapers. Nepali – language newspapers, as well as some English newspapers, are locally printed, whereas Hindi and English newspapers are printed in Siliguri. Important local dailies and weeklies include Hamro Xa – Xa – Prajashakti (Nepali Daily), Himalayan – Mirror (English Daily), the Samay – Dainik, Arunachal Pradesh – Express (English), Arunachal Pradesh – Now (English), **Kanchanjunga – Times (Nepali Weekly),** Pragya – Khabar (Nepali Weekly) and Himalibela. Furthermore, the state receives regional editions of national English newspapers such as The Statesman, The Telegraph, The Hindu and The Times of India. Himalaya Darpan, a Nepali Daily published in **Siliguri,** is one of the leading Nepali Daily newspapers in the region. The Arunachal Pradesh Herald is an official weekly publication of the government. Online media covering Arunachal Pradesh's **Figure 16** shows **Dro – dul Chorten Stupa and Buddha Park** include the Nepali newspaper Himgiri, the English news portal Haalkhabar and the literary magazine Tistarangit. ***Avyakta, Bilokan, the Journal of Hill Research, Khaber Khagaj, Panda, and the Arunachal Pradesh Science Society Newsletter are among other registered publications***.

Internet cafés are well established in the district capitals, but broadband connectivity is not widely available in the state or region. Satellite television channels through dish antennae are available in most homes in the state. ***Channels served are largely the same as those available in the rest of India, although Nepali – language channels are also available. The main service providers include Dish TV, Doordarshan and Nayuma***.

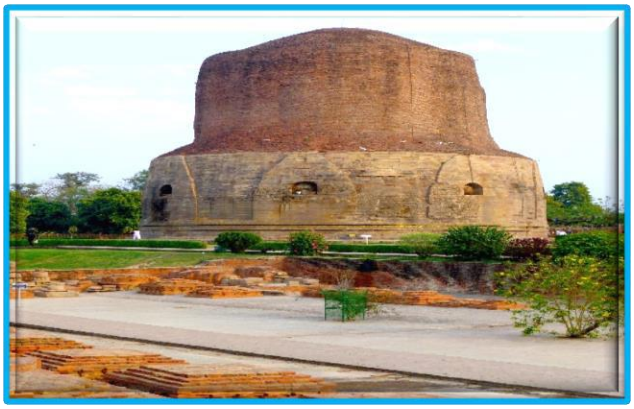
	
Dro – dul Chorten is a Stupa in Gangtok in the Indian State of Sikkim.	**Stupa in the Indian State of Sikkim.**
	
Prayer Wheels at Dro – dul or Do – drul Chorten in Gangtok Sikkim India.	**Buddha Park.**

Figure 16: Dro – dul Chorten Stupa and Buddha Park.

Education in Arunachal Pradesh

As per details from **Census 2011, Arunachal Pradesh** has population of 13.84 Lakhs, an increase from figure of 10.98 Lakh in 2001 census. Total population of Arunachal Pradesh as per 2011 census is 1,383,727 of which male and female are 713,912 and 669,815 respectively. In 2001, total population was 1,097,968 in which males were 579,941 while females were 518,027. The total population growth in this decade was 26.03% while in previous decade it was 26.21%. The population of Arunachal Pradesh forms 0.11% of India in 2011. In 2001, the figure was 0.11%.

Recently as per **Arunachal Pradesh Census Data,** 68.27% houses are owned while 22.63% were rented. In all, 72.10% couples in Arunachal Pradesh lived in single family. In 2011, 53.03% of Uttar Pradesh population had access to Banking and Non-Banking Finance Corporation. Only 1.96% of Uttar Pradesh population had internet facility which is likely to improve in 2021 due to Jio. 7.92% of family in Uttar Pradesh owned car while 14.02% owned two wheelers and as per projection, population of **Arunachal Pradesh** in 2018 is 16.75 Lakhs. In few months we will also get details of election data for Arunachal Pradesh. The largest institution is the Arunachal Pradesh **Rajiv Gandhi** University of Technological Sciences, which offers higher education in engineering, medicine and management. The **Figure 17** shows **Arunachal Pradesh's Rajiv Gandhi University of Technological Sciences and Campus in Itanagar**. It also runs a host of distance education programs in diverse fields. There are two state-run polytechnic schools, the **Advanced Technical Training Centre (ATTC)** and the **Centre for Computers and Communication Technology (CCCT),** which offer diploma courses in various branches of engineering. ATTC is situated at Bardang, Singtam, and CCCT at Chisopani, Namchi. Arunachal Pradesh University began operating in 2008

at Yangang, which is situated about 28 Kilometers (17 miles) from Singtam. Many students, however, migrate to Siliguri, Kolkata, Bangalore and other Indian cities for their higher education.

Library at Rajiv Gandhi University, Itanagar.

Rajiv Gandhi University Department Of Geography.

Rajiv Gandhi University, Itanagar.

Rajiv Gandhi University Campus, Education Department.

Figure 17: Arunachal Pradesh's Rajiv Gandhi University of Technological Sciences and Campus in Itanagar.

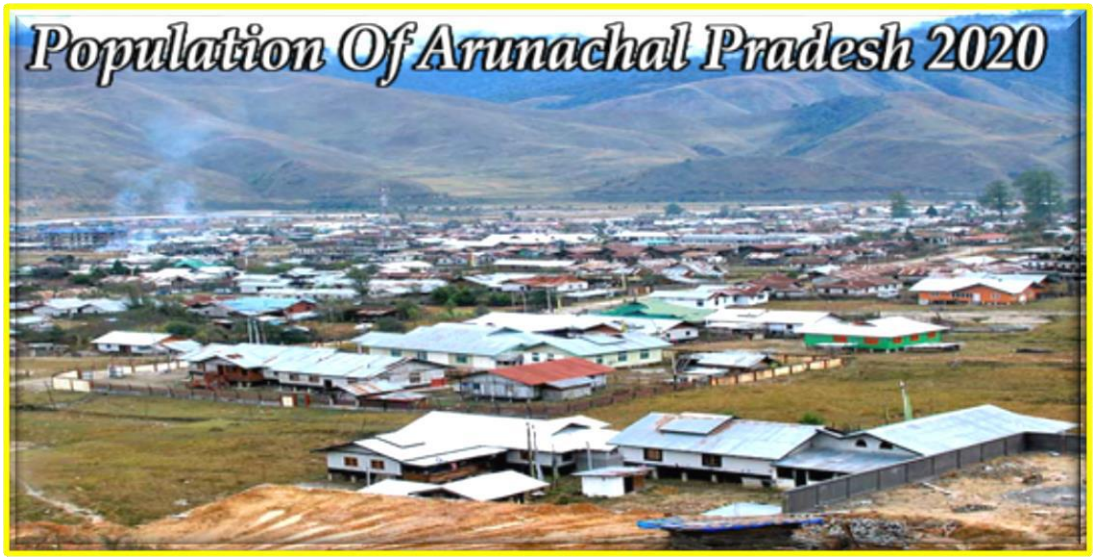
Pavement Condition

The existing road has CL – 9 specification an intermediate lane configuration from ***92+250 Km to 113+650 Km.*** total length of the road as per remote sensing. Total Sq. Km. Area as per 5 Km. buffer boundary is ***83.743 Km²*** and carriageway width 3.50 m to 3.75 m bituminous surfaces and cement concrete surfaces and condition of the pavement is varying from poor to fair and having shoulder width of 1.0 m to 1.5 m on either side along the road and condition of shoulders is also poor and covered with vegetation. The entire project road traverses between hilly and mountainous terrains. The existing alignment passing through the mountainous steep terrain and the existing hill slope vary from 10° to 85°. The Condition of the pavement is usually very poor defects like, cracking, ravelling, potholes and worn – out BT surface at Project Road. Average travel speed obtained is around 20 – 30 Km/ Hr due to Very poor condition of project road. All major utilities follow the road alignment as the project road connects to Janbo Utilities like Electric Pole, **"Optical Fiber Conference" (OFC)** etc. were observed on both sides of road.

All major utilities follow the road alignment as the project road connects to links ***Siliguri (West Bengal) to Itanagar*** and journey takes approximately ***17 Hours and 7 minutes (720.00 Km) via NH – 27 and NH – 15***. Arunachal Pradesh National Transport runs bus and truck services. Privately run bus, tourist taxi and jeep services operate throughout Arunachal Pradesh, and also connect it to Siliguri. A branch of the highway from Melli connects Western Arunachal Pradesh. Towns in Southern and Western Arunachal Pradesh are connected to the hill stations of Kalimpong and Darjeeling in Northern West Bengal. The state is furthermore connected to Tibet by the mountain pass of Nathu – La – Pass. ***Arunachal Pradesh is located between 26.28° N and 29.30° N latitude and 91.20° E and 97.30° E longitude and has an area of 83.743 Km² (32,333 Sq. Mi.) and the topography rapidly rises to 7,000 m at its Highest Peak***.

Pavement Existing Condition.

Built – Up Area.



Arunachal Pradesh population in 2020 is estimated to be 30 Million (3 Crores), According to Unique Identification Aadhar India, updated December 2019, by end of year 2019 the projected population is 1,548,776.

Fairs and Festivals of Arunachal – India's Devbhoomi

Festivals form an essential aspect of the socio – cultural life of the people of the state. As a matter of fact, festivals are the mirror of the people's culture. Since agriculturist the mainstay of the population, naturally the festivals celebrated by the people are closely connected with their occupation. Such festivals are

celebrated at a larger scale for thanking the gods for their providence and for saying a prayer for a bumper crop. Throughout the year festivals are celebrated by one or the other tribe. Some of the important festivals are Solung, Mopin, Losar, Boori Boot, Dree, Nechi Dau, Khan, Kshyatsowai, Loku, Longte Yullo, Moi, Nyokum, Ojiale, Reh, Sanken, Si – Donyi and Tamladu. Animal sacrifices are a common ritual in most of the festivals, particularly in the Non – Bodic tribes. The festivals have been firmly blended with the lifestyle of the people of Arunachal Pradesh. For some communities like the Mijis these are the occasions to bring all people together who might otherwise be scattered in far flung villages. This serves as a reminder of the richness of their cultural heritage. The spring time festivals are celebrated during the period from January to April by the different groups. In the celebrations of these festivals, the religious rites and the sacrifices are generally performed by their priests assisted by some select male members.

The Losar Festival

The losar festival of the Monpas, which is their new year, is celebrated for five days. On the eve of the festival people clean out their homes to usher in the New Year and discard the old. The dirt and grit of the old year is considered to symbolize ill health. During the five days of festivities prayers are offered for prosperity and good health, the festivities include the hoisting of religious flags atop their homes; visits to the homes of friends and relatives; holy Buddhist scriptures are read in every home and butter lamps are lit in houses and the campuses.

The Reh Festival

Appeasement of the deities who control the peace and prosperity of the people is through behind the six day celebrations of the Reh festival, essentially associated with the Idu Mishmis. The festival comes to an end with great fanfare and the priest dance performed during the six days is its special attraction.

The Ojiyale Festival

The wanchos celebrate their most popular festival, Ojiyale during March – April, for a period of six to 12 days interspersed with prayer, songs and dance. Villagers exchange bamboo tubes of rice beer as a mark of greeting and goodwill. Pigs' skin is offered to the village chief as a mark of respect.

The Tamladu Festival

Another important festival is Tamladu, essentially celebrated by the Digaru Mishis tribe. During the festival, prayers are offered to the god of the earth and the god of the waters for protection against natural calamities. The supreme – Lord Jebmalu, is worshipped for the prosperity and welfare of human being, the standing crops and domestic animals.

The Khan Festival

Another is the Khan festival, an occasion for the reunion of the people. Besides the usual festivities, the significance of the festival lies in the ceremony whereby the priest ties a piece of wool around everybody's neck. The belief is that the enchanted thread will bring good luck to each of them.

The Sanken Festival

It is an occasion to bathe the images of Lord Buddha ceremoniously. This also heralds the New Year and people sprinkle water on each other a sign of merriment.






The Traditional Festival of Sprinkle Water Or Sanken in Arunachal Pradesh.

The Mopin Festival

One of the groups celebrate Mopin for wealth and prosperity as also good health and universal happiness. Smearing of rice powder on each other's faces marks the beginning of the festival which is celebrated for five days.

The Moh Mol Festival

The Moh Mol festival of the Tangsas is celebrated for three days to welcome the New Year. And **Table 12** shows the **List of Village with Length in Arunachal Pradesh State.**

The Traditional Festival of Moh Mol in Arunachal Pradesh.

Table 12: List of Village with Length in Arunachal Pradesh State.

Sr. No.	Location		Length (m)	Land Use (Built Up/ Agricultural/ Forest/ Industrial/ Barren)	Name of Village/ Town
	From	to			
A	*B*	*C*	*D*	*E*	*F*
1.	92+250	*94+200*	1950	*Built Up*	Moying
2.	96+850	*97+850*	1000	*Built Up*	Ramsing
3.	100+650	*100+850*	200	*Scattered Built Up*	Pittung
4.	106+350	*106+550*	200	*Scattered Built Up*	Hawacamp

Geometrics

The horizontal alignment is passing through Hilly Terrain; Mountainous and Steep Terrain in its entire length. There are many acute curves and hair pin curves with inadequate sight distance are present on the project road especially before urban area and approaches of structures. The vertical alignment is not smooth as it's having hilly topography in its entire length. The horizontal alignment of the project traverses through hilly terrain in its entire length. It is essential to improve substandard geometrics at various locations on project road. Geometric improvements shall be made as per standard and specifications. In order to upgrade the road to the geometric requirements commensurate with the design speed, improvement has been proposed for the Project Road. The alignment passes through several villages and habitation areas of which some have built – up sections. The improvement works, consist of the existing intermediate lane carriageway to 2 lane with paved shoulder **"Carriageway" (10.0 m Width)** of Rigid pavement with hard shoulder of 2.0 m on either side of rural section and intermediate lane to 2 lane with paved shoulder of 2.50 m **"Carriageway" (12.0 m Width)** of Rigid pavement on either side on built up section. The surface and subsurface drainage system shall be planned as per IRC SP: 42 – 1994. A camber of 2.5% shall be provided in main carriageway and minimum longitudinal gradient of 0.05% in rural areas and 0.2% in urban shall be provided for smooth surface runoff. Longitudinal lined/ unlined drain shall be provided near ROW in scattered built up section with outlets to cross drainage structures **(Figure 18)**.

Horizontal Alignment along the Projected Road in Arunachal Pradesh.

Projected Road Junctions.

Figure 18: Projected Road Horizontal Alignment/ Junctions in Arunachal Pradesh.

Table 13: As per IRC: SP: 48, 1998 Curve Detail "ROAD INVENTORY".

Classification	As per IRC: SP: 48 – 1998 and IRC: 52 – 2001								As per IRC: SP: 73 – 2015 and IRC: 84 – 2014	
	Mountanious Terrain				Steep Terrain				Mountanious and Steep	
	Area not Affected by Snow		Snow Bound Areas		Area not Affected by Snow		Snow Bound Areas			
	Ruling Minimum	Absolute Minimum	Ruling Minimum	Absolute Minimum	Ruling Minimum	Absolute Minimum	Ruling Minimum	Absolute Minimum	Disirable Minimum Radius	Absolute Minimum Radius
National Highways and State Highways	80	50	90	60	50	30	60	33	150	75

8. ENVIRONMENTAL CHECKLIST

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST
ROADS AND HIGHWAYS

INSTRUCTIONS

(i) The project team as **"Environmental Expert/ Specialist"** completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the **"Ministry of Environment and Forest and Climate Change" (MoEF & CC)** for concern nodal/ zones/ regional officer or expert/ specialist.

(ii) Answer the questions assuming the **"Without Mitigation"** case. The purpose is to identify potential impacts on its environment and surrounding areas. Use the **"Remarks"** section to discuss any anticipated mitigation measures and **"Rapid Environmental Assessment Checklist" (REAC)/ "Initial Environmental Examination" (IEE) Report** is shown in **Table 14**.

Table 14: Rapid Environmental Assessment Checklist.

Country/ Project Title	**India: Arunachal Pradesh Sub – Project: Initial Environmental Examination Report for: Moying to Migging, Road**		
Sector Division/ Section	**Road and Transport Government of India (GOI)**		
Screening Questions	**Yes**	**No**	**Remarks**
A. Project Site			
Is the project area adjacent to or within any of the following environmentally sensitive zones/ sites/ areas?		**X**	No environmentally sensitive zone/ site is located within the projected road;
Cultural Heritage Site;		**X**	No archaeologically protected monument or cultural heritage site/ zones is located within the road;
Protected Area;		**X**	No protected areas are located/ placed close to roads and nearby zones/ areas;
Wetland Area;		**X**	No protected or classified wet land is located close to roads and nearby surrounding areas;
Mangrove Cover/ Area;		**X**	Project road is not located in Coastal Areas;
Estuarine Locality/ Area;		**X**	No Estuarine is located in the Project Area;
Buffer Zone of Protected Area;		**X**	No such area is located in the Project Vicinity;
Special Area for Protecting Biodiversity;		**X**	No such area is located in the Project Vicinity;
B. Potential Environmental Impacts			
Encroachment on historical/ cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		**X**	The area is no mountainous throughout the proposed alignment and there is no human settelment nor any historical/ cultural places. So there no human encroachment;
Encroachment of precious ecology (*e.g.,* Sensitive or protected areas)?		**X**	Attempts have been made to minimizing the cutting of trees while finalizing the road widening options, but we didn't found any sensitive or procted area in the projected area;
Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		**X**	The proposed alignment is crossing only small natural drains. All drainage courses will be maintained to avoid alteration in surface water hydrology so that water courses are not affected. The temporary soil stockpiles will be designed so that runoff will not induce sedimentation of waterways. Silt fencing during construction will be provided. **To mitigate this problem the environmental management plan is already in corporated with their mitigation method;**
Deterioration of surface water quality due to silt runoff and sanitary wastes from worker – based camps and chemicals used in construction?		**X**	Adequate sanitary facilities including **"Soak Pits Treatment (SPT)",** facilities will be provided at construction camps, which will be set – up away from habitat and water bodies. No harmful ingredients are likely to be used in the construction activities. Surface water quality is not impacted due to construction. Measures like embankment slope stabilization, **"Reinforced Cement Concrete (RCC)",** retaining walls are proposed to prevent siltation of ponds located next to the road due to surface runoff;
Increased local/ regional areas air pollution due to rock crushing, cutting and filling works and chemicals from asphalt processing?	✓		Regional/ local/ on site**"Air Pollution Level (APL)",** will be high during construction period due to structure/ road construction work; vehicle movementsand asphalt processings etc. The **A**sphalt **M**ixing **P**lant **(AMP) OR H**ot **M**ix **P**lant **(HMP)** will be located away from habitat areas adequetly high stack for effective dispersion of likely Dust Emissions. Separation measures like spraying of water on unpaved vehicle

			movement areas are proposed to minimize the dust generation. To mitigate this problem the **E**nvironmental **M**anagement **P**lan**s (EMPs)**are already in corporated with their mitigation methods and measures;
Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological and radiological hazards during project construction and operation?	✓		Workers may get exposed to dust and noise during construction activities. However, the exposure levels are likely to be short and insignificant. Workers will be provided requisite **Personal Protective Equipments (PPEs)** to minimize such exposure and associated harmful occupational health effects. To mitigate this problem the **E**nvironmental **M**anagement **P**lan is already in corporated with their mitigation methods;
Noise and vibration activities due to blasting and other civil works on site construction of roads/ bridges and valuable residential and commercial structures establishments?		**X**	No blasting is involved. No significant noise generation is expected during construction activities except normal construction equipment operational noise. These noise levels will be impulsive in nature and its impact will be confined within few Meters of either side of the road. All stationary noise making sources equipment like DG set, compressors will be installed with acoustic enclosures/ mufflers/ silencers to reduce noise level on site if specified for the region or state.

9. STATUTORY CLEARANCES REQUIRED

The **"Environmental Impact Assessment/ Statement" (EIA/ S)** process adopted will follow regulations of "**Government of India" (GOI)** and "**Maharashtra and Karnataka Government"**. As per current policy since the project is more not more than 100 Km in length so the MOEF notification will not apply and need no **"Environmental Impact Assessment/ Statement" (EIA/ S)** Clearances. **Table 15** presents clearances required under the proposed project for roads network area.

Table 15: Required Statutory (EIA/ S) Clearances.

Sr. No.	Act / Rules	Purpose	Applicable Yes/ No	Authority
1.	*Environment Protection Act (EPA) – 1986.*	*To protect and improve overall environment.*	*No*	**MOEF; GOI; DOE; SPCB**
2.	*Environmental Impact Assessment Notification (EIAN) 14th September, 2006.*	*To provide environmental clearance to new development activities following environmental impact assessment.*	*No*	**MOEF; (EIAN)**
3.	*Notification for use of Fly Ash (NFA).*	*Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal.*	*Yes*	**NFA**
4.	*Coastal Regulation Zone (CRZ) Notification 1991 (2002).*	*Protection of fragile coastal belt.*	*No*	**CRZN**
5.	*National Environment Appellate Authority Act, (NEAA) 1997.*	*Address grievances regarding the process of Statutory Environmental Clearance (SEC).*	*No*	**NEAA; SEC**
6.	*The Land Acquisition Act (LAA) – NH – 1956.*	*Set out rule for acquisition of land by government.*	*Yes*	**Revenue Department; LAA**
7.	*MOEF Circular on Marginal Land Acquisition and Bypasses 1999.*	*Defining "Marginal Land" Acquisition relating to the 1997 Notification (MLAN).*	*No*	**MOEF; MLAN**
8.	*The Forest (Conservation) Act – 1927; The Forest (Conservation) Act – 1980; Forest (Conversion) Rules – 1981.*	*To check deforestation by restricting conversion of forested areas into non – forested areas.*	*Yes*	**Forest Department; Government of Haryana (GOH)**
9.	*Wild Life Protection Act – 1972.*	*To protect wildlife through certain of National Parks and Sanctuaries.*	*No*	**CCF; Department of Forest; (GOH)**
10.	*Air (Prevention and Control of Pollution) Act – 1981.*	*To control air pollution by and Transport Controlling Emission of Air Department (TCEPA).*	*Yes*	**GO UP; SPCB; TCEPA**

		Pollutants as per the prescribed standards.		
11.	*Water Prevention and Control of Pollution) Act – 1974.*	*To control water pollution by controlling discharge of pollutants as per the prescribed standards.*	*Yes*	**(GOH); SPCB**
12.	*Noise Pollution (Regulation and Control Act) 1990.*	*The standards for noise for day and night have been promulgated by the MOEF for various land uses.*	*Yes*	**MOEF; (GOH); SPCB**
13.	*Ancient Monuments and Archaeological Sites and Remains Act – 1958.*	*Conservation of cultural and historical remains found in India.*	*No*	**ASI; GOI**
14.	*Public Liability and Insurance Act (PLIA) – 1991.*	*Protection form hazardous materials and accidents.*	*Yes*	**PLIA**
15.	*Explosive Act – 1984.*	*Safe transportation, storage and use of explosive material.*	*Yes*	**Chief Controller of Explosives**
16.	*Minor Mineral and concession Rules (MMCR).*	*For opening new quarry.*	*Yes*	**District Collector; MMCR**
17.	*Central Motor Vehicle Act – 1988 and Central Motor Vehicle Rules (CMVR) – 1989.*	*To check vehicular air and noise pollution.*	*Yes*	**Motor Vehicle Department; CMVR**
18.	*National Forest Policy 1952; National Forest Policy (Revised) 1988 (NFP).*	*To maintain ecological stability through preservation and restoration of biological diversity.*	*Yes*	**Forest Department; GOI; and (GOH); NFP**
19.	*The Mining Act (MA) – 1989.*	*The mining act has been notified for safe and sound mining activity.*	*Yes*	**Department of Mining (DOM); MA**

Widening Proposal

The proposed widening has been carried out through considering social and environmental aspects of the project. Concentric widening has been proposed in built – up portion to save acquisition of road side established or installed residential and commercial structures. Likewise eccentric widening (LHS or RHS) has been proposed in open areas to save tree from the other side. In other words, only one side tree requires to be felled. Out of total **"Existing Length 189.100 Km"** length concentric widening is **"Proposed"** for about **"21.400 Km"** mainly in built – up locations shown in **Tables 16, 17, 18 (a) to (d)**.

Table 16: Pavement Crust Thickness for Widening and New Construction.

Description	Proposed	
Pavement Crust Thickness for Widening and New Construction	**Rigid Pavement: PQC** – 300 mm (M40); **DLC** – 150 mm (M15); **Drainage + GSB** – 225 (150+75) mm; **Sub – Grade** – 500 mm	**Overlay: BC** – 40 mm; **DBM** – 50 mm

Table 17: Chainage References of Village Community/ Town (Moying to Migging Road).

Sr. No.	Existing Chainage (Km) Starting Point	Existing Chainage (Km) Ending Point	REMARKS Name of Village/ Town/ Bypass/ Area
	From	To	
A	*B*	*C*	*D*
1.	Moying Chainage: *92+250 Km* E – 94°59'58.62" N – 28°38'45.60" Z – 3,139 M OR 10,298.56 Feet	Migging Chainage: *189+100 Km* E – 94°46'21.54" N – 28°51'03.46" Z – 5,070 M OR 16,633.86 Feet	Moying to Migging Road

Table 18 (a): Chainage of Reference Minor Junction Details (Moying to Migging Road).

Sr. No.	Design Chainage (Km)	Destination of Cross Road or Railway	Road Side	Type of Junction	Type of Intersections
A	*B*	*C*	*D*	*E*	*F*
1.	85+450	*HQ 105 RCC*	LHS	*Y – Junction*	Minor
2.	88+360	*Forest Rest House*	RHS	*Y – Junction*	Minor
3.	89+720	*Ramsing*	RHS	*T – Junction*	Minor
4.	90+230	*Ramsing*	LHS	*Y – Junction*	Minor
5.	93+300	*Forest*	RHS	*Y – Junction*	Minor

Table 18 (b): Chainage of Reference Major Junction Details (Moying to Migging Road).

Sr. No.	Design Chainage (Km)	Destination of Cross Road or Railway	Road Side	Type of Junction	Type of Intersections
A	*B*	*C*	*D*	*E*	*F*
1.	86+290	*Yingkiong*	RHS	*Y – Junction*	Major

Table 18 (c): Chainage of Reference Details of Minor Bridge (Moying to Migging Road).

Details of Existing Bridge						Details of Proposed Bridge		
Sr. No.	Existing Chainage (Km)	Design Chainage (Km)	Type of Existing Structure	No of Span × Length of Span	Existing Width (m)	Type of Structure Proposed	Arrangement No of Span × of Length Span	Proposal
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
1.	97+525	*90+025*	SLAB	*1 × 6.0*	7.20	*MNB*	1 × 10.0	*Reconstruction*
2.	98+870	*91+300*	MNB	*1 × 11.2*	4.60	*MNB*	1 × 20.0	*Reconstruction*
3.	99+270	*91+660*	FCW	*15.0*	7.20	*MNB*	1 × 20.0	*New Construction*
4.	101+380	*93+730*	MNB	*1 × 34.5*	5.30	*MNB*	1 × 50.0	*Reconstruction*
5.	104+370	*96+330*	MNB	*1 × 22.0*	4.10	*MNB*	1 × 50.0	*Reconstruction*
6.	105+750	*97+570*	MNB	*1 × 10.5*	4.60	*MNB*	1 × 20.0	*Reconstruction*
7.	108+230	*99+980*	MNB	*1 × 34.0*	5.30	*MNB*	1 × 55.0	*1 × 55.0 m Span Under*
8.	112+320	*103+215*	SLAB	*1 × 6.0*	7.20	*MNB*	1 × 15.0	*Reconstruction*

Table 18 (d): Chainage of Reference Details of FCW Reconstructed to Slab Culverts (Moying to Migging Road).

Details of Existing Bridge						Details of Proposed Bridge		
Sr. No.	Existing Chainage (Km)	Design Chainage (Km)	Type of Existing Structure	No of Span × Length of Span	Existing Width (m)	Type of Structure Proposed	Arrangement No of Span × of Length Span	Proposal
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
1.	155+350	*142+030*	FCW	*10.0 M*	7.0	*SLAB*	1 × 2.0	*Reconstruction*
2.	165+300	*151+190*	FCW	*10.0 M*	6.8	*SLAB*	1 × 3.0	*Reconstruction*

Major Bridge/ Minor Bridge and Cross Drainage Structures (Culverts)

There are 00 Nos. of Major Bridge, 00 Nos. Vented Cause Way (VCW), 03 Nos. of **"Flush Cause Ways" (FCW)**, 00 Nos. of **"Hume Pipe Culvert" (HPC)**, and 92 Nos. Culverts, 00 Nos. of (Arch) Minor Bridges, and 05 Nos. of Minor Bridges along the Existing Road. During inventory and condition survey, the details of Bridge and 92 Nos. of Culverts Wise Improvement Proposal containing Rehabilitation, Widening or Reconstruction with culverts retained generally require clearing of vent way and existing **"DESIGN PARAMETERS"** for Proposed Structures are shown in the **Table 19** respectively. The flowing design standards have been assumed adopted and approved as per **"Indian Roads Congress (IRC) Guidelines",** contained in IRC: 73, IRC: 86, IRC: 38 and IRC: SP: 23.

Table 19: Details of Existing DESIGN PARAMETERS for Proposed Structures.

Sr. No.	Item	Plain/ Rolling Terrain
1.	*Design Speed (Km/ Hr)*	20 Km/ Hr – 30 Km/ Hr, As per IRC: SP: 48 – 1998, Sub Clause: 6.3.1
2.	*Right of Way*	24: 00 m
3.	*Land Width (m) Open/ Built – up Area*	In Open Areas – 25 m and in Built – up Areas 3.75 m
4.	*Width of Carriageway (m)*	3.75 m
5.	*Paved Shoulders*	Nil
6.	*Unpaved Shoulders*	2 × 1.25 m
7.	***Camber/ Cross Fall***	-------
(i)	*Carriageway and Paved Shoulders*	2.5%
(ii)	*Earthen Shoulders*	3.0%
8.	*Maximum Super Elevation*	7.0%
9.	*Minimum Radii of Horizontal Curves (m)*	30 m Ruling/ 20 m Absolute Minimum
10.	*Minimum Length of Vertical Curves (m)*	15 m for every Deflection Angle of 5°
11.	*Drains*	As per Design (Not Final)
12.	*Sight Distance*	As per IRC: 73, IRC: 86, IRC: 38 and IRC: SP: 23
13.	***Gradient***	-------
(i)	*Ruling Gradient*	5.0%
(ii)	*Limiting Gradient*	6.0%
(iii)	*Exceptional Gradient*	7.0%
14.	*Vertical Clearance for Power/ Telecommunication Lines* *Low Voltage up to 110 V* *Electric Power Line up to 650 V* *Electric Power Line more than 650 V*	 5.5 m 6.0 m 6.5 m

RIGHT OF WAY AND LAND PATTERN

The available **"RIGHT OF WAY" (ROW)** is 24 m and finished road width 8.8 m as per provision in IRC 48 – 1998 and in Built up Area and 3.75 m in Open Area along the projected corridor. Design has been done within available ROW and the existing alignment is a link between **Moying to Migging Road**. The land use pattern on both side of road is agricultural and built – up area and the details of land use pattern along the project road areas shown in the **Figure 19**-:

1.	***Built – up Area Land Pattern***	:	***15.00%***
2.	***Agricultural Area Land Pattern***	:	***79.00%***
3.	***Barren Area Land Pattern***	:	***00.00%***
4.	***Forest Area Land Pattern***	:	***06.00%***
5.	***Private Area Land Pattern***	:	***00.00%***

Figure 19: Prototype – Paradigm of Land Use Pattern of Existing Road.

TERRAIN

The terrain is hilly and mountainous region at most of the stretch and has normal gradient throughout the Hilly/ Mountainous region but also has rolling terrain in **189.100 Km.** and the details of which are given in the **Table 20** below:

Table 20: Hilly OR Mountainous Terrain All Most Stretch/ Normal/ Rolling Gradient.

Sr. No.	Existing Chainage		Design Chainage		Length (Km)	Land Use Pattern and Type of Terrain
	Km	Km	Km	Km		
1.	92+250	189+100	92+250	189+100	21.400	Rolling Or Mountainous Terrain

RESERVED FOREST

There is forest land area exists in about **189.100 Km.** length of the road passes through forest. The forest along the project corridor is reserved forest. Chainage – wise details of forest are given below on the projected corridor as results evaluated from the study area. In the regions **Moying to Migging Road** has found forest land exists on the project corridor. In Arunachal, 81% of the total geographical land is taken care and under control of the Forest Department of Arunachal. Consequently, it has been a land of conservationists, environmentalists, botanists and obviously, nature lovers. With 17 species of Tree Ferns, 27 species of Oaks, 35 species of Bamboos, 28 species of Primulas, 268 species of Ferns and 329 species of Flowering Plants, Forests in Arunachal definitely set example of **"God's Plenty"**.

Arunachal covers a geographical area of 8,157 Sq. Km., out of which 4,289 Sq. Km. is allotted to Reserved Forests of Arunachal, 216 Sq. Km. to Protected forests in Khasmal and 137 Sq. Km. in Gorucharan. A very dense forest of Arunachal covers about 225 Sq. Km., moderately dense forests about 826 Sq. Km. and 789 Sq. Km. is occupied by open forests. Between 670 to 4,520 Feet the vegetation includes Laurels, Bamboos, Sal and Fig Trees. Alder, Birch, Chestnut, Oak, Maple are found in the Temperate forests of Arunachal between 4,520 to 14,570 Feet. And above this region, Cypresses, Juniper and Rhododendrons grow till 17,590 Feet.

The main objectives of Forest Department of Arunachal are as below:

- *Protection of Trees;*
- *Prevent Illegal Poaching of Trees;*
- *Carry A – forestation Campaigns;*
- *To Monitor Pollution, and Carry out Researches on Forestry;*
- *To Protect Soil Erosion.*

Few years back, a forestation was done through 746.80 Hectares in Forestry Hector of Arunachal and 531.90 Hectares in Soil Conservation Sector. There are four schemes sponsored by Central Government to

assist the Forest Department. These are as below:

- *Integrated Wasteland Development Project;*
- *Integrated A – forestation and Eco – Development Project;*
- *Area Oriented Fuel Wood and Fodder Project;*
- *Non – Timber Forest Produce.*

No trees were allowed to be cut from the reserved forests. During the first decade of the present century **Moying to Migging Road** were the only towns of commercial importance in the erstwhile/ former/ previous State.

TRAFFIC: Projected Traffic

The daily traffic volume count has been carried out at 2 locations considering the traffic intensity and merging and diverging traffic on the project road corridor. To convert the mixed traffic into common unit, passenger car unit factor is used as given in **"Indian Road Congress" (IRC)** 102: 1988; Report Data. Adopted equivalent passenger car units and **"Details of Reserved Forest with Existing and Design Chainage"** for the study have been presented in **Table 21**. A summary of traffic data in terms of **"Annual Average Daily Traffic" (ADT)** and **"Passenger Car Unit" (PCU)** has been presented in **Figures 20 (a) to (b)** to have better appreciation. The report is concerned about **Moying to Migging Road** and the Traffic Survey Locations and Schedules are given below:

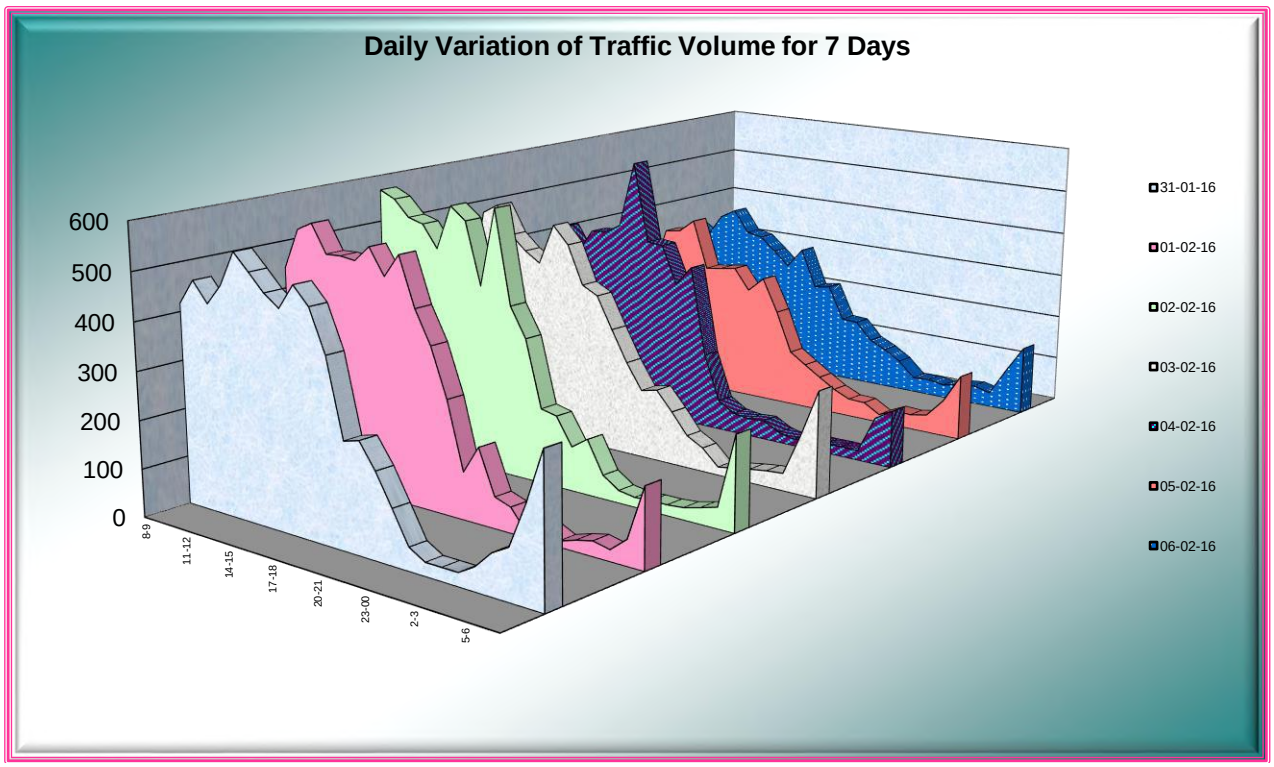


Figure 20 (a): Daily Variations of Traffic Volume at Moying (Chainage 92+250) to Migging (Chainage 189+100) on Projected Road.

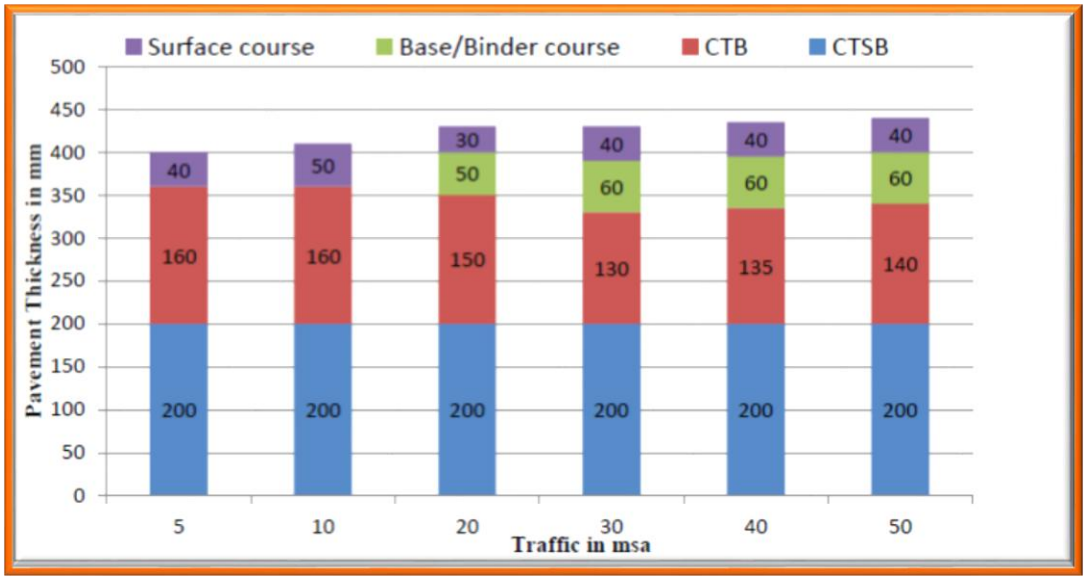


Figure 20 (b): Catalogue for Pavement with Bituminous Surface with CTSB, CTB and SAMI – Effective CBR 10% (Plate – 22).

Table 21: Details of Reserved Forest with Existing and Design Chainage.

Sr. No.	Existing Chainage		Design Chainage		Length (Km)	Type of Forest
	Km	Km	Km	Km		
1.	92+250	*113+650*	142+020	*167+100*	21.400	*Reserved Forest*
2.	113+650	*142+020*	167+100	*189+100*	22.000	*Reserved Forest*

The GOI Vide Letter NO. I5 – 2 (03) 12018 – CAMPA dtd. 27 lLl/ 2018 has approved APO 2018 – 19 for an amount of Rs. 259.15 Crore duly approved by Steering Committee in its meeting held on 9th September 2018 for 2017 – 18 and 2018 – 19 vide letter NO. FOR. 01 – 65/ Cons/ 09/ Pt – V/ lo7 ll – 20 dtd. 13/ 09/ 2018.

Forest Resources Recorded Area

The recorded forest area in the State is 51,540 Sq. Km., which is 61.55% of the geographical area. Per capita forest in the State is estimated to be about 6.00 Hectare as against national average of 0.10 Hectare. Reserved Forests, Protected Forests and Unclassed Forests constitute 20.460, 18/ 9% and 61.05% of the total forest area respectively. Of the total forest area, 5.138 Million Hectare is State – owned and only 15,500 Hectare are under private ownership as per Data State of Forests Report of **"Forest Survey of India" (FSI),** Dehradun **(Table 22)**.

Table 22: Details of Classification of Recorded Forests in Arunachal.

Sr. No.	Category of Recorded Forests	Area (Sq. Km)	%age of Recorded Forests	%age of Geographical Area
1.	**Reserved Forests**	*10,089.99*	**19.58**	*12.05*
2.	**Protected Plot**	*07.80*	**00.02**	*00.01*
3.	**Anchal Reserve Forests**	*325.13*	**00.63**	*00.39*
4.	**Village Reserve Forests**	*300.24*	**00.58**	*00.36*
5.	**National Parks**	*2,468.23*	**04.79**	*02.95*
6.	**Wildlife Sanctuary**	*2,468.23*	**14.33**	*08. 82*

7.	Orchid Sanctuary	100.00	00.19	00.12
8.	Un – Classified Forests	0,860.86	59.88	36.85
	Total	51,540.00	100.00	61.55

Protected Areas

There are 2 (Two) National Parks, 11 (Eleven) Wildlife Sanctuaries and 8 (Eight) Community Reserve in the State covering an area of 2,468.235 Sq. Km. and 7, 487.75 Sq. Km. respectively. The protected area constitutes 11.89% of the geographical area of the State. Arunachal Pradesh has three **"Tiger Reserves" (Namdapha, Pakke and Kamlang)** covering 3630.185 Sq. Km. In addition, the State has a biosphere reserve named **"Dihang – Dibang Biosphere Reserve",** with an area of 5,112 Sq. Km. situated in the higher reaches of **"West Siang, Upper Siang and Dibang Valley"** Districts of the State.

Forest Cover

The forest cover of the State, based on interpretation of satellite data of November, 2006 – January 2007, is 67,353 Sq. Km., which is 80.43% of the State's geographical area. In terms of forest canopy density classes, the State has 20,858 Sq. Km. very dense Forests, 31,556 Sq. Km. moderately dense forests and14, 939 Sq. Km. open. The district – wise forest cover as per latest State of Forests of **"Forest Survey of India" (FSI),** Dehradun **(Tables 23 to 25)**:

Table 23: Satellite Data Details of Forest Cover in Arunachal.

Sr. No.	District	Geographical Area (Sq. Km)	Very Dense Forests	Mode of Dense Forests	Open Forests	Total	%age of Geographical Area	Scrub
1.	Changlans	4,662	1,864	1.460	931	4,255	91.27	00
2.	Dibang Valley and Lower Dibang Valley	13,029	1,696	4,999	2,622	9,317	71.51	05
3.	East Kameng and West Kameng	11,556	3,420	4,648	2,192	10,260	88.79	35
4.	Lohit and Anjaw	11,042	1,966	4,040	1,625	7,631	66.93	00
5.	Papum Pare	3,462	990	1,556	703	3,249	93.85	00
6.	East Siang	3,655	884	1,281	637	2,802	76.66	00
7.	Upper Siang	7,050	1,633	2,633	1,325	5,597	79.39	02
8.	West Siang	7,813	2,477	2,741	1,501	6,719	86.00	00
9.	Lower Subansiri and Kurung Kumey	9,548	3,007	4,250	1,424	8,675	90.86	28
10.	Upper Subansiri	7,032	1,876	2.749	1,185	5,810	82.62	25
11.	Tawang	2,172	366	484	375	1.225	56.40	16
12.	Tirap	2,362	679	715	419	1,813	76.76	00
	Total	83,743	20,858	3 1.5 56	14,939	67,353	80.43	111

Table 24: Forest and Tree Cover in Arunachal.

Sr. No.	Category	Area (Sq. Km)	%age of Geographical Area
1.	Forest Cover	*67.353*	80.43
2.	Tree Cover	*592*	0.71
3.	Forest and Tree Cover	*67,945*	81.14
	Total	68,604.35	162.28

Table 25: Summary of Outlay for 2017 – 18 and 2018 – 19; Compensatory Afforestation, Wildlife and Biodiversity Conservation in Arunachal.

Sr. No.	Particulars	Outlay for 2017 – 2018 and 2018	Outlay for 2018 – 2019
1.	Compensatory Afforestation	*2,152.493*	2,452.268
2.	Net Present Value (NPV)	*10,240.09*	9,946.57
3.	CAT Plan	-------	965.191
4.	Wildlife and Biodiversity	*39.73*	35.08
5.	Wildlife Conservation	*82.639*	-------
	Total	12,541.95	13,399.11

ROAD JUNCTIONS/ INTERSECTIONS

Major Bridge/ Minor Bridge/ Submergence and Cross Drainage Work Structures

There is 00 Nos. Vented Cause Way (VCW), 03 Nos. of Flush Causeway, 00 Nos. of Hume Pipe Culvert (HPC), and 92 Nos. Culverts, 00 Nos. of (Arch) Minor Bridges, and 05 Nos. of Minor Bridges along the Existing Road. During inventory and condition survey, the details of culverts wise Improvement Proposal containing Rehabilitation, Widening or Reconstruction. Crust design has been done based on the field CBR evaluated from the samples collected from site during field survey at every 1.0 Km interval and critical CBR has been adopted for crust design in accordance with IRC – 37: 2012, using 10% CBR for sub grade and from the curves as mentioned in IRC: 37 – 2012 pavement thickness were computed for the relevant million standard axles and pavement thickness required for the above designed MSA and as per IRC guidelines is shown in following **Tables 26 (a) to (f)**.

Table 26 (a): Crust/ Pavement Composition Moying to Migging Road.

Sr. No.	Section	Adopted (MSA)	CBR (%)	Crust/ Pavement Composition (mm)			
				BC	DBM	WMM	GSB
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1.	Moying to Migging Road	*05*	08%	*40*	60	*200*	200

Table 26 (b): Soil Classification Moying to Migging Road.

Chainage		Type of Soil
From	To	
0,000	*1,450*	Ordinary Rock
1,450	*2,150*	All Kind of Soil
2,150	*3,170*	Hard Rock
3,170	*4,560*	All Kind of Soil
4,560	*5,750*	Ordinary Rock
5,750	*7,760*	Hard Rock

Chainage		Type of Soil
From	To	
7,760	8,950	Ordinary Rock
8,950	9,980	All Kind of Soil
9,980	11,250	Hard Rock
11,250	13,560	Ordinary Rock
13,560	14,630	All Kind of Soil
13,560	16,645	Hard Rock

The **"Place Janbo"** is spread in valley which is surrounded by high hills on East and West side. **"Army Training Camp"** is the last point of project stretch and is spread on a wide flat ground (plateau) surrounded by high hills and it is more or less **"16.00 Km"** from **"Migging"**. The remaining portion of the project stretch is traversing in hilly terrain **"Moying" (10,298.56 Feet in Height)** and ends at **"Migging" (Approximately 16,633.86 Feet in Height)**.

Table 26 (c): List of Junctions' Composition Moying to Migging Road.

Sr. No.	Location (Km)	Destinations of Cross Road	Type of Junction	Road Side
A	B	C	D	E
1.	92+450	HQ – 105 – RCC	T – Junction	RHS
2.	92+870	Yingkiong	Y – Junction	RHS
3.	95+860	Forest Rest House	T – Junction	LHS
4.	97+200	Ramsing	T – Junction	RHS
5.	97+790	Ramsing	Y – Junction	LHS
6.	101+050	Forest	Y – Junction	RHS

Table 25 (d): Existing Bridges, Cross Drainage and Culverts Structures.

Type of Structure (TS)	Major Bridges (MB)	Minor Bridges (MB)	Slab/ Arch/ Box Culvert (S/ A/ BC)	Vented Cause Way (VCW)	Hume Pipe Culvert (HPC)	Flush Cause Way (FCW)
A	B	C	D	E	F	G
Existing Structure 100 Nos.	00	05	92	03	00	00

Table 25 (e): Details of Minor Bridge Structures (Bailey Bridge).

Sr. No.	Location	Details of Existing Structures				
		Type of Existing Structure	Number of Span × Length of Span	Width of Structure (M)	Condition of Structure	Type of Bridge
A	B	C	D	E	F	G
1.	98+870	MNB	1 × 11.2	4.60	Poor	RCC Deck Slab/ Steel Girder
2.	101+380	MNB	1 × 34.5	5.30	Poor	Bailey Bridge
3.	104+370	MNB	1 × 22.0	5.20	Poor	Bailey Bridge
4.	105+750	MNB	1 × 10.5	4.60	Poor	RCC Deck Slab/ Steel Girder
5.	108+230	MNB	1 × 34.0	5.30	Poor	Bailey Bridge

Table 26 (f): Details of Existing FCW Culvert Structures.

Sr. No.	Location	Details of Existing Structures			
		Type of Existing Structure	Number of Span/ Pipe × Length of Span/ Diameter	Width of Structure (M)	Condition of Structure
A	*B*	*C*	*D*	*E*	*F*
1.	99+280	*FCW*	15.0 M	*7.2*	Poor
2.	103+140	*FCW*	16.0 M	*7.2*	Poor
3.	112+950	*FCW*	05.0 M	*6.8*	Poor

Minor Bridge at Chainage: 101+380.

Minor Bridge at Chainage: 108+230.

Slab at Chainage: 92+850.

Slab at Chainage: 110+590.

FCW at Chainage: 103+140.

FCW at Chainage: 112+950.

TRAFFIC: Characteristics on Projected Road

In this chapter, the report is concerned about **Moying to Migging Road**. Traffic Survey Locations

and Schedules were, as given below **(Table 27)**:

Table 27: Classified Different Average Daily Traffic (ADT) Surveys and Dates of Commencement at Two Locations.

Location/ Chainage (Km)	Date of Traffic Survey		Duration
	From	To	
MOYING TO MIGGING			
Classified Traffic Volume Count			
Near Moying/ 94+000	*07/ 12/ 2018*	*13/ 12/ 2018*	**7 Days/ 24 Hours**
Near Janbo/ 145+000	*07/ 12/ 2018*	*13/ 12/ 2018*	**7 Days/ 24 Hours**
Survey Location	**Average Daily Traffic**	**Average daily PCUs**	
Near Moying	*165*	*198*	**-------**
Near Janbo	*114*	*165*	**-------**
Type of Vehicles	**Survey Location**		
	(Km 94+000)	**(Km 145+000)**	
AA	***BB***	***CC***	***DD***
2 – Wheeler	*76*	**32**	-------
3 – Seater	*05*	**00**	-------
Car/ Vans/ Jeeps (Taxi)	*35*	**33**	-------
Mini Bus	*00*	**00**	-------
LCVs	*13*	**14**	-------
2 – Axle Trucks	*10*	**09**	-------
3 – Axle Trucks	*00*	**00**	-------
Multi Axle Trucks	*00*	**00**	-------
Tractor	*00*	**00**	-------
Tractor with Trailer	*02*	**06**	-------
Cycle	*00*	**00**	-------
Cycle Rickshaw	*00*	**00**	-------
Army Car	*05*	**10**	-------
Army Bus	*01*	**00**	-------
Army Truck	*18*	**10**	-------
Others	*00*	**00**	-------
Total	**165**	**114**	

Capacity Analysis

Capacity analysis for section has been carried out in order to define the **"Level of Service" (LOS)** offered by road sections under the prevailing roadway and traffic conditions. Capacity and design service volumes for various lane configurations specified by IRC: 64 – 1990: **"Capacity of Roads in Rural Areas" (CRRA)** has been adopted for determining the Level of Service offered by the road sections during design period. Standards for lane width of National Highways and Road developed under Central Sector Schemes in Hilly and Mountainous terrains in circular No.: NH – 150/ 28/ 2018 – P and M Dated, 23rd March 2018 **(Table 28)**.

Table 28: Categorized Average Daily Traffic (ADT) Inventory Reviews and Periods of Instigation at Two Locations.

AVERTAGE DAILY TRAFFIC INVENTORY SURVEY (Date: 07.12.2018 to 13.12.2018)																		
Road Name: Moying to Migging																		
Section : Moying to Migging From Km 94+000 To 145+000 Km.														Direction: Bothways				
Location (Km)	Motorised Traffic														Non – Motorised Traffic		Grand Total	
	Passenger Vehicles					Goods Vehicles				Agricultural		Army Vehicles			Passenger			
							Road Trucks											
	Two Wheeler	Three Wheeler	Car/ Jeep	Mini Bus	Bus	Tempo/ LCV	2 – Axle	3 – Axle	M – Axle	Tractor with Trailer	Tractor	Army Car	Army Bus	Army Trucks	Cycle	Cycle Rickshaw	ADT	PCU
PCU Factor	0.5	1.0	1.0	1.5	3.0	1.5	3.0	3.0	4.5	4.5	1.5	8.0	4.0	3.0	0.5	2.0	-----	-----
94+000	*76*	05	*35*	00	*00*	13	*10*	00	*00*	0.2	*00*	5.0	*1.0*	18	*00*	00	*165*	198
145+000	*32*	00	*33*	00	*00*	14	*09*	00	*00*	06	*00*	10	*00*	10	*00*	00	*114*	165
Average of All Locations	*54*	03	*34*	00	*00*	14	*10*	00	*00*	04	*00*	08	*01*	14	*00*	00	*140*	182

A. Near Moying at Km 94+000

Survey was carried out in **Moying Village (94+000)**. ADT recorded at this station is **165 Nos. / 198 PCU**. Fast moving vehicles were recorded as 100% of the Total Traffic (in PCU). Peak hour traffic low is 31 Nos. formed around 18.79% of the total traffic. Peak hour is identified during 2:00 to 3:00 PM.

B. Near Janbo at Km 145+000

Survey was carried out in **Janbo Village (145+000)**. ADT recorded at this station is **114 Nos. / 165 PCU**. Fast moving vehicles were recorded as 99.05% of the total traffic (in PCU). Peak hour traffic flow is 16 Nos. formed around 14.40% of the total traffic. Peak hour is identified during 11:00-12:00 AM.

Survey was carried out in **"Moying and Janbo Village" (94+000 and 145+000)** and **"Average Daily Traffic" (ADT)** recorded at this station is 165 Nos. / 198 and 114 Nos. / 165. **"Passenger Car Unit" (PCU)**. Fast moving vehicles were recorded as 100% and 99.05% of the Total Traffic (in PCU). Peak hour traffic flow of 31 Nos. formed around 18.79% and 14.40% of the total traffic and peak hour is identified during 2:00 to 3:00 PM and 11:00 to 12:00 AM respectively.

Classified Traffic Continuous Volume Count (TCVC) Survey

The objective of **"Traffic Continuous Volume Count" (TCVC)** survey is to estimate traffic intensity on the projected road. The classified volume count surveys have been carried out for 7 Days, 24 Hours. The traffic is counted in number of vehicles by vehicle category – wise in each direction over 24 Hrs a day for 7 Days. The counts were recorded in the formats as per IRC – specifications. Classified volume count survey has been carried out at two locations the details are given above in the **Table 28**. Reconnaissance survey was conducted on the Projected Road for selection of locations for various traffic surveys. While selecting the traffic volume survey location, consultants have considered the aspect of private sector participation in this road development and accordingly, the locations were selected. The first location has been selected near **Moying Village** at **Chainage 94+000**, the second TCVC location has been chosen near **Janbo Village** at **Chainage 145+000** respectively.

	
At Chainage: 94+000 (TVC – 1).	**At Chainage: 145+000 (TVC – 1).**
"Traffic Continuous Volume Count" (TCVC)	

Axle Load Survey

The vehicle damage factor is a multiplier for converting the number of commercial vehicles of different axle loads to the number of standard axle load repetitions. Design of new pavement for additional lane or strengthening of existing pavement is based upon the cumulative number of 80 KN *(IRC – 37 – 2018 Clause No. 4.4.2)* **"Equivalent Standard Axles" (ESA)** that will pass over during the 15 – year design period. The classes of traffic which lead to significant axle loads (or damage) to the pavement and accordingly considered for design are: LCVs, Two/ Three axle and Multi Axle Trucks. **"Cumulative Standard Axles" (CSA)** are calculated in accordance with the guidelines provided in IRC: 37 – 2018 and IRC: 81 – 1997. The overloaded vehicles have serious adverse impact on performance of pavement **(Tables 29 to 32)**. It has been ascertained that the damaging effect of axles on flexible pavement is approximately proportional to the fourth power of the axle load *(IRC – 37 – 2018 Clause No. 4.4.3)*.

	
At Chainage: 145+000 (Axel Load Survey).	
The "Equivalent Single Axle Loads" (ESALs) have been calculated assuming that the project road will be opened to traffic in the year 2022.	

Table 29: Classified "Variable Frequency Drive" (VFD) Surveys of Commencement at Two Locations.

LOCATION	DIRECTION	Commercial Vehicle			
		LCV	2 – AXLE	3 – AXLE	MAV
AA1	*BB1*	*CC1*	*DD1*	*EE1*	*FF1*
145+000	Moying to Migging	*00.0066*	*02.0039*	*0.0000*	**0.0000**
	Migging to Moying	*00.0086*	*01.6776*	*0.0000*	**0.0000**
Adopted Maximum VDF		**00.0086**	**02.0039**	**0.0000**	**0.0000**

Table 30: Classified "Million Standard Axle" (MSA) Surveys of Commencement at Two Locations.

Name of the Road	MSA for 15th (145+000)	Adopted Design MSA
Moying – Migging Road	*0.49*	**10**

Table 31: Proposed Truck Bay in Arunachal Pradesh State.

Sr. No.	Existing Chainage	Design Chainage	Remarks
1.	*96+475*	*89+000*	**Up to Mark**

Table 32: Proposed Bus Bay/ Bus Stop in Arunachal Pradesh State.

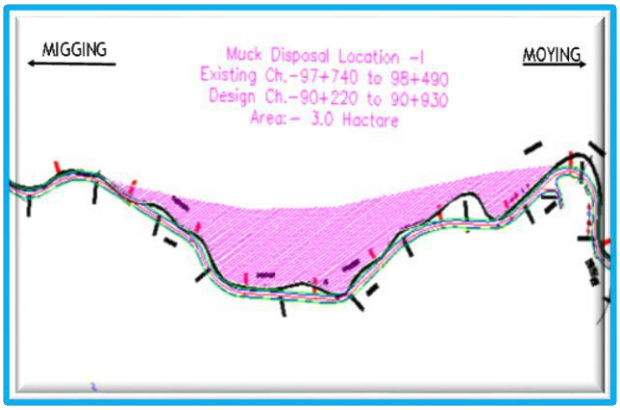
Sr. No.	Existing Chainage	Design Chainage	Remarks
1.	*92+250*	*85+660*	**Up to Mark**
2.	*97+030*	*89+550*	
3.	*100+700*	*93+000*	

Muck Disposal Area and Camp Site

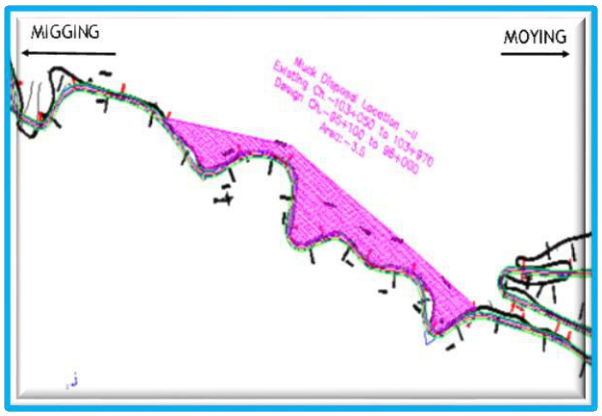
Tentatively four locations has identified during Site Survey along the Project Road for muck disposal Figure 21. The same will be ascertained during land acquisition survey (Table 33).

Table 33: Muck Disposal Area and Camp Site Loction in Arunachal Pradesh State.

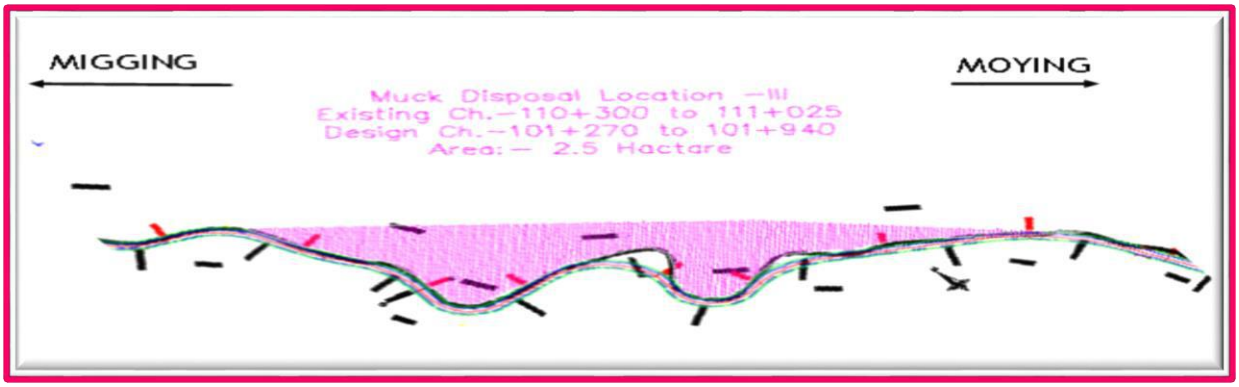
Sr. No.	Existing Chainage		Design Chainage		Area in Hectare
1.	**97+740**	*98+490*	**90+220**	*90+930*	**3.0**
2.	**103+050**	*103+970*	**95+100**	*96+000*	**3.5**
3.	**110+300**	*111+025*	**101+270**	*101+940*	**2.5**



Location – I



Location – II



Location – III

Figure 21: Muck Disposal Area and Camp Site.

Traffic Growth Rate

The growth rates estimates were subjected to scenario analysis and the most likely case was adopted for the purpose of the present study. The traffic growth estimates scenario is based on the likely growth of the Indian economy and its relationship to the growth in the state economy. Information presented in the study area reveals that traffic growth is more than 7% in initial years of the project. Adopted growth rate is 5% Ref. IRC – 37, 2018, Page No. 14 Clause 4.2.2 for commercial vehicles along the Section. The growth of remain traffic moving vehicles is taken as 5% ***"Reference: Ministry of Shipping, Road Transport and Highways, (18th January, 2008 Reference No. RW/ NH – 37011/ 57/ 2006 – PIC) 5% Traffic Growth Rate."*** Summary of projected traffic based on adopted growth rate is provided in **Table 34** given below:

Table 34: Projected Traffic Volume, Vehicle/ Day and PCU/ Day Moying – Migging Road.

Project Road	Year 2018	Year 2021	Year 2026	Year 2031	Year 2036
AA2	*BB2*	*CC2*	*DD2*	*EE2*	*FF2*
Projection of "Average Daily Traffic" (ADT)					
Total Fast Moving Vehicle (Motorised Traffic)	*140*	*177*	*227*	*290*	**370**
Slow Moving Vehicle (Non – Motorised Traffic)	*000*	*000*	*000*	*000*	**000**
Traffic (Number)	*140*	*177*	*227*	*290*	**370**
Projection (PCUs/ Day)	(182)	(231)	(295)	(376)	(480)

Note: *Values in bracket indicate PCUs/ Day;*

PAVEMENT COMPOSITIONS/ CONDITIONS

The flexible pavement is adopted for proposed carriageway reconstruction and Flexible Pavement design period of 15 year. That has been designed as per **"IRC 37: 2018".** The proposed pavement design standard is presented in table given below and hence the **"Design of Proposed Better Crust Thickness for Ridge Pavement Composition"** as is shown in the **Table 38**. The condition survey of existing pavement includes the assessment of pavement, shoulder, embankment and drainage condition. In pavement condition data regarding pavement distress like cracking, ravelling, potholes are recorded in terms of pavement affected. The edge break is measured in length and rutting is measured in mm depth. Shoulder Condition is assessed as earthen shoulder, corrugation or ruts development in mm and shoulder edge drop in mm.

Existing Pavement Condition and Composition.

Reconstruction Proposal

In order to meet future traffic requirement, the existing carriageway is proposed to upgrade to achieve high speed of travel with comfort and safety. Concentric widening scheme shall be followed to minimise land

acquisition issues and to ensure maximum utilisation of existing carriageway. **Tables 35 to 40** given below shows relation between existing and proposed chainage and section wise improvement proposed for these section.

Table 35: Design of Existing Chainage for Homogenous Section.

Sr. No.	Homogenous Section	Existing Chainage		Length (Km)
		From	to	
1.	*Package No.: – I*	*92+250*	*113+650*	**21.400**
2.	*Package No.: – II*	*113+650*	*142+020*	**28.370**
3.	*Package No.: – III*	*142+020*	*167+100*	**25.080**
4.	*Package No.: – VI*	*167+100*	*189+100*	**22.000**
	Total Length in Km			**96.850**

Table 36: Design of Existing – Proposed Chainage for Homogenous Section.

Sr. No.	Homogenous Section	Existing Chainage		Proposed Chainage	
		From	to	From	to
1.	*Package No.: – I*	92+250	**113+650**	*85+657*	**104+530**

Table 37: Design of Flexible Pavement for Homogenous Section.

Sr. No.	Homogenous Section (Package No.: – I)	(Length = 18.873 Km)
1.	*Design Period*	*15 Year*
2.	*Design MSA*	*10*
3.	*Design CBR (%)*	*10*
4.	*Design CBR (%) for Hard Shoulder*	*12*
5.	*BC (mm)*	*30*
6.	*DBM (mm)*	*50*
7.	*WMM (mm)*	*250*
8.	*Granular Sub – Base (mm)*	*200*

Table 38: Design of Proposed Better Crust Thickness for Ridge Pavement Composition.

Sr. No.	Section	CVPD				CBR	Pavement Composition (mm)			
		Present Year 2017	Base Year 2020	15 Year	30 Year	(%)	BC	DBM	CRM	GSB
1.	Moying to Migging Road	*453*	**514**	*1,068*	**2,220**	*10%*	**40**	*60*	**200**	*200*

Table 39: Design of Curve Improvement Details Section.

Sr. No.	Curve Radius (m)	Curve Radius (m)
1.	*300 – 150*	41
2.	*150 – 80*	56
3.	*80 – 50*	46
4.	*50 – 30*	15
5.	Hair Pins	04

Table 40: Summary of Curve Improvement Details.

Sr. No.	Type of Structure	Proposals
1.	Slab Culverts	100
2.	Minor Bridge	08

10. ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROJECT

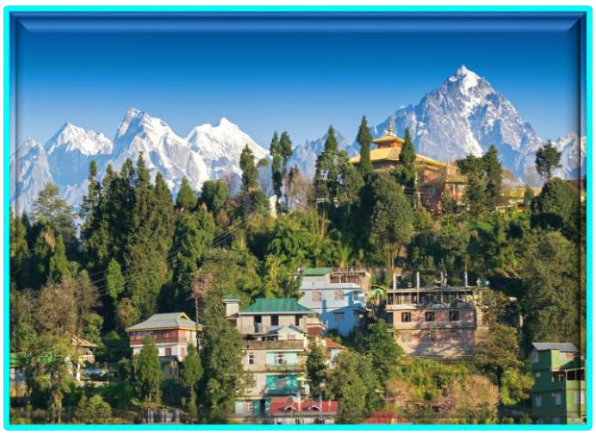
The environmental impact assessment has been carried out and which is based on status of the environment, and impact of proposed four lanning roads/ bridges based on these findings of the **"Environmental Management Plans" (EMPs)** have been prepared for the implementation in the project. Following section discusses status of the environment, and its complementary impact assessment work plan assigned to **"Environmental Management Plans" (EMPs)** required for the project development/ implementation system and process.

11. BASELINE ENVIRONMENTAL INDEX AND STATUS

Demographic and Climatic Conditions

Arunachal has been rated top in the **"Planning Commission's Green Ranking"** based on quality of air and water, waste management, forest cover and climate change. Environment performance will account for 2% of a state's overall performance. ***"The Measure is meant to be both an Incentive and Compensation to States for "Green Initiatives"***. For allocating funds tied to environmental performance, the government has two options. The first is to devolve 2% of the gross budgetary support on the basis of the performance index. The second is to allocate funds by giving an additional weightage of 2% to the performance criteria of the **"Gadgil Formula"**. ***"The Himalayas is divided into five regions i.e., Punjab Himalayas, Kumaon Himalayas, Nepal Himalayas and Assam Himalayas. Himalayas are home to various snow – capped peaks, here is the list of some of the highest peaks of Arunachal"*.**



Incredibly Best and Beautiful Hilly Areas in Arunachal Pradesh.

The people of Arunachal are warm, simple and friendly with a natural gaiety. The custom and rituals of Arunachalese are as diverse as the ethnic groups that inhabit the land. They have an impressive repertoire of folk songs and dances. People of Arunachal love to celebrated with a gay abandon and their way of life is inextricably bound up with nature along deep ravines and their valleys allowing monsoon to penetrate in the Northern most parts, which nourishes this **"Garden of the Himalayas"**. At higher altitudes, monsoon mist cling to huge tracts of lichen covered forest, where every conceivable species of Rhododendron and giant magnolia trees, conifers and beautiful flowering plants as Primulas, Gentians, Blue Poppies, Wild Strawberry, Raspberry. All over Arunachal forest and wilderness areas are inhabited by the Snow — Leopard, Thar, Yaks, Wild Ass in the Tibetan Pleatue, Bharal or Blue Sheep, Shapi and the symbol of Arunachal — the endangered Red Panda etc. Amidst the grandeur of the mountain peaks lush valleys, fast flowing rivers, Arunachal offers her visitors a rare and singular experience. Within a matter of an hour one can move from its sub – tropical heat of the lower valleys to the cold of the rugged mountain slopes that reach up to the areas of perpetual snow. An ideal time to visit the Arunachal place is from March to June and October to mid – December. Flowers take a breath taking landscape in April – May. October comes again with a new cycle of flowers. The sky is clear in November as one of the best times to enjoy the scenic splendour of Arunachal Pradesh. It is quite cold in March and December and the monsoon stays from end June to early September.

Climate

The climate of Arunachal Pradesh varies with elevation. The low altitude 100 Meter to 1,500 Meter have a **"Humid Subtropical Climate" (HSC)**. High altitude and very high altitude areas (3,500 Meter to 5,500 Meter) have a subtropical highland climate and alpine climate. Arunachal Pradesh receives 2,000 Millimetres to 5,000 Millimetres (79 Inches to 197 Inches) of rainfall annually, 70% to 80% obtained between May and October. The climate of the state has been roughly divided into the tropical, temperature and alpine zones. For most of the period in a year, the climate is cold and humid as rainfall occurs in each month. The area experiences a heavy rainfall due to its proximity to the Bay of Bengal. The rainfall in North district is comparatively less than of the other districts. The general trend of decrease in temperature with increase in altitude holds good everywhere. Pre — monsoon rain occurs in April – May and monsoon (South — West) operates normally from the month of May and continues up to early October. The climate of project areas is on the whole dry, hot in summer and cold in winter. The year may be divided into five seasons in every state/

region of concern. Weather and Climate Index has a great influence on human activities and it affects on the life style of the population and reduces efficiency of work. Man has made great progress in the field of **"Artificial Intelligence"** as well as in the field of irrigation, but the food production is still controlled by the climatic condition of any region as a whole around the world. The cold season from March to December is followed by hot season, which lasts till the onset of the North – Westmonsoon. The monsoon withdraws by 15th September and is followed by the Post — Monsoon or the **"Transition Period" (TP)**. Thunderstorms, in association with Pre — Monsoon and Monsoon rains occur mostly during June to September. During the winter also, a few thunderstorms occur in association with the Western Disturbances. A few thunderstorms may be accompanied by hail and hail storms. Occasional dust storm occurs during the hot season and contributes in increasing the level of **"Suspended Particulate Matter" (SPM)** in the upper atmospheric region, which causes increases of CO_2 level and **"Global Warming"** and **"Green House Effect" (GHE)**.

Moying – Migging (मोईंग – मिगगिंग)

Arunachal Pradesh is nestled in the upper Himalayan range and because of the altitude, experiences a tundra or alpine weather patterns. The temperature range hence remains between 8°C – 35°C. Visiting Arunachal can be a pleasant experience for visitors who generally face the heat of the mainland when travelling to other parts of India. The weather in Arunachal can be cool and refreshing and here are listed the details on the best time to visit Arunachal Pradesh. Arunachal is an ideal summer vacation destination for families, solo travellers and even adventure seeking honeymooners. With the temperatures ranging from 20°C – 35°C, it makes an ideal summer vacation for family, honeymooners and even for solo travellers. If travelling in summer, trek and go sightseeing around places like Tawang, Roing, Ziro, Namdapha National Park etc. and this is also the time to see wildlife in abundance in the wildlife reserves or bask in nature around the beautiful waterfalls and find peace in the many temples and monasteries around. Since summer is considered off – season, one can get the best deals on hotels and travel on budget. After summer in the hills, the monsoon season cools the land and nature is bountiful and beautiful. Though monsoon is short – lived, the overall region receives quite a bit of rainfall, close to 2,000 mm to 4,000 mm. At times there can be a sudden change in weather patterns though and often heavy showers and landslides are common. The adventure – seeking type, some tourist attractions that are not to be missed and experienced include Nuranang Falls and Bap Tenges Kang Waterfall. This is the ideal time to visit Arunachal as the weather is cool and pleasant; just the perfect season to go for a sightseeing expedition. Winter is surprisingly the ideal time to go as there is the special attraction of the winter festival. Nyokum Yullo and Chalo Loku are agricultural festivals celebrated during the month of February. Another draw is the Pangsau Pass Winter Festival, celebrated during the month of January, which is one of the most popular tourist attractions of the region.

Itanagar, October 13th: To speed up road projects in Shiyom and Siang Valleys, ADG (East) of BRO Dr. S. S. Porwal inspected and reviewed the progress of works on road from Tato to Manigaon and Bile to Migging. Emphasizing on timely completion of the road projects, Dr. Porwal informed that Moying – Dime – Migging road would be improved to double lane specification in a time bound manner to ensure smooth mobility of armed forces. Appreciating the current pace of works in the light of difficult terrain and bad weather conditions, he stressed on the need to augment capacity to execute the works through local hiring of plants and machineries and recruitment of highly skilled workers. The Commander of 761 – BRTF S. K. Pradhan apprised the ADG (BR) of the steps taken to improve Moying – Janbo and Moying – Dime – Yingkiong stretch of the road in last year and the current year's planning to improve Boling – Moying – Dime and Janbo – Migging Stretches. Brigadier C. C. Jaleel, Chief Engineer and Lt. Col. Sameer Malik also participated in the review meeting. Boarder Roads Organisation has 9 projects for road development in North Eastern States, out of which 4 Projects are in Aruchal Pradesh. In order to fast track the projects, the government has recently created the office of ADG (BR) East at Guwahati to oversee and facilitate road construction activities on NE states. Dr. S. S. Porwal, VSM is the first ADG (BR) to hold the assignment and was on a 4 days visit to Project Brahmank.

Economic Profile

Arunachal's gross state domestic product for 2004 is estimated at $ 6 Billion in current prices. Born out of partition of Uttar Pradesh, the new state of Arunachal produces about 8% of the output of the old Uttar Pradesh state. The Arunachal Pradesh is the second fastest growing state in India. It's **"Gross State Domestic Product" (GSDP)** (at constant prices) more than doubled from ₹ 24,786 Crores in FY 2005 to ₹ 60,898 Crore in Financial Year 2012. The real GSDP grew at 13.7% (CAGR) during the FY 2005 – FY 2012 period. The contribution of the service sector to the GSDP of Arunachal was just over 50% during FY 2012. Per capita income in Arunachal is ₹ 1, 03,000 Crore (FY 2013) which is higher than the national average of ₹ 74,920 Crore (FY 2013). According to the Reserve Bank of India, the total foreign direct investment in the state from April 2000 to October 2009 amounted to US $ 46.7 Million. Like most of India; agriculture is one

of the most significant sectors of the economy of Arunachal. Basmati rice, wheat, soybeans, groundnuts, coarse cereals, pulses, and oil seeds are the most widely grown crops. Fruits like apples, oranges, pears, peaches, litchis, and plums are widely grown and important to the large food processing industry. Agricultural export zones have been set up in the state for leechi, horticulture, herbs, medicinal plants, and basmati rice. During 2010, wheat production was 831 thousand tonnes and rice production was 610 thousand tonnes, while the main cash crop of the state, sugarcane, had a production of 5,058 thousand tonnes. As 86% of the state consists of hills, the yield per hectare is not very high and 86% of all crop lands are in the plains while the remaining is from the hills.

Other key industries include tourism and hydropower, and there is prospective development in IT, ITES, biotechnology, pharmaceuticals and automobile industries. The service sector of Arunachal mainly includes tourism, information technology, higher education, and banking. During 2005 – 2006, the state successfully developed three **"Integrated Industrial Estates" (IIEs)** at Haridwar, Pantnagar, and Sitarganj; Pharma City at Selaqui; Information Technology Park at **"Sahastradhara" (Dehradun);** and a growth centre at **"Siggadi" (Kotdwar)**. Also in 2006, 20 industrial sectors in public private partnership mode were developed in the state.

Sustainable Design and Life Cycle Management: More than any other human endeavour the built environment has direct, complex, and long lasting impact on the **"EARTH"** and its **"BIOSPHERE"**. Around one – tenth of global economy is devoted to **"CIVIL — CONSTRUCTION"** and about one half of world's major resources are consumed by **"CONSTRUCTION"** and related industries. The **"Three Columns of Sustainability Development – Environmental, Economic and Social"** are shown in **Figure 22**.

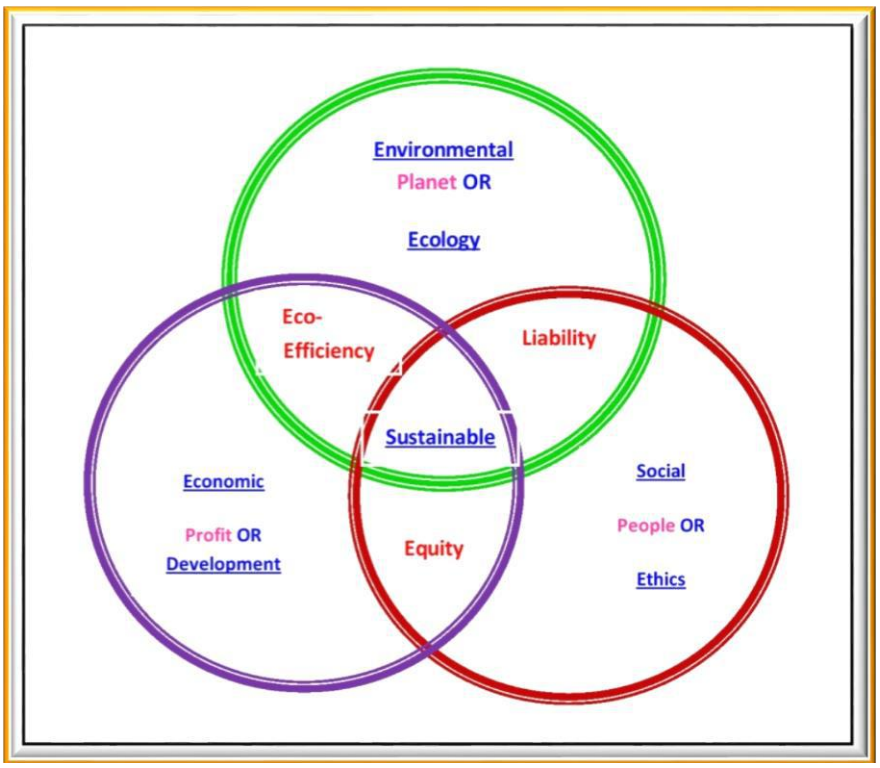


Figure 22: Three Columns of Sustainability Development – Environmental, Economic and Social.

While the situation is not so acute in India at present, increasing urbanization may push us in that direction. These statistics underline the importance of changing the **"CIVIL CONSTRUCTION PRACTICES" (CCP)**. To address these challenges, there is a need to develop effective approaches for life cycle design and management of **"CONSTRUCTIONS"** that will ensure their sustainability in terms of improved physical performance, cost effectiveness, and environmental compatibility. These optimized designs and management systems should provide the owners with the solutions that achieve an optimal balance between three relevant and competing criteria, namely, ***(i)* "Engineering Performance" (*e.g.*, Safety, Serviceability and Durability), *(ii)* "Economic Performance" (Minimum Life Cycle Costs and Minimum User Costs) and *(iii)* "Environmental Performance" (Minimum Greenhouse Gas Emissions, Reduced Materials Consumption, Energy Efficiency, etc.)**.

12. AIR, WATER AND NOISE LEVEL

Air Quality

The results analysis of air samplesis presented in general for all monitoring stations the PM_{10} values were monitored in the range 110 — 112 µg/ m³. While comparing with the **"National Ambient Air Quality" (NAAQ)** Standard of 100 µg/ m³ by the **"Central Pollution Control Board" (CPCB)** all the monitored PM_{10} values were found to be near the limit (Slightly Higher). This is because of high vehicular location and dryness of the areas. $PM_{2.5}$ values were ranging from 35 — 38 µg/ m³. While comparing with the NAAQ Standard of 60 µg/ m³ and the monitored $PM_{2.5}$ values were found to be well within the limit. Similarly monitored values for SO_X, NO_2 and CO are also found within the limits are as shown in the **Table 41**.

Table 41: AAQ Monitoring Result of Project Road.

Sr. No.	Parameters	Unit	MOYING Chainage 92+250	MIGGING Chainage 189+100	Prescribed Limits (µg/m³)	Protocol
Date of AAQ Monitoring			29.12.2019	30.12.2019		
A – 01	PM_{10}		*98*	**91**	*100*	**IS: 5182 (Part – 23), 2006.**
A – 02	$PM_{2.5}$		*35*	**38**	*60*	**CPCB Guidelines.**
A – 03	SO_2		*17*	**17**	*80*	**IS: 5182 (Part – II), 2001.**
A – 04	NO_X		*19*	**25**	*80*	**IS: 5182 (Part – VI), 2007.**
A – 05	CO		*840*	**1,200**	*2,000*	**IS: 5182 (Part – 10).**

The maximum SO_2 and NO_X levels monitored were 23.41 µg/ m³ and 35.15 µg/ m³ respectively. While comparing with the NAAQ Standard (80 µg/ m³), the monitoring results were found to be well within the limits. The maximum CO concentration monitored was 1.8 µg/ m³ and most of the CO levels were monitored below the detectable limit of 2 µg/ m³. While comparing the NAAQ Standard, the monitored CO levels were found to be well within the limit. All Hydro — Carbon (HC) values were found to be below the detectable limit of 65 µg/ m³. All Particulate Lead values were found to be below the detectable limit of 0.01 µg/ m³ and within the NAAQ Standard of 1.0 µg/ m³ (24 — Hourly).

Noise Levels

Ambient Noise Standards

Ambient noise standards were established as per the CPCB/ MOEF Gazette Notification dated 26th December, 1989. It is based on the **"A"** weighted equivalent noise level, Leq are given in the **Table 42**.

Table 42: National Ambient Noise Standards.

Area Code	Category of Zones	Day* Limits of Leq {dB(A)}	Night* Limits of Leq {dB (A)}
A	**Industrial**	*75*	**70**
B	**Commercial**	*65*	**55**
C	**Residential**	*55*	**45**
D	**Silence Zone****	*50*	**40**

Sources**: GOI; CPCB, 1989.

Monitoring Locations and Results

The noise measurement work has been carried out continuously for a period of 24 Hours. At each site 2, 880 data were recorded, each taken at an interval of 30 seconds of which 1, 800 data recorded at day time (07: 00 AM to 10: 00 PM) and 1, 080 at night time (10: 00 PM – 07: 00 AM) as shown in the **Table 43**.

Table 43: Equivalent Noise Level Data.

Sr. No.	Name of Locations	Date of Monitoring	Category of the Area	Leq dB (A), Day	Leq dB (A), Night
1.	*MOYING Chainage 92+250*	01.01.2020	*Educational Area on Site*	52.6	*35.2*
2.	*MIGGING Chainage 189+100*	04.01.2020	*Religious Area on Site*	44.2	*46.6*

The monitored noise levels were ranging from 65.2 dB (A) to 54.2 dB (A) While comparing the MOEF Ambient Noise Norms for different categories, Leq noise levels at all locations during day time and during night time, were found to be exceeding their respective limits. This is because of regular movement of diverse vehicles. It may be noted that as the noise survey was carried out at sensitive receptors *i.e.,* School Zones; Domestic Zones; Sensitive Zones; Old People Living Zones; Children Parks; Zoo Parks and Hospital Zones respectively, noise standards is found above the limits at almost all the location.

Water Quality

Water Quality Standard

The rivers, canal, lakes and ponds located along the proposed project road are a source of water for the local, regional inhabitants, for domestic as well as agricultural uses. An analysis of their present status and the quality of the water has been done through and with the help of state/ local/ regional agencies. They have been classified as per the CPCB standard classification norms for best optimum use of data and report used as shown in the **Table 44**.

Table 44: CPCB Best Use Classification for Surface Water Bodies.

Sr. No.	Parameters	Class – A	Class – B	Class – C	Class – D	Class – E
1.	pH	*6.5 – 8.5*	*6.5 – 8.5*	*6.0 – 9.0*	*6.5 – 8.5*	**6.5 – 8.5**
2.	Dissolved Oxygen (as O_2), Mg/ l, Minimum.	*6*	*5*	*4*	*4*	-------
3.	BOD, 5 Days at 20°C, Maximum.	*2*	*3*	*3*	-------	-------
4.	Total Coli – form Organism, MPN/ 100 ML, Maximum.	*50*	*500*	*5,000*	-------	-------
5.	Free Ammonia (as N), Mg/ l, Maximum.	-------	-------	-------	*1.2*	-------
6.	Electrical Conductivity, Mhos/ Cm, Maximum.	-------	-------	-------	-------	**2,250**
7.	Sodium Absorption Ratio, Maximum.	-------	-------	-------	-------	**26**
8.	Boron (as B), Mg/ l, Maximum.	-------	-------	-------	-------	**2**

Class A	*: Drinking Water Source without Conventional Treatment but after Disinfection;*
Class B	*: Outdoor Bathing (Organized);*
Class C	*: Drinking Water Source after Conventional Treatment and after Disinfections;*
Class D	*: Propagation of Wild – Life and Fisheries;*
Class E	*: Irrigation, Industrial Cooling, and Controlled Waste Disposal;*
Below E*: Not Meeting A, B, C, D and E Criteria.*	

Water Quality Variation along the Projected Road

Surface Water Quality: The pH of surface water was found to be in the range 7.10 to 7.91 along the Corridors. Total hardness is found 337 – 234 ppm (parts per million). Lead contents were found to be below the detection limit. In general, surface water quality along the Corridors is good and complies with **"CPCB Surface Water Quality Norms"**. Details of water quality features are mentioned in **Tables 45 (a)** and **(b)** below.

Table 45 (a): Ground Water and Surface Water Quality along the Projected Road.

Sr. No.	Parameters	Units of Measurement	Surface Water Quality Monitoring Result along the Project Road			Protocol
			MOYING	MIGGING	Desirable Limit	
Date of Sampling			18.03.2020	19.03.2020	< OR ≥ OR Nil	
1.	Colour	Hazen Units	<5	<5	5	IS: 3025
2.	Turbidity	NTU	34	7	<5	IS: 3025
3.	pH	-------	7.91	7.09	6.5– 8.5	IS: 3025
4.	Temperature (T)	°C	14	14	14	IS: 3025
5.	Dissolved Oxygen (DO)	mg/l	3.8	4.2	4.4	IS: 3025
6.	Conductivity	µmhos/cm	1,250	674	976	IS: 3025
7.	Total Suspended Solids (TSS)	mg/l	30	<4	<4	-------
8.	Total Dissolved Solids (TDS)	mg/l	812	316	634	IS: 3025
9.	Alkalinity as $CaCO_3$	mg/l	410	291	370	IS: 3025
10.	Total Hardness as $CaCO_3$	mg/l	234	289	337	300
11.	Calcium as $CaCO_3$	mg/l	123	198	174	IS: 3025
12.	Magnesium as $CaCO_3$	mg/l	111	91	163	IS: 3025
13.	Sodium as Na	mg/l	92	41	51	APHA
14.	Potassium as K	mg/l	86	13	10	APHA
15.	Chloride as Cl	mg/l	98	24	24	IS: 3025
16.	Phosphate as PO_4	mg/l	0.43	0.03	0.03	-------
17.	Sulphate as SO_4	mg/l	29	45	51	IS: 3025
18.	Nitrate as NO_3	mg/l	0.12	0.06	0.08	IS: 3025
19.	Oil and Grease (OG)	mg/l	Nil	Nil	Nil	IS: 3025
20.	Phenolic Compounds (PC)	mg/l	<92.2501	<92.2501	<92.2501	IS: 3025
21.	Chemical Oxygen Demand (COD)	mg/l	97	<4	<4	-------
22.	Biological Oxygen Demand (BOD)	mg/l	52	<2	<2	IS: 3025

Table 45 (b): Ground Water and Surface Water Quality along the Projected Road.

Sr. No.	Parameters	Units of Measurement	Surface Water Quality Monitoring Result along the Project Road			Protocol
			MOYING	MIGGING	Desirable Limit	
Date of Sampling			21.03.2020	22.03.2020	< OR ≥ OR Nil	

23.	**Arsenic as As**	*mg/l*	*<0.01*	*<0.01*	*0.01*	**IS: 3025**
24.	**Mercury as Hg**	*mg/l*	*<92.2501*	*<92.2501*	*92.2501*	**IS: 3025**
25.	**Lead as Pb**	*mg/l*	*<0.01*	*<0.01*	*0.01*	**IS: 3025**
26.	**Cadmium as Cd**	*mg/l*	*<0.01*	*<0.01*	*92.2503*	**IS: 3025**
27.	**Chromium as Cr^{+6}**	*mg/l*	*<0.05*	*<0.05*	*0.05*	**IS: 3025**
28.	**Copper as Cu**	*mg/l*	*<0.01*	*<0.01*	*0.05*	**IS: 3025**
29.	**Zinc as Zn**	*mg/l*	*<0.01*	*<0.01*	*5*	**IS: 3025**
30.	**Selenium as Se**	*mg/l*	*<92.2505*	*<92.2505*	*0.01*	**IS: 3025**
31.	**Iron as Fe**	*mg/l*	*0.15*	*0.01*	*0.3*	**IS: 3025**
32.	**Total Coli – form**	*MPN/ 100 ml*	*50*	*28*	-------	**IS: 5401 – (Part – II)**
33.	**Faecal Coli – form**	*MPN/ 100 ml*	*20*	*13*	-------	**IS: 5401– (Part – II)**

ECOLOGICAL AND ENVIRONMENTAL TEXTURE

Flora

Arunachal is endowed with a unique and diverse range of biodiversity. From the snow bound peaks of the Himalayas to the moist Alpine scrub, sub Alpine forests, dry – temperate and moist – temperate forests to moist deciduous forests, the state possesses a wide biodiversity that in return nurtures a large multiplicity of floral and faunal forms. The state is home to nearly 4,048 species of Angiosperms and Gymnosperms belonging to 1,198 genera under 192 families. Of these nearly 116 species are specific to Arunachal *i.e.,* their geographical distribution is limited to the boundaries of the state. Around 161 species of flora found in Arunachal are recognized as rare or threatened under the categorization of the **"International Union for Conservation of Nature" (IUCN)**. Out of the 223 species of Orchids reported from the North Western Himalayas, over 150 have been reported from the State.

The Arunachal flora includes a variety of species of plants. The abundance of flora in the state can be understood from the fact that the forests cover as much as 36% of the total area of Arunachal. There are about 4,000 different types of plants in Arunachal. The rhododendrons form a significant part of the Arunachal flora. They are abundant in the alpine and temperate regions of Arunachal. Near about 35 different varieties of rhododendrons grow in these regions. The flowering time of these plants stretches between May and August. The flowers of these plants decorate the entire region. The rhododendrons are the brightest and most colorful members of the flora at Arunachal. The orchids that grow in the state of Arunachal exhibit a lot of variety. More than 600 different kinds of orchids are found here. These orchids are an important part of the flora of Arunachal. The terrestrial orchids are found in the temperate areas, while the epiphytic orchids are found in the tropical regions.

The ecological studies have been carried out to understand the present status of terrestrial and aquatic ecosystem within 10 Km distance, on either side from the **"Right of Way" (ROW)** of proposed project. The information provided is based on physical surveys and secondary sources such as information collected from forest department. There is **"Reserved Forest" (RF)** in this road but no eco — sensitive areas near the project route. "***The prominent species include teak mixed with Bamboo, Palm, Kadamb and Banyan Trees. Other Trees include Neem, Peepal and Mango etc."*** There are no endangered species of flora in the area.

Fauna

This great floral diversity supports a wide variety of faunal forms too. It includes about 102 species of mammals, 623 species of birds, 124 species of fish, 69 species of reptiles and 19 species of amphibians. Highly endangered species like the Snow Leopard, Musk Deer, Tiger, Asian Elephant, Bharal, Himalayan Monal, Cheer Pheasant, and King Cobra etc. find suitable habitat in the forests of Arunachal. This precious natural wealth is our common heritage. In order to conserve this heritage, the state has declared twelve areas as **"Protected"** including 6 National Parks and six Wildlife Sanctuaries. Nearly 65% of the geographical area of the State is under forest cover, of which over 12% comes under the **"Protected Area Network" (PAN)**. This exceeds the national average by a fair margin and is a reflection of the state's commitment to conservation. The Corbett National Park, established in 1936 is the first National Park of the Asian mainland. The **"Nandadevi Biosphere Reserve",** established under the **"Man and Biosphere"** programme of **UNESCO** has the honour of being Arunachal's only and the country's second **"Biosphere Reserve"**. This biodiversity wealth is the pride of Arunachal.

The natural vegetation of forests may be divided into:

- *Trans – Himalayan Zone;*
- *Sub – Alpine and Alpine Zone;*
- *Montane or Temperate Region;*
- *Sub – Mountain and Sub – Tropical Region;*
- *Tropical Wet Evergreen and Semi Evergreen Region;*

The original fauna of Arunachal in its Southern low lands of height of 800 Feet to 5,000 Feet include Laurel, Fig, Bamboo and Sal Tree. These plantations have been greatly reduced for providing farming land. At a height of 5,000 Feet to 13,000 Feet, one can find temperate trees like chestnut, oak, birch, maple, magnolia, silver fir and alder. The alpine region of height more than 13,000 Feet is covered with cypress, juniper and rhododendron. Therefore, the flora in Arunachal varies with the height of a place. The world of Arunachal fauna exhibits a great deal of variety. There are as many as 550 types of birds in the state. Some of the well – known birds include Eagles, Giant Lammergeier Vultures, Minivet, Whistling Thursh, Pheasant and Bulbul. Some of the birds of Arunachal belong to the endangered species. Some important members of

the fauna of Arunachal are the birds of the place. The zoologists have discovered that the forests of this state of India are crowded with more than 400 different species of butterflies. The Arunachal Rivers house a variety of fish like salmon, trout and carp. Among the animals, the Red Panda dwells at a height of 6,000 to 12,000 Feet on treetops. Yak is very closely associated with this mountainous state of India. These animals are quite economically viable for the people of the region.

Blue sheep found here is a kind of squirrel that can fly. Tahr, Binturong and Marmot are found in the greeneries of the state, mainly in the Kangchendzonga National Park. The wild animals, which are found in this area/ site/ region, include the *Nilgai* (Boselaphus Tragocamelus), *Antelok* (Anelok Cervicapra), *Pig* (Sus Scrofa), *Wolf* (Canis Lupus), *Jackal* (Conis Aureus), *Fox* (Vulpes Bengalensis), *Hare* (Lupus Ruficandatus), *Monkey* (Macaca Mulatta), *Wild Cat* (Felis Bengalensis) and the *Porcupine* (Hystric Leucura). The game – birds of the area include the usual varieties found throughout the plains as well as hilly areas. Among them mention may be made of the *Peafowl* (Pavo Cristatus), the *Black Partridge* (Frencolinus Francolinus) and the *Gray Partridge* (Francalinus Pondicervanus). The area is famous for the number and variety of water fowls, which visit it during the winter season. The *Goose* (Anser Anser), *Common Teal* (Anas Crecca), red – crested *Pochard Duck* (Netta Rufina), White – *Eyed Pochard* (Aythya Rufa) and *Widgeon* (Mareca Penelope) visit the area/ site/ region only in Winter Season and inhabit the fringes of Rivers, Lakes, Ponds, Stream Channels and Swamps etc.

Aquatic Life

Snakes are common in the area especially in the rural areas or sites, the chief being the *Cobra* (Naja Naja), *Karait* (Bungarus Caeruleus), and *Rat – Snake* (Ptyas Mucosus). Indian *Crocodile* or *Naka* (Crocodilus Pulustris), and the *Ghariyal* (Gavialis Gangeticus) are also found in the rivers or lakes. Fish of almost all the varieties that occur elsewhere in the state are found in the rivers, lakes and ponds of this area, the common species being *Rohu* (Lebeo Rohita), *Bhakur* (Catla Catla), *Nain* (Cirrhina Mrigala), *Parhin* (Wallagonia Attu), *Krunch* (Lebeo Calbasu), *Tengan* (Mystus Seenghla) etc.

Archaeological and Historical Sites

There is no archeologically protected monument or historical sites along the project route or roadways network of construction site.

Environmental Impacts

Impact on Topography

During the construction of the proposed project, the topography will change due to excavation of borrow areas, fills for project road, especially construction of project related cross drainage structures and intersections etc. Provision of construction camp/ yard for material handling will also alter the existing topography. There will be change in topography at re – alignments as these re – alignments have been proposed through agriculture farming fields. The change in topography will also be due to the probable induced developments of the project. With adequate planning, all topographical impacts or signature could be made to enhance the local aesthetics. Similarly, it will invite benefits in the form of land leveling and tree plantations in the vicinity/ region/ area/ site of the projected road.

Impact on Climate

The widening and strengthening of project is not going to have impact on micro as well and macro – climate of the region on the site or area/ region.

Impact on Air Quality

There will be rise in **"Suspended Particulate Matter" (SPM)** levels due to the construction activities, because the project runs entirely in plain areas. Since the emission will be fugitive in nature and it is difficult to quantify the SPM standards even expected to be violated, as the background values are not alarming rate at many places. **"Affected Persons" (APs)** should be completely well – versed even; if it is exceeded then it will be for very short time period. There will be some increase in levels of gaseous pollutant also, which are highly harmful to all or whole ecosystem surviving/ sustaining on this **"Precious Planet Earth"**. The impact on ambient air quality has been assessed using **"AERMOD – Lakes Environmental Software"** and **"CALINE4 – A Dispersion Model for Predicting Air Pollution Concentrations near Roadways or Road Network"**. The air quality predictions have been done for the horizon years 2010, 2020 and 2030. The results of various or numerous types of mathematical modelling applications

shows that CO, SO_2, NO_X, HC, **"Respirable Particulate Matter" (RPM)** stuff concentration will remain within the limits of CPCB tills the end of project life. The SPM levels are well within limit at present also. But significant contribution of SPM is expected from vehicular emissions; transportation; industrial as well as domestic activities in future as given in **Figure 23**.

"Affected Persons" (APs) should be fully informed of their rights and responsibilities from the very beginning of the process to achieve transparency and understanding between the APs and the project implementers.

Primary stakeholders include the APs, the beneficiaries of the project, the host population, the **"Project Partner Agencies" (PPAs)** such as **"Urban Development Authority" (UDA)**, and more importantly the project proponent and the **"Ministry of Defence and Urban Development" (MOD and UD)**, Ministry of Finance and Ministry of Land and Land Development. The secondary stakeholders are those who have an interest in the project such as the National Government, the political authority, policy – makers, advocacy groups, NGOs and other private and public sectors which have indirect involvements with the project.

Therefore, PPA need to be assisted more closely in explaining and guiding them in resolving the issues in a more productive manner more favourable to the APs, as per involuntary resettlement principles and guidelines. This nature of consultation with the project APs and their profiling are mandatory as per the requirements of preparing the **"Resettlement Action Plans" (RAP),** which needs to be carried out as socio – economic and census surveys as an integral part of detailed designing.

Implementation Stage	***Involve APs in decision – making committees;*** ***Involve APs in monitoring and evaluation;*** ***Establish "Grievance Redress Committee" (GRC) procedures, representatives of APs;*** ***Arrange APs inputs to entitlements, income restoration and resettlement options;*** ***Consultations with APs on alternatives;*** ***Involve APs in assessing project impacts.***

Figure 23: Increase in Levels of Pollutant – Emissions – Impact on Future Generated Aspects/ Prospects from Various Sources.

Impact on Noise Levels

The impact of noise levels from the proposed project on the neighbouring communities is addressed by carrying out Noise Modelling using **"FHWA Model"** developed by **"Federal High Way Administration" (FHWA)**. It has been concluded after Mathematical Modelling that both day time and night time equivalent noise levels are within the permissible limits as right from start of project life. Noise sensitive receptors have been identified along the projected road site/ area. The noise sensitive receptors include school, hospitals, colleges; old orphan people's sensitive house zones (Ashrams) and other nearby housing transportation activities along the road side etc. The predicted levels indicate that the noise levels in future years will not exceed permissible limits right from start of project life as given in **Figure 24**. Hence there is no need to protect these noise sensitive receptors.

Figure 24: Noise Levels Impact Must Not Exceed the Permissible Limits in Sensitive Zones along Road Side.

Impact on Water Resources and Quality

The construction and operation of the proposed project roads will not have any major impacts on the surface water and the ground water quality in the area projected site/ region. Contamination to water bodies may results due to spilling of construction materials, oil, grease, fuel and paint in the equipment yards and **"Asphalt Crusher Plants" (ACP) or "Hot Mixing Plants" (HMP)**. This will be more prominent in case of locations where the project road crosses water streams; major canals distributaries, minor/ major ponds and minor/ major small lakes etc. Mitigatory measures have been planned; generated; Initialized and finalized to avoid contamination of these water bodies are given in **Figure 25**.

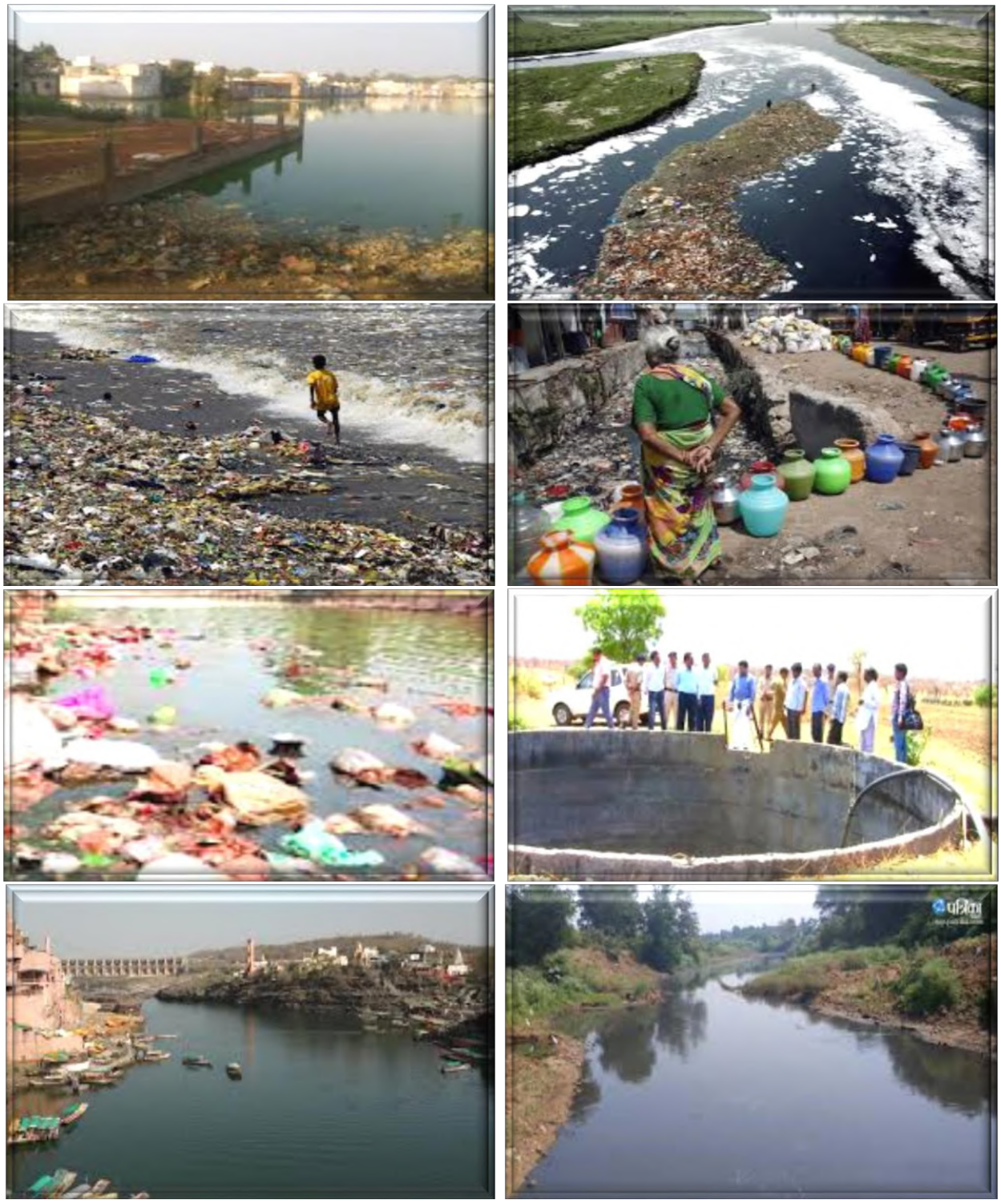


Figure 25: Mitigatory Measures Plans Generated; Initialized and Finalized to Avoid Contamination Impact on Water Resources and Quality.

Impact on Ecological Resources and Soil Quality

There is no wildlife sanctuary in the close vicinity of the projected road. The study area passes primarily through agricultural land in plain areas. There will be temporary impact on terrestrial ecology, as trees will be cut. But after construction no impact is anticipated as compensatory a forestation is planned. There are no endangered species or rare species of flora and fauna in the projected area. There is no major loss of vegetation; hence adverse impact in terms of availability of nesting sites for the bird doesn't arise in the region. Furthermore; there is no sensitive Environmental/ Natural/ Ecological area near the existing

projected roads, so the impact will be insignificant or inconsequential. Brief potential impacts are shown in **Figure 25** and are presented in matrix below in the **Table 46**.

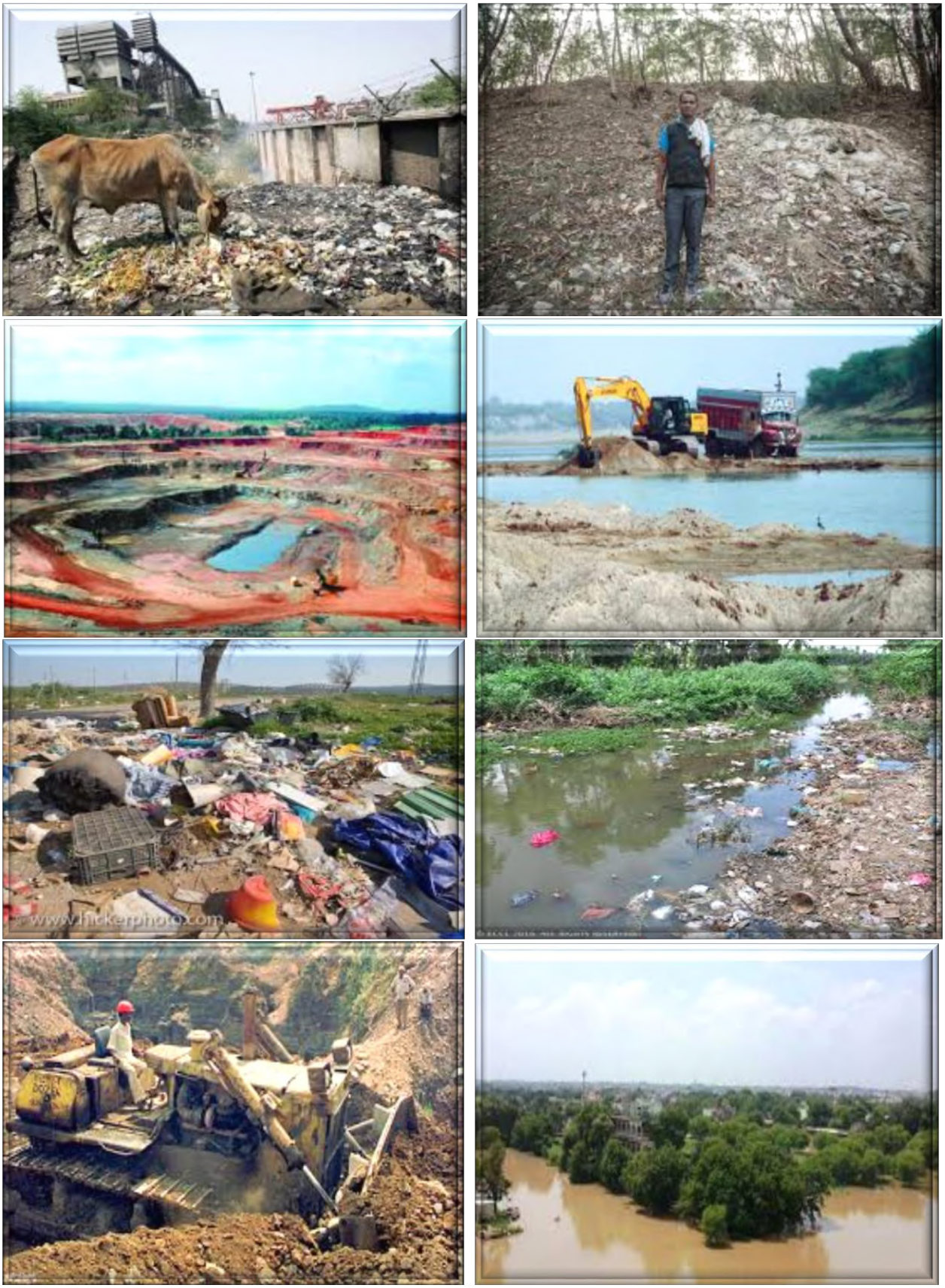


Figure 26: Plan Mitigatory Measures to Avoid Soil Contamination Impact on Agricultural Land and Other Sensitive Zones in Environmental/ Natural/ Ecological Vicinity/ Area/ Site.

Table 46: Potential Environmental Impacts.

Project Activity	Pre – Construction	Construction Phase						Operation Phase
Component Affected	**Land Acquisition**	**Site Clearance**	**Earth Moving (Borrow Pits)**	**Contractor Camps**	**Quarries Areas**	**Construction of Highway**	**Asphalt Crusher Plants**	**Operation**
Soil	*Loss of productive agricultural land*	*Loss of crops, and increase in soil erosion*	*Loss of top soil and erosion*	-------	*Increase in erosion, siltation and slope instability*	*Soil pollution*	*Pollution due to spills*	**Soil contamination due to surface runoff**
Ground Water	-------	-------	-------	*Water Extraction for drinking*	-------	*Exploitation of water for construction*	-------	**Maintenance of trees/ shrubs**
Surface Water	-------	*Change in water quality and siltation*	*Water logging and mosquito breeding*	*Water pollution from sanitary and other wastes*	*Water logging problems*	*Change in water quality*	*Water pollution due to spill into water bodies*	**Degradation due to spill – over sand road run off**
Drainage	-------	*Change in natural drainage pattern*	*Change in drainage pattern*	-------	*Modification in natural drainage*	*Interference with natural drainage, water logging*	-------	**Cleaning and maintenance**
Air Quality	-------	*Increase in air pollution*	*Particulate matter pollution*	*Atmospheric pollution due to fuel burning*	*Dust pollution*	*Dust pollution*	*SPM, SO_2*	**Increase in SPM, NOx, CO**
Noise Quality	-------	*Reduced buffering of noise*	*Increase in noise levels due to machinery*	-------	*Vibration from blasting operations*	*Vibrators, concrete batching plants noise etc.*	*Increase in noise*	**Increase in noise levels due to increased traffic**
Forest	-------	*Habitat loss, and vegetation*	*Loss of forest*	*Encroachment into forest areas*	*Loss of habitat/ cover*	*Loss of forest*	-------	-------
Trees	*Tree cutting clearance*	*Loss of trees*	*Loss of trees*	*Cutting of trees*	*Tree cutting*	*Loss of trees*	-------	-------
Temples/ Mosques	*Clearance*	*Removal/ rehabilitation*	-------	-------	-------	-------	-------	-------

Impact on Drainage Pattern

The proposed widening and strengthening will not alter drainage pattern of the area as adequate cross drainage structures have been planned along the new alignments and existing culverts along the project road are planned for **"Rehabilitation and Resettlement" (R and R)**. Construction of bridges across water streams may result in siltation of water body, which can affect aquatic life and fauna in the region/ area or proposed site. Proper mitigatory measures have been recommended in **"Environmental Management Plans" (EMPs)**.

Impact on Human Use Values

Impact on human use values are including **"Precious Planet Earth's",** common property resources such as temples, mosques, wells, hand pumps, stream channels, stream fountains and tube well etc. Impact on these has been minimized through proper planning of the alignments along roadside/ location site. The environmental impacts have been summarized as in **Figures 27 (a) to (d)** and **Table 36** given below.

Mitigation Avoidance and Enhancement Measures

The mitigation measures have been planned for identified adverse environmental impacts alignment enhancement design phase is being applied along roadside to reduce tree cuttings as compensatory plantation process or relevance. These mitigation measures have been identified as **"Environmental Management Plans" (EMPs)** during **"Planning, Construction and Operation Phase"**.

Design Phase

Figure 27 (a): Mitigation Enhancement as per Alignment Design Phase to Reduce Tree Cutting and Compensatory Plantation Relevance.

Anticipated; Recommended and Refined Enhancement Measures of Road Design Phase for ZERO Pollution Level...!!!

Figure 27 (b): Anticipated Refined Enhancement Measures of Road Design Phase as per Alignment to Reduce Tree Cutting and Compensatory Plantation Relevance for ZERO Pollution Level.

Figure 27 (c): Recommended Refined Enhancement Measures of Road Design Phase as per Alignment to Reduce Tree Cutting and Compensatory Plantation Relevance for ZERO Pollution Level.

Road Designing Phase for ZERO Pollution Level

Figure 27 (d): Road Designing Phase as per Alignment to Reduce Tree Cutting and Compensatory Plantation Relevance for ZERO Pollution Level.

Impacts during design phase is limited to removal of trees, acquisition of land and structures, relocation of water ways, water parks, water bodies, water locations, water streams or channels identification and management of borrow pits are as mentioned in **Table 47**.

Table 47: Impacts during Design Phase.

Impacts	Mitigation Measures
Land Acquisition	*Alignment design to minimize the land acquisition whenever applicable;*
Major Displacement	*Bypasses and detours to be considered preciously;*
Removal of Trees	*Alignment design to reduce the number, widening on the side of the road where less trees are required to be cut. Compensatory plantation to be planned;*
Impact on Public Utilities *e.g.*, Community Wells etc.	*Alignment design to be considered. In case of removal alternate arrangement to be done before;*
Impact on Cultural Sites	*Alignment design to be considered. Public consultation may be needed if impact cannot be avoided;*
Relocation of Waterways	*Hydrology to be considered. Public consultation will be needed, wherever applicable;*
Access Restriction	*Required alternatives, underpasses, proper signposts for people should be included in design all types of roads constructions;*
Congestion in Settlement Areas	*Service road to be provided everywhere all over the road network;*
Borrow Pits	*Locations to be selected considering minimum loss of productive land and redevelopment and resettlement;*
Environmental Specifications for Contractors	*Environmental qualifications specification should be included in pre – qualification packages for the contractors and structure designers.*

Construction Phase

Environmental management during construction phase is more crucial, because major impacts during construction like earthworks road network, movement of heavy machineries etc. causes lot of disturbances and management becomes essential at this stage during construction work. The construction workers camp will be located at least 500 Meters away from habitations. The construction yard, **"Hot Mix Plants" (HMPs)** and crushers like **"Asphalt Crusher Plants" (ACP)** etc. will be located at 500 Meters away from habitations and in downwind directions. The minimum distance of these will be kept 3.0 Km. from reserve forest areas. Adequate cross drainage structures have been planned to maintain proper cross drainage. ***"In order to compensate negative impacts on floral species due to cutting of trees the project plans compensatory plantation in the ratio of 1: 3 i.e., for everyone has to be applied... if one tree is cut...!!! Then three or more trees will be planted".*** The acquisition of forest area will be minimal and will be compensated through compensatory afforestation. The noise barriers have been planned closed to educational institute so that post project noise levels are within the specified limits. The project will take an opportunity to provide **"Environmental Enhancement Measures" (EEM)** to improve aesthetic activities in the projected area. The planned **"Environmental Enhancement Measures" (EEM)** include ponds enhancement, plantation in median and in available clear space in **"Right of Way" (ROW)**, seating arrangements around trees must be installed or placed in the specific region. The pond **"Enhancement Measures" (EM)** will include such as stepped access; washing platforms and seating arrangements ought to be applied etc. Some of ditches will be filled up due to embankment construction in the **"Right of Way" (ROW)**. In order to avoid contamination of water bodies during construction sedimentation chambers, oils and grease separators, oil interceptors at storage areas and at construction yard have been planned. The bill of quantities for mitigation and enhancement measures has been given in respective **"Environmental Management Plans" (EMPs)** of construction packages. **Table 48** below summarizes impacts and its Environmental Management Plan during Construction Period.

Table 48: Environmental Management Plan during Construction Period.

Impacts	Mitigation Measures
Soil Erosion	*Proper planning for slope stabilization, topsoil storage, plantation and turf on slopes;*
Loss of Topsoil	*Arable lands will be avoided for earth borrowing network. If needed, topsoil will be separated and refilled after excavation on operational site/ region/ area;*
Borrowing of Fill Materials	*Excavation from pre – selected locations. After excavation the borrow pits will be dressed to match with the surroundings. In specific cases borrow pits can be excavated in consultation with local people to use those pits as water harvesting point locations in particular areas/ sites;*
Disposal of Construction Waste	*No haphazard dumping of construction waste. Only pre – selected location maintaining local environmental regulations activities/ performance will be used for operational site;*
Disposal of Human Waste by Construction Workers	*Specific landfill sites should be identified to manage solid waste generated from habitation of construction workers on operational site/ area/ specified region;*
Generation of Dust	*Water will be sprayed during construction phase, in earth handling sites, asphalt mixing or crushing sites and other excavation areas for suppression of dust on operational site;* *In case fly ash is used, dust emission during its unloading, storage at open place and handling for road construction should be suppressed by water sprinkling at regular interval and operation with space and time;* *Dust emission from piles of excavated material should also be controlled by spraying water on the piles located areas/ sites/ regions;* *Special care should be taken when working near schools and medical facilities and other sensitive zones.*

Environmental issues change during operation phase and its mitigation plans are also related with vehicular movement, road safety and management of ecological as well as natural/ environmental/ ordinary issues. Environmental aspects are thus more or less related to vehicular emission; domestic; industrial or anthropogenic activities in the surrounding areas. The mitigation measures for different environmental aspects are discussed in **Table 49** below.

Table 49: Environmental Management during Operation Phase.

Impacts	Mitigation Measures
Dust	*Bad road maintenance of road gives high rise to dust pollution. Road Surface will be maintained properly and constantly;*

Gaseous Pollution	*All vehicles should be checked for **"Pollution Under Control (PUC)"**, certificates and occasional spot testing of emission from vehicles will be carried out in specified regions;*
Noise	*Noise level for different automobiles has been prescribed in Environment (Protection) Rules, 1986. Signs will be posted to restrict blowing of horns with high tons in front of highly sensitive locations or zones;*
Surface Runoff	*Surface runoff from the road will not be disposed directly in the water – bodies or surfaces used by people for bathing and washings purposes etc. It should also not be disposed directly in to any watercourse with good water quality;*
Wild Life	*There should be speed restrictions through specific forest area in the night and day time to prevent accident with wild animals. There will be proper signs and indications for the drivers to inform about these activities happening in the region/ area or site;*
Flora	*Tree plantations will be monitored continuously on regularly basis;*
Safety	*Safety signs and signals should be kept always clean and updated on regular basis;*
Public Amenities	*Bus stops, underpasses etc. should be kept in order for specified zones on the site/ region or area.*

Waste Water and Solid Treatment Process

Current treatment strategies are directed towards reducing the amount of solid waste that needs to be land filled, as well as recovering and utilizing the materials present in the discarded wastes as a resource to the largest possible extent. Different methods are used for treatment of solid as well as waste water and the choice of proper method depends upon refuse characteristics, land area available and **"Disposal of Human Waste by Construction Workers"** with disposal cost as they are given below in pyrolysis process as shown in the **Figure 28**:

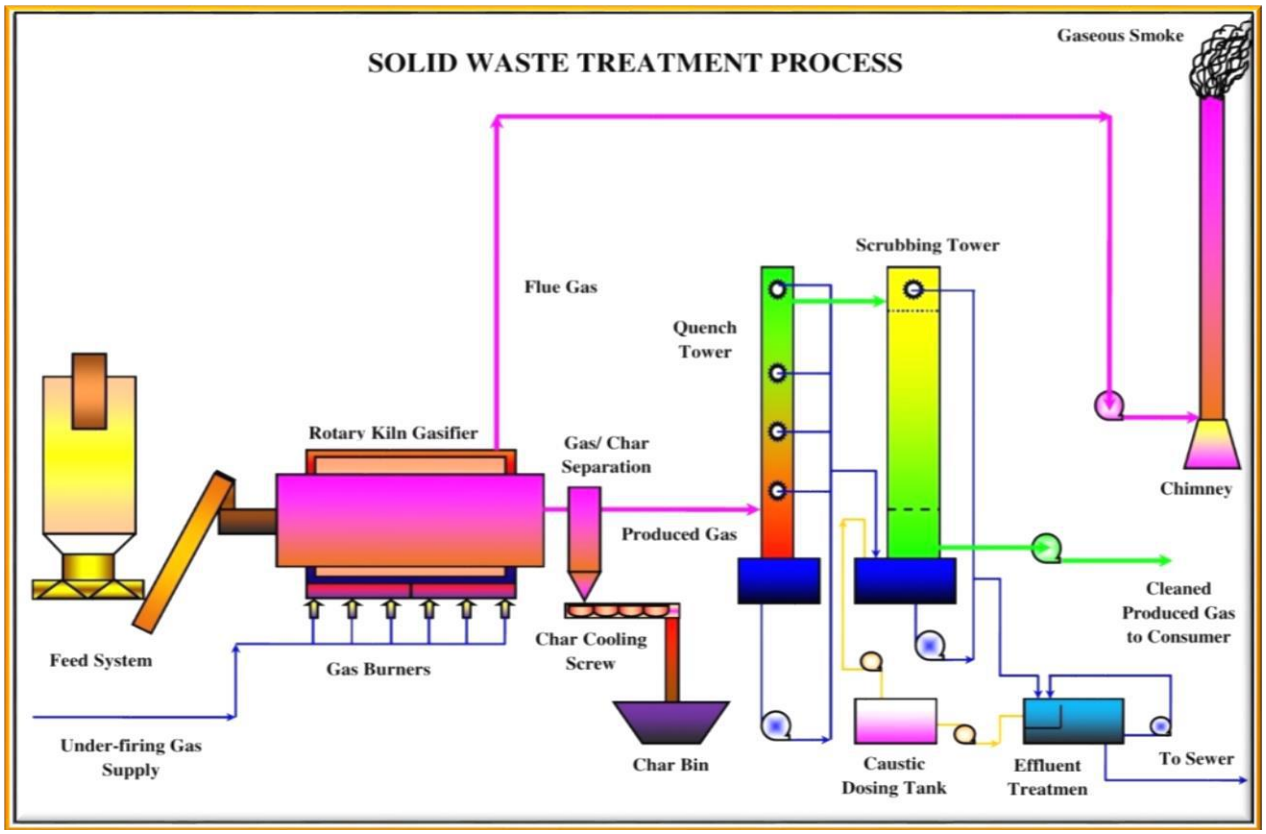


Figure 28: Process of Pyrolysis in Solid and Waste Water Treatment.

Pyrolysis: Pyrolysis is defined as thermal degradation of waste in terms of may be water or solid in the absence of air to produce char, pyrolysis oil and syngas, *e.g.*, the conversion of wood to charcoal also it is defined as destructive distillation of waste in the absence of oxygen. External source of heat is employed in this process. Because most organic substances are thermally unstable they can upon heating in an oxygen – free atmosphere be split through a combination of thermal cracking and condensation reactions into gaseous, liquid and solid fraction.

- *Incineration process;*
- *Compaction process;*

- *Pyrolysis process;*
- *Gasification process;*
- *Composting process.*

Solid Waste Handling Practice

Proper method should be adopted for management of solid waste disposal in a soil. Industrial wastes can be treated physically, chemically and biologically until they are less hazardous. Acidic and alkaline wastes should be first neutralized; the insoluble material, if biodegradable should be allowed to degrade under controlled conditions before being disposed off into the soil. As a last resort, new areas for storage of hazardous waste should be investigated such as deep well injection and more secure landfills. Burying the waste in locations situated away from residential areas is the simplest and most widely used technique of solid waste management.

Environmental and aesthetic considerations must be taken into consideration before selecting the dumping site's soil condition and quality. Incineration of other wastes is expensive and leaves a huge residue and adds to air, water and soil as major pollutant in terms of residue as well. ***"Pyrolysis Practice or Technique"*** is a process of combustion in absence of oxygen or the material burnt under controlled atmosphere of oxygen as Solid Waste Handling Pyrolysis Technique shown **Figure 29**. It is an alternative to incineration. The gas and liquid thus obtained can be used as fuels. Pyrolysis of carbonaceous wastes like firewood, coconut, palm waste, corn combs, wheat pod, cashew shell, rice husk, paddy straw, barley pod, maize husk and saw dust, yields charcoal along with products like tar, methyl alcohol, acetic acid, and acetone and fuel gases.

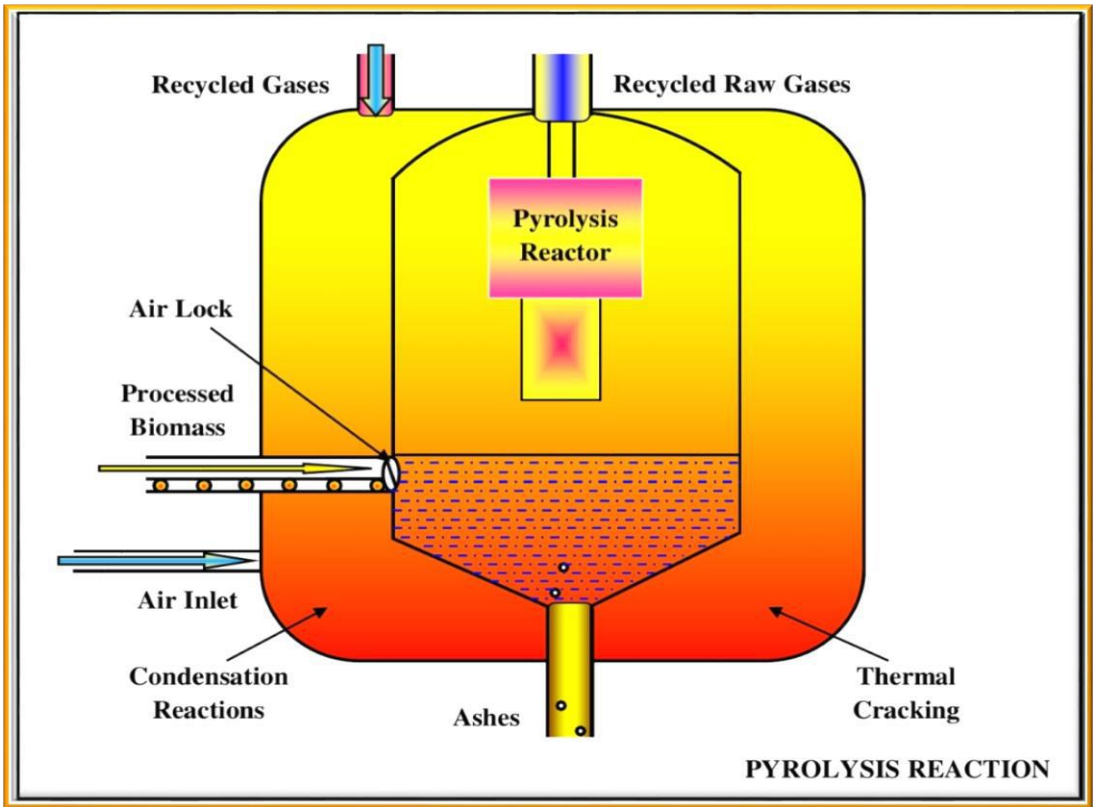


Figure 29: Solid Waste Handling Pyrolysis Technique.

Environment Baseline: Environmental, ecological and societal profile of the study region/ vicinity of project location are based on secondary data of Physiographic, Topology, Climate, Water Quality, Biological outline of town. The study has to be incorporated regarding ***"Sewage Treatment Plant" (STP)*** both in terms of theoretically and technically applicability for the specific region. The working model of Sewage Treatment Plant or principal subject matter has to be applied in the town so that it must play significant role for the people and its cultural civilization of the society as shown in the **Figure 30**. The flora and fauna recognized in the study spot are commonly found and not precise to the province due to the deficiency of forest in the study zone.

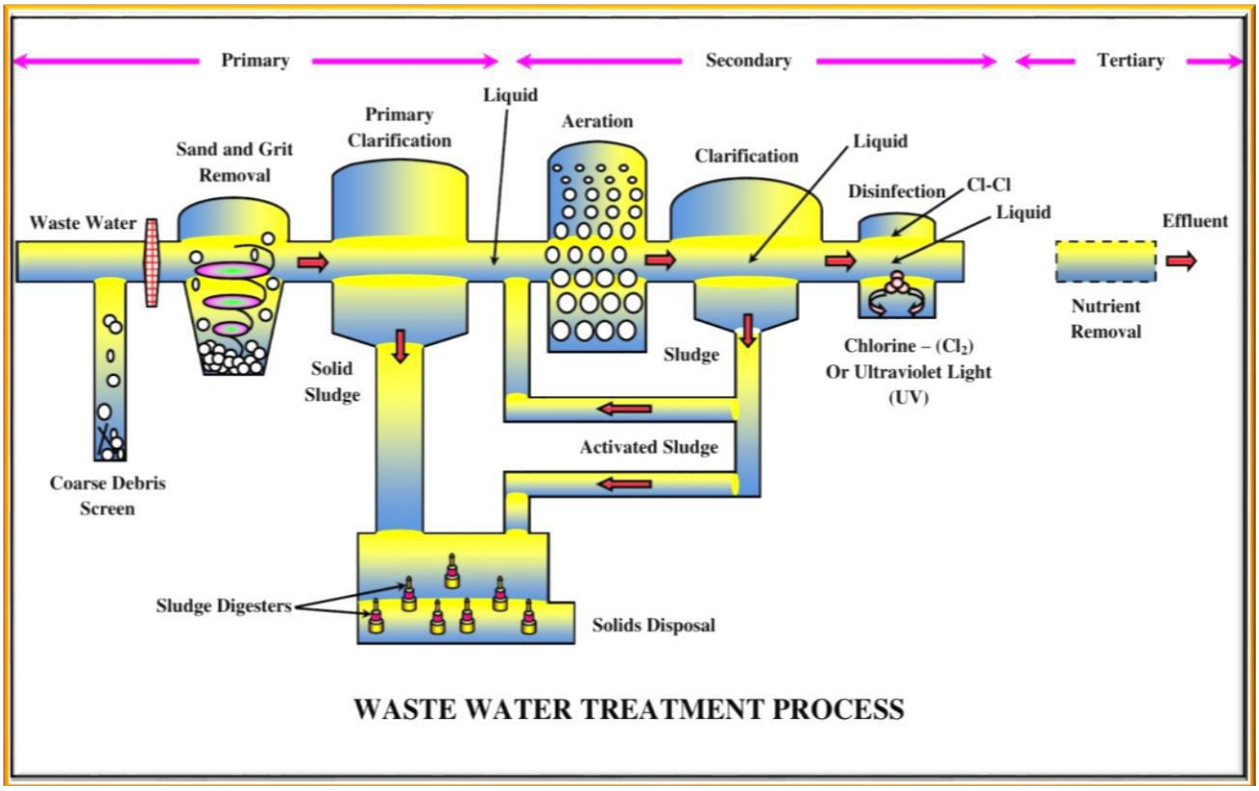


Figure 30: Sewage Treatment Process (STP) of Wastewater Layout.

13. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLANS

"National Highway Authority of India" (NHAI) has a well – established **"Environmental Management Unit" (EMU),** Head by a Senior Officer **"Indian Forest Services" (IFS)** from "**Ministry of Environment and Forest" (MOEF),** who is supported by an officer of **Dy. G. M.** rank from **"State Pollution Control Board" (SPCB)**. Main responsibility of EMU will be established to monitor the progress regarding **"Environmental Management Plan" (EMP)**. **"Environmental Management Plan"** will be the responsibility of contractors and will be closely coordinated by the **"Engineer" (Supervision Consultant)**. **Table 50** as given below discusses about the remedial measures components, locations/ regions/ areas, time frame work and institutional responsibility with applicable criteria.

Table 50: Institutional Responsibility of Remedial Measures.

Environmental Components	Remedial Measures Components	Locations/ Regions/ Areas	Time Frame Work	Applicable Responsibility Criteria
Design – Phase				
Major Resources (Alignment, Public Amenities and Public Utilities)				
Alignment	*Avoid impacting school, health facilities, water bodies and residential quarters.*	*Throughout the Project Corridor.*	*During Design*	**Design Consultant**
Public Amenities	*Provision of service roads, underpasses, safety signs, bus stops, lay bees, parking spaces etc.*	*Throughout the Project Corridor as Mentioned in EIA Report.*	*During Design*	**Design Consultant**
Closure of Public Utilities *e.g.*, Tube – Wells, Wells, Bus Stops etc.	*Alternative arrangement.*	*Throughout the Project Corridor as Mentioned in Social Impact Assessment (SIA).*	*At the Beginning of Construction Activities.*	**Contractor, Supervising Engineer**
Construction – Phase				
Water Resources and Pollution (Water Bodies, Rivers, Drinking and Wastewater Water)				

Water Bodies	*Construction of embankments, de – siltation and environmental enhancement as mentioned in EIA report.*	*Water Bodies As Mentioned in EIA Report.*	*Throughout Construction Phase*	**Contractor, Supervising Engineer**
Rivers/ Nallahs	*Prevention of pollution of water.*	*Rivers/ Nallahs Mentioned in EIA Report.*	*Throughout Construction Phase*	**Consultant, Contractor, Supervising Engineer**
Water Requirement for Construction	*Arrange water without affecting local requirement. Do not use local water bodies. Drill boreholes with required permission. No water collection within forest area.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Drinking Water Requirement	*Arrange water without affecting local requirement.*	*Workers' Camps Working Site.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Wastewater from Workers' Camp	*Ensure proper sanitation and drainage. No direct wastewater discharge in water bodies or the rivers/ Nallahs.*	*Workers' Camps*	*Throughout Construction Phase*	**Contractor, Supervising Engineer**
Air and Noise				
Dust Generation	*Spraying of water, proper handling of fly ash.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Dust Generation near Sensitive Locations	*Spraying of water, work during scheduled period only.*	*Schools, PHCs as Mentioned in EIA Report.*	*During Construction Near the Vulnerable Sites.*	**Contractor, Supervising Engineer**
Asphalt Plant	*Location away from sensitive areas.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Stone Crushers	*Implementing proper air pollution control measure as per law.*	*Stone Crushers.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Gaseous Emission from Construction Work Vehicles	*Ensure checking of vehicular emission and obtaining Pollution Under Control (PUC) certificate.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Noise from Machineries and Construction	*Ensure machineries meeting noise level standards. Blasting to be done with required caution.*	*Throughout Projected Locality/ Region*	*Throughout Construction Phase*	**Contractor, Supervising Engineer**
Noise at Sensitive Locations	*Work only at scheduled period. Construct noise barrier if suggested. No work during night in forest areas.*	*At Schools, PHCs as Mentioned in EIA Report. In Forest Areas.*	*During Construction Near the Vulnerable Sites.*	**Contractor, Supervising Engineer**
Land and Soil				
Storage of Construction Materials, Debris. Fly Ash, etc.	*Prevent siltation from washing of construction materials.*	*Throughout the Project Corridor.*	*During Rainy Seasons.*	**Contractor, Supervising Engineer**
Soil Erosion	*Proper planning for slope stabilization, topsoil storage, plantation and turf on slopes.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Borrow Pits and Queries	*Excavation from pre – selected locations. After excavation the borrow pits will be dressed to match with the surroundings.*	*Selected Borrow Pits and Quarries as given in EIA Report.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Solid Waste from Construction Work	*Ensure dumping outside city area with permission from local authority or used as landfill material.*	*Throughout Project Area/ Site/ Region*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Flora (Plants' Life)				
Tree Felling	*Ensure plantation of trees on both sides of road and around in consultation with forest department.*	*Throughout the Project Corridor and Beyond.*	*Throughout Construction Phase.*	**Design Consultant, Contractor, Supervising Engineer**
Fauna (Plants' Life)				

Forest Area	*No work after evening. No use of water bodies, safety regulations, no workers' camp.*	*In the Forest Area.*	*Throughout Construction Phase*	**Contractor, Supervising Engineer**
Others (Public, Religious and Aesthetics)				
Workers' Camp	*Ensure providing camp of proper dimension and environmental quality as given in EIA report.*	*Workers' Camps.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Public Facilities	*Ensure access to all important locations.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Religious Places	*Ensure minimum disturbance during festival time.*	*Throughout the Project Corridor.*	*Religious Festivals.*	**Contractor, Supervising Engineer**
Aesthetics	*Planting flowering creepers on medians, slope vegetations, suitable design of restaurants etc.*	*Throughout the Project Corridor.*	*Throughout Construction Phase.*	**Contractor, Supervising Engineer**
Operation – Phase				
Sources (Dust, Gaseous Pollution, Forest, Safety and Public Amenities)				
Dust	*Road maintenance.*	*Throughout the Project Corridor.*	*Throughout Operation Phase.*	**Contractor, Supervising Engineer**
Gaseous Pollution	*Check the vehicles for pollution control.*	*Throughout the Project Corridor.*	*Throughout Operation Phase.*	**Contractor, Supervising Engineer, Traffic Department**
Forest	*Speed restriction safety signs underpass maintenance.*	*In Forest Areas.*	*Throughout Operation Phase.*	**Contractor, Supervising Engineer, Traffic Department**
Safety	*Maintain all safety provisions.*	*Throughout the Project Corridor.*	*Throughout Operation Phase.*	**Contractor, Supervising Engineer, Traffic Department**
Public Amenities	*Bus stop and other amenities to be properly kept.*	*Throughout the Project Corridor.*	*Throughout Operation Phase.*	**Contractor, Supervising Engineer, Traffic Department**

14. PRINCIPAL COMPONENT ANALYSIS (PCA) INDICATORS

Significant Indicators as **"Principal Component Analysis" (PCA)** performed also indicates that indicators, which play significant role in explaining vulnerability among the districts states. Amongst all the indicators considered in particular sector indicators with weights greater than the average weight of all indicators are considered as important in explaining vulnerability study applications. **Table 51** gives the list of significant indicators in order of their importance for each sector. These indicators can play important role in decision making process/ system/ methodology in a goal to reduce vulnerability.

Table 51: Principal Component Analysis as Significant Indicators of Remedial Measures.

Sr. No.	Principal Indicators Analysis/ Aspects	Conceptual Basis
(A)	**Social Aspects/ Analysis**	
1.	*Population Served Per Health Centre (Community, Primary and Sub Health Centers);*	Adaptive Capacity
2.	*Percentage of Households With Access To Sanitation Facilities;*	Adaptive Capacity
3.	*Level of Urbanization;*	Adaptive Capacity
4.	*Percentage of Households With Access to Safe Drinking Water;*	Adaptive Capacity
5.	*Density of Population;*	Sensitivity
6.	*Number of Slum Dwellers Per Slum;*	Sensitivity
7.	*Percentage of Households Owning Radio, Transistor, Television and Telephones;*	Adaptive Capacity
8.	*Proportion of Elderly Population Aged 65 and Above;*	Sensitivity

9.	*Proportion of Child Population in The Age Group 0 – 6;*	Sensitivity
10.	*Literacy Rate and Growth;*	Adaptive Capacity
(B)	**Economic Aspects/ Analysis**	
11.	*Agricultural Credit Societies Per Lakhs of Population;*	Adaptive Capacity
12.	*Loan Disbursed by Agricultural Credit Societies Per Cultivator;*	Adaptive Capacity
13.	*Scheduled Commercial Banks Per Lakhs of Population;*	Adaptive Capacity
(C)	**Agricultural Aspects/ Analysis**	
14.	*Percentage of Land Holdings Below 1 Hectare;*	Sensitivity
15.	*Fertilizer Consumption and Utilization;*	Adaptive Capacity
16.	*Percentage of Net Irrigated Area to Geographical/ Physical/ Environmental Area By Surface Water;*	Adaptive Capacity
17.	*Percentage of Bio – Farming Villages in Total Villages;*	Adaptive Capacity
18.	*Percentage Share and Contribution of Agricultural And Cultivators Main Workers;*	Sensitivity
19.	*Yield and Capitulate of All Crops;*	Adaptive Capacity
(D)	**Water Aspects/ Analysis**	
20.	*Crop Water Stress, Strain and Sprain (Evapo – transpiration/ Potential Evapo – transpiration);*	Sensitivity
21.	*Surface Water Availability and Accessibility;*	Adaptive Capacity
(E)	**Climate Aspects/ Analysis**	
22.	*Warm Nights – Days, When Minimum Temperature > 90^{th} Percentile;*	Exposure
23.	*Warm Days – Cool Nights – Days, When Maximum Temperature > 90^{th} Percentile;*	Exposure
24.	*Warm Spell Duration Indicator (Annual count of days with at least 6 consecutive days when maximum temperature > 90^{th} percentile);*	Exposure
25.	*Cool Days – Cool Nights – Days, When Maximum Temperature < 10^{th} Percentile;*	Exposure
26.	*Cool Nights – Days, When Minimum Temperature < 10^{th} Percentile;*	Exposure
27.	*Flood Discharge;*	Exposure
28.	*Extremely Wet Days – Annual Total Rainfall, When Rainfall > 99^{th} Percentile;*	Exposure
(F)	**Health Aspects/ Analysis**	
29.	*Percentage of People Having Diarrhea and Other Dieses;*	Sensitivity
30.	*Index, Directory, Catalog, Guide, Manifestation or Indicator of Malaria;*	Sensitivity
(G)	**Pollution Aspects/ Analysis**	
31.	*Pollution of Rivers/ Wetlands, Degradation of Forests and Biodiversity Loss is Being Observed;*	Exposure
32.	*Effective Industrial Waste Management and Pollution Control;*	Exposure
33.	*With Increasing Pollution Increase in Respiratory Diseases and Allergies is Also Predicted to Increase on the Site;*	Exposure
34.	*Water Pollution is another Big Concern for the State. Depletion of Water Resources and Deterioration of Water Quality is Big Concern for the State;*	Exposure
35.	*Use of More Efficient Technology to Reduce Pollution. Effective Industrial Waste Management and Pollution Control;*	Exposure
36.	*Climate Change (CC) could Increase Air Pollution Levels by Accelerating the Atmospheric Chemical Reactions that Produce Photochemical Oxidants due to a Rise in Temperature;*	Exposure
37.	*Long Term Targets – By achieving renewable sources of environmental factors/ parameters through agriculture – ecosystem management, implementation of main schemes as soil carbon storage and metersing, enhancing soil health, reducing ground water pollution specially harmful chemicals and enhancing biodiversity modifications;*	Exposure
38.	*The other serious issues of groundwater quality are high concentration of fluorides (mainly in granitic terrain), agricultural, municipal and industrial or anthropogenic pollutions;*	Exposure
(H)	**Forest Aspects/ Analysis**	
39.	*Percentage of High Density Forest Area to Geographical Area;*	Adaptive Capacity
40.	*Non – Timber Forest Products (NTFPs) Diversity (Number of Varieties);*	Adaptive Capacity
41.	*Number of Joint Forest Management (JFM) Communities, Neighbourhood – Area – District – Groups of People;*	Adaptive Capacity
(I)	**Soil Aspects/ Analysis**	
42.	*Dependence on natural resources is the way of life but unsustainable practices of harvesting, irrigation, elimination of crop residue, forest degradation, deteriorating soil and water quality are augmenting the problems besides other impacts of Climate Change (CC) occur in the state;*	Adaptive Capacity
43.	*Mono – cropping reduces the crop diversity and adversely affects the soil health in the state or region;*	Sensitivity
44.	*Soil and water conservation innovative ideas must be applied through demonstration of best engineering practices;*	Sensitivity
45.	*Set up a knowledge management network to avail information on land – use pattern, soil types, weather or climatic conditions, genotypes of crops, water availability, pasture, off – season crops and agro – forestry practices etc.*	Adaptive Capacity
46.	*Develop capacity to run agriculture related climate models, decipher their projections, to understand the impact on crops, soils and water like precious and important factors etc. in the region/ area or state;*	Adaptive Capacity

47.	*Soil testing – practice and packages must be applied during civil construction work (soil kit to the farmers);*	**Exposure**
48.	*Undertake and revise soil resource mapping at village/ local/ regional or state level;*	**Exposure**
49.	*Promote use of water and soil conservation techniques, namely dry land farming, drip irrigation, intermittent flooding, drying sowing use of high yielding drought resistant cultivars as appropriate etc. in different areas or states;*	**Adaptive Capacity**
50.	*Promote agro – forestry and agro – climatic or weather conditions to increase forest biomass and hence soil moisture;*	**Exposure**
51.	*Identify critical unspecified areas within forests for soil and water conservation;*	**Exposure**
52.	*This effort would not only provide fodder to the animals, but also would curb or reduce further land degradation and soil erosion;*	**Exposure**
53.	*Soil moisture stress to the crops leading to their stunted growth in the region or state;*	**Exposure**
54.	*Soil and water conservation technologies will need to be strongly adopted after observing or seeing the rising temperatures and decreasing water conditions in the state;*	**Adaptive Capacity**
55.	*Soil and water conservation through demonstration of best practices: Application of mulching techniques, drip irrigation, and micro/ macro irrigation practices, techniques and methodologies etc. should be encouraged;*	**Adaptive Capacity**
56.	*Soil conditions may pose threat problems with an expected increase in acidity, alkalinity and salinity;*	**Sensitivity**
57.	*Soil temperature may increase in spring hence the planting time may also vary accord to space and time;*	**Sensitivity**
58.	*Further, it would be worthwhile to build and strengthen capacity in the state to run climate models, interpret their projections, and use the same to run the various bio physical models to understand the impact of* ***"Climate Change" (CC)*** *on crops, soils, water etc. and then to design appropriate adaptation strategies during construction of civil work or human made or designed, but not natural process;*	**Adaptive Capacity**
59.	*In some regions mono – cropping of soybean wheat is rendering the soil infertile, sterile, unproductive, barren, unfruitful, arid, uncultivable and may lead to over use of artificial fertilizer which may be detrimental in the long run;*	**Sensitivity**
60.	*Promoting and managing agro – forestry, agro – climatic specific crops farming practices and management including that of water, soil, pests, crops, cropping cycle and practices for harnessing the full productivity potential of the different zones should be done on high priority basis for regional areas or site locations;*	**Adaptive Capacity**
61.	*This would mean promoting measures for soil moisture conservation through development of watersheds and small catchments that would also increase biomass production and increase the fertility of the* ***"Precious Soil"*** *as well on* ***"Precious Planet Earth"****;*	**Adaptive Capacity**
62.	*Also as the evapo – transpiration rate increases with increase in temperature, it will lead to depletion in moisture retention capacity of the different soil types and can pose a threat to agricultural activities;*	**Sensitivity**
63.	*Expansion of area of cultivation under mono – cropping of profitable crops without nutrition management is leading to rapid decline in soil fertility of these farms and agricultural fields;*	**Adaptive Capacity**
64.	*Simple soil and water conservation techniques, methodologies, applications, processes and overall watershed development including the rejuvenation of tanks is proposed to be the focus;*	**Adaptive Capacity**
65.	*Low capacity of natural water recharge and resources system in the sub – soil in most of the areas of* ***"Arunachal Pradesh"*** *is also a major concern;*	**Sensitivity**
66.	*Water logging in canal command areas leads to soil salinity and needs immediate attention towards conjunctive use of surface streams, channels and ground water;*	**Sensitivity**
67.	*The state is characterized by a great diversity of parent rocks and minerals, which have weathered under different climatic conditions, vegetative covers and topographic situations to form soils with different characteristics in different zones;*	**Exposure**
68.	*Shifting of rainfall pattern affects cropping and farming patterns. Mono – cropping reduces the crop diversity and adversely affects the precious and significant soil health conditions.*	**Sensitivity**

Aspects of Transparent Skeleton – Flowers in Rainy Season, Diphylleia Grayi Rare – Plants.

Figure 31 (a): TCS: TYPICAL CROSS SECTION FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – I

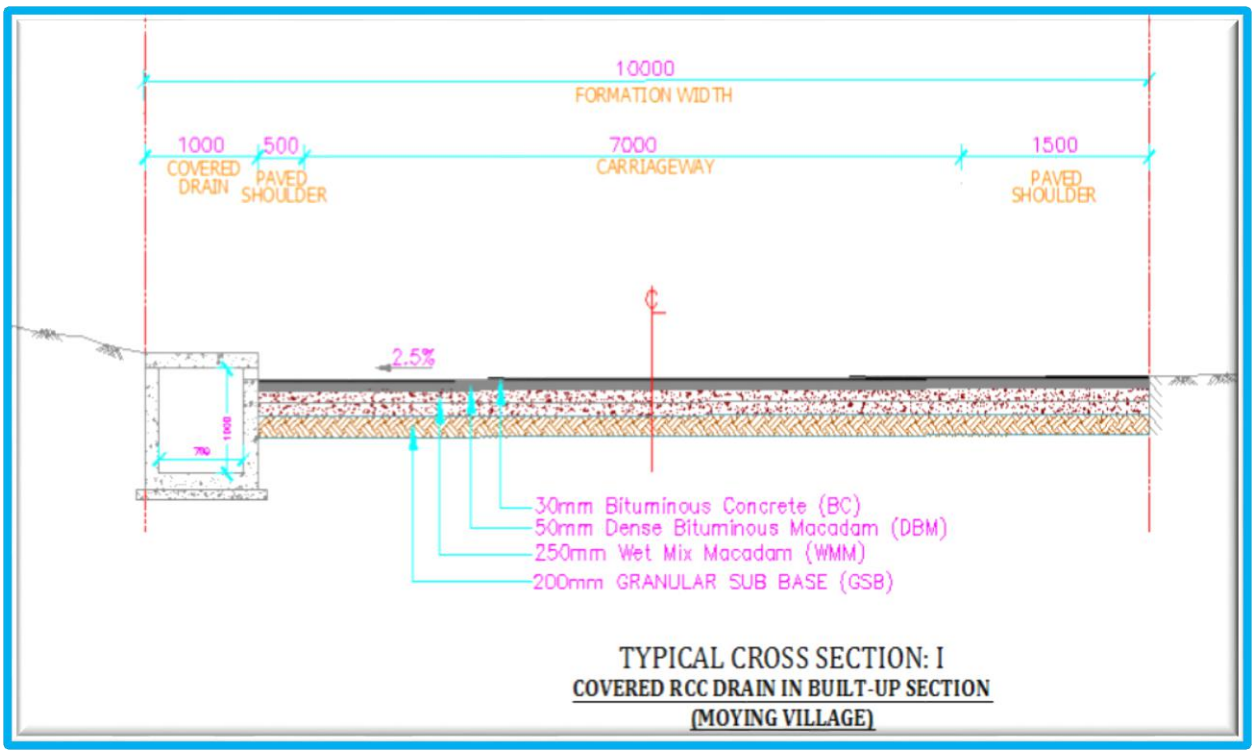


Figure 31 (b): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – II

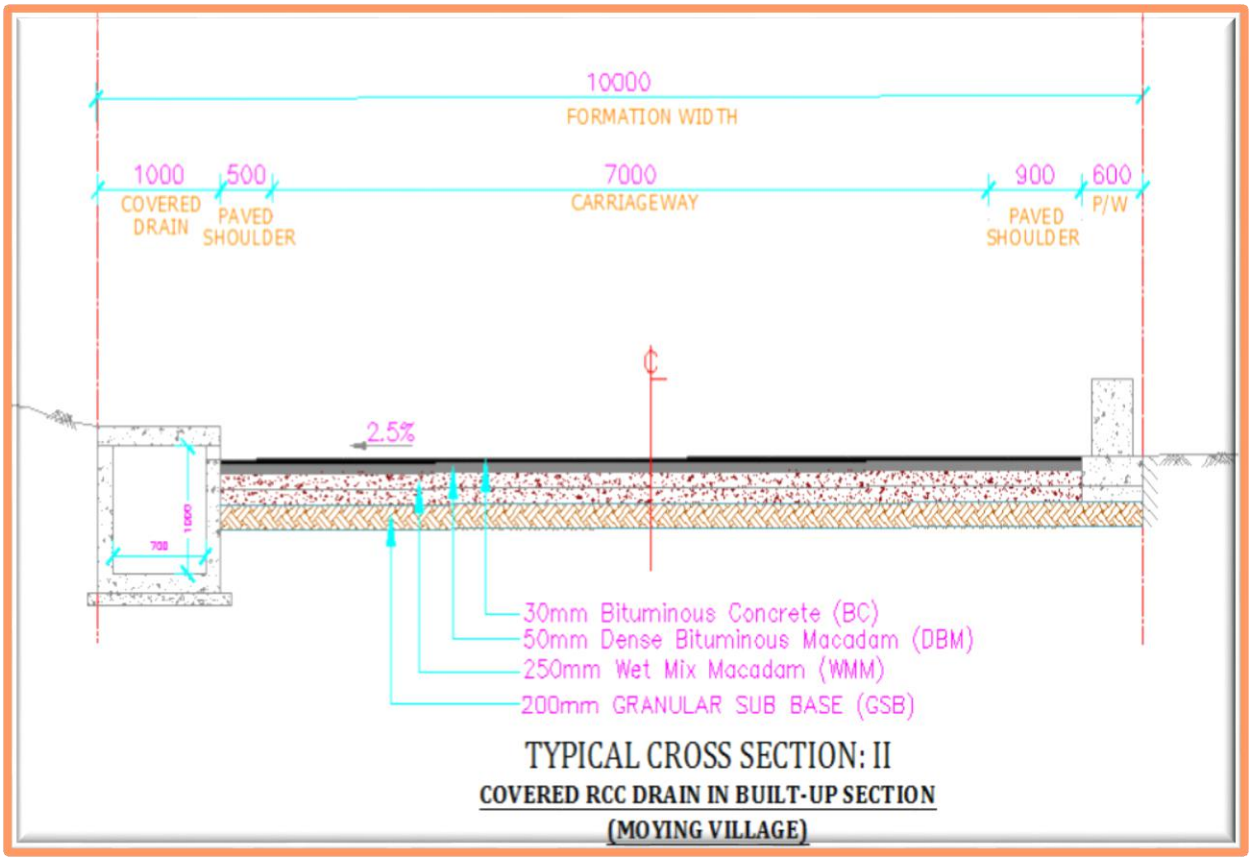


Figure 31 (c): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – III

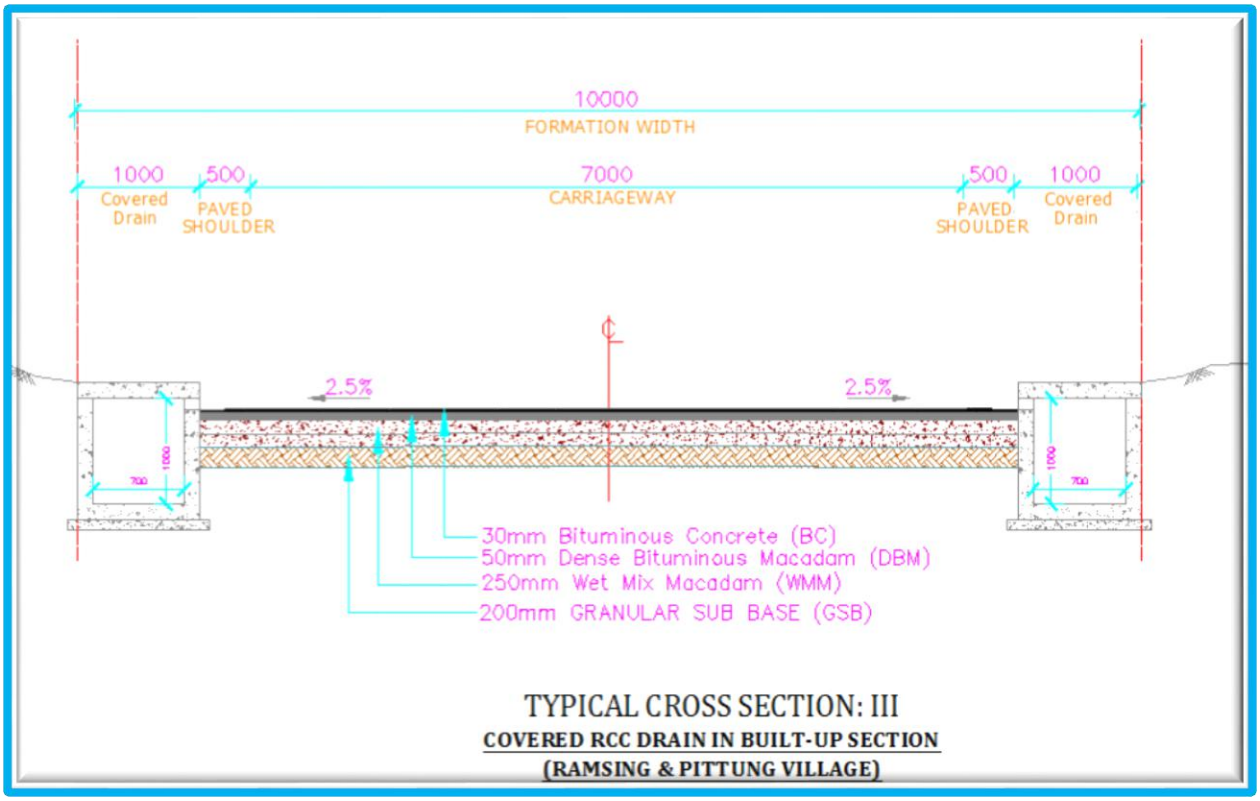


Figure 31 (d): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – IV

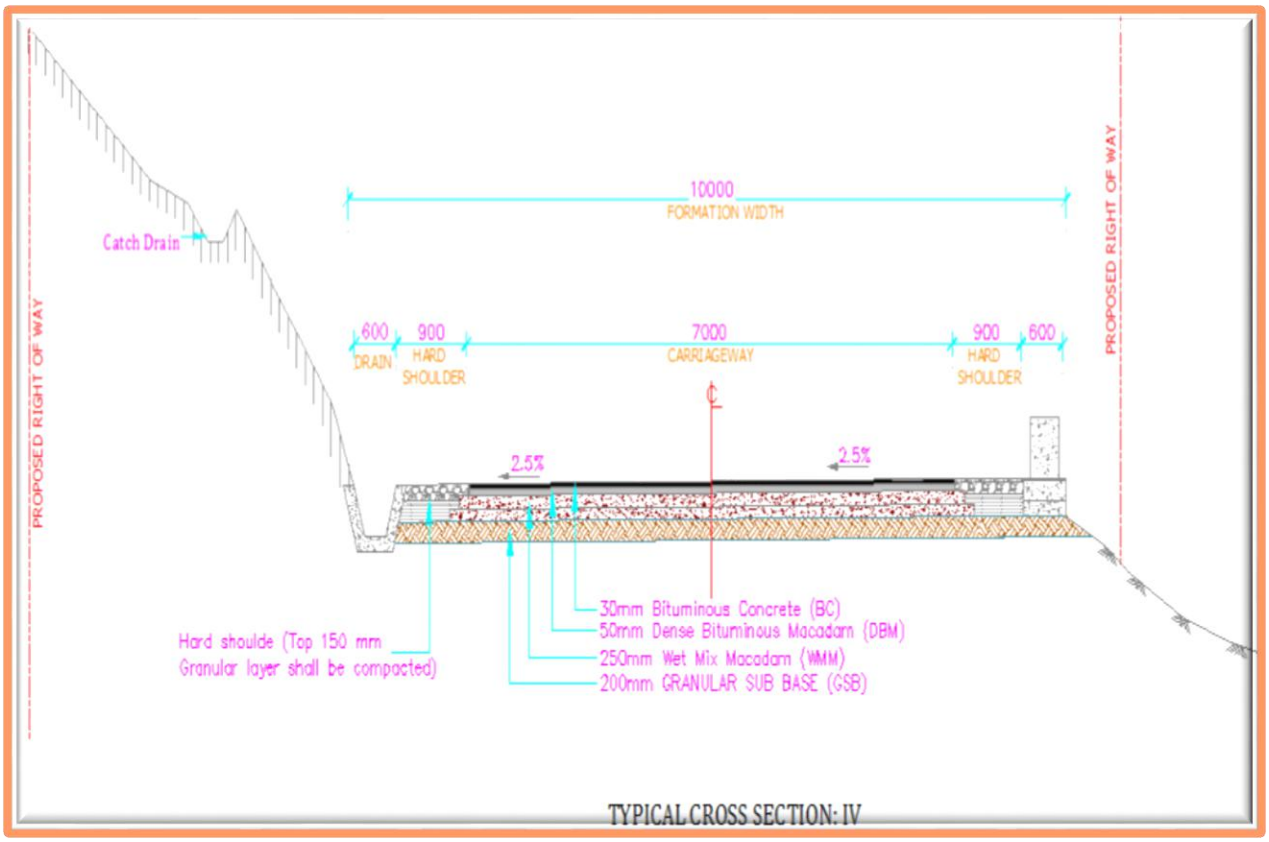


Figure 31 (e): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.

TYPICAL CROSS SECTION – V

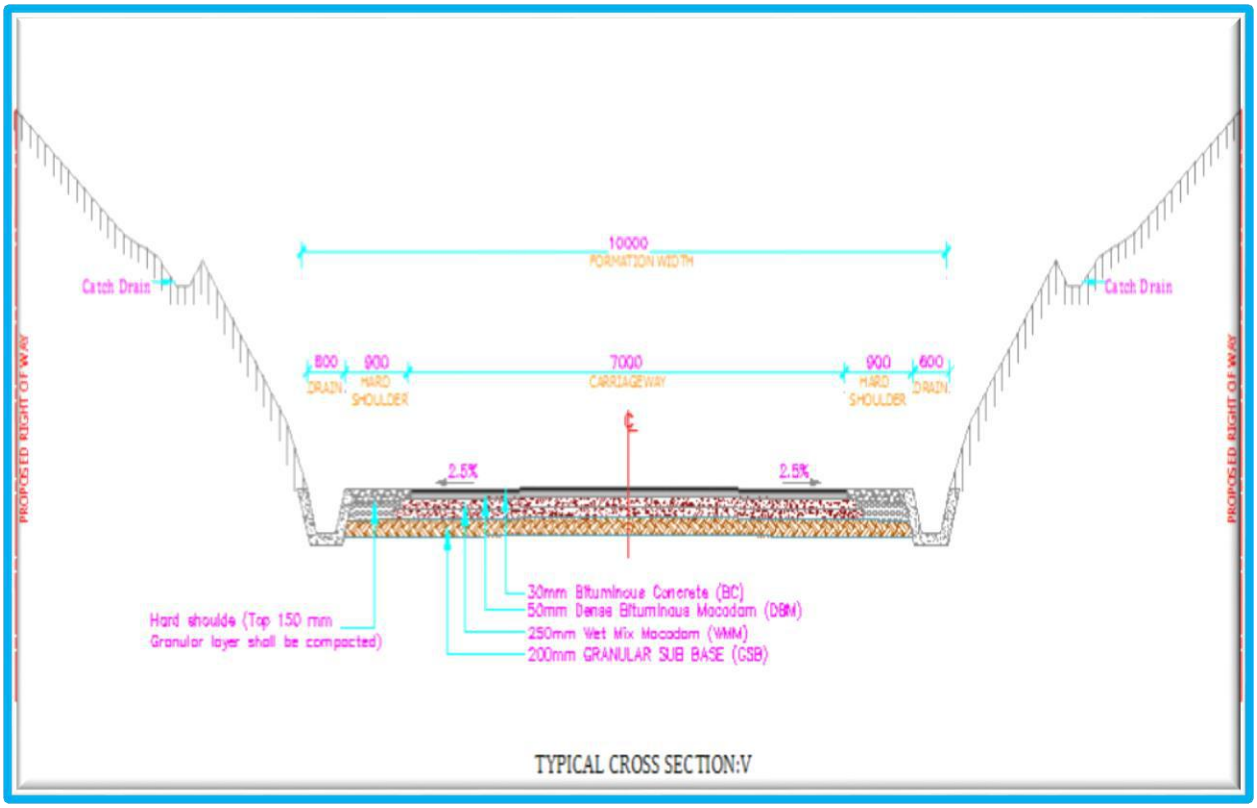


Figure 31 (f): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.

TYPICAL CROSS SECTION – VI

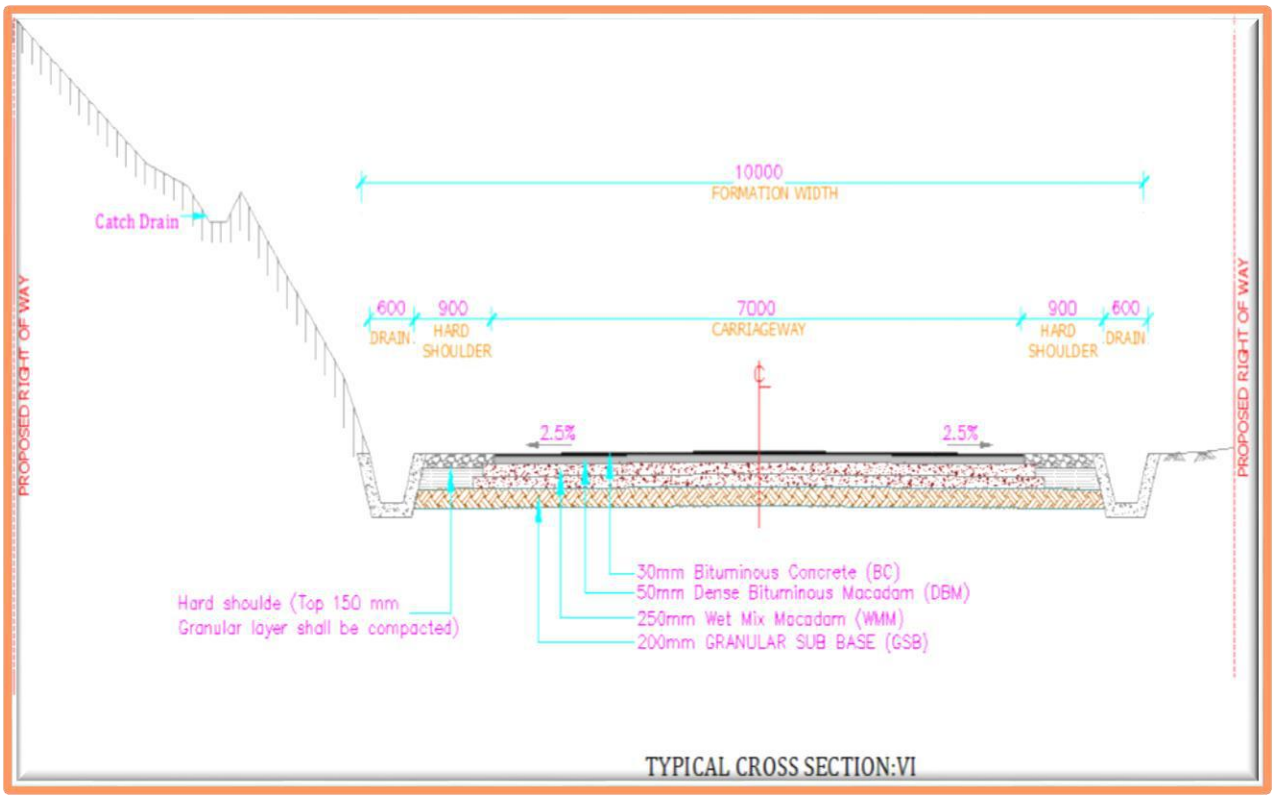


Figure 31 (g): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – VII

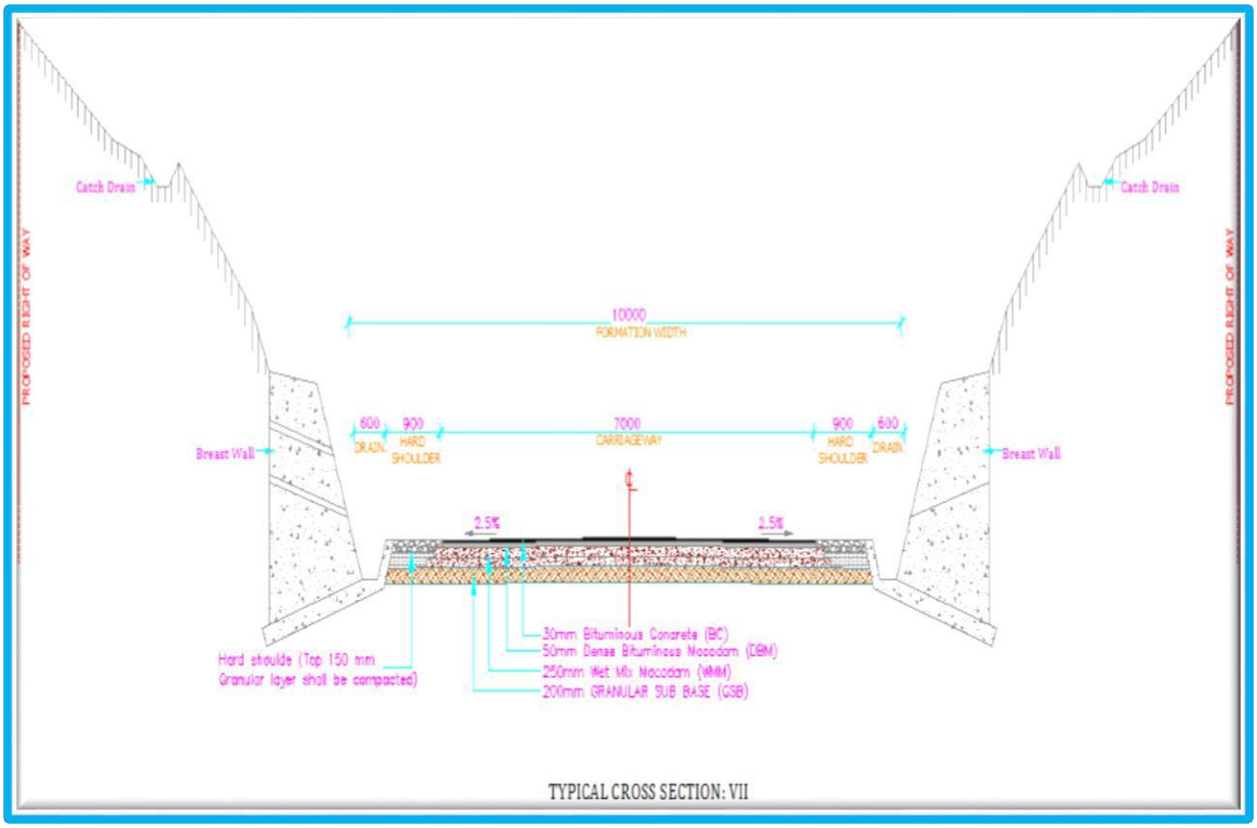


Figure 31 (h): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – VIII

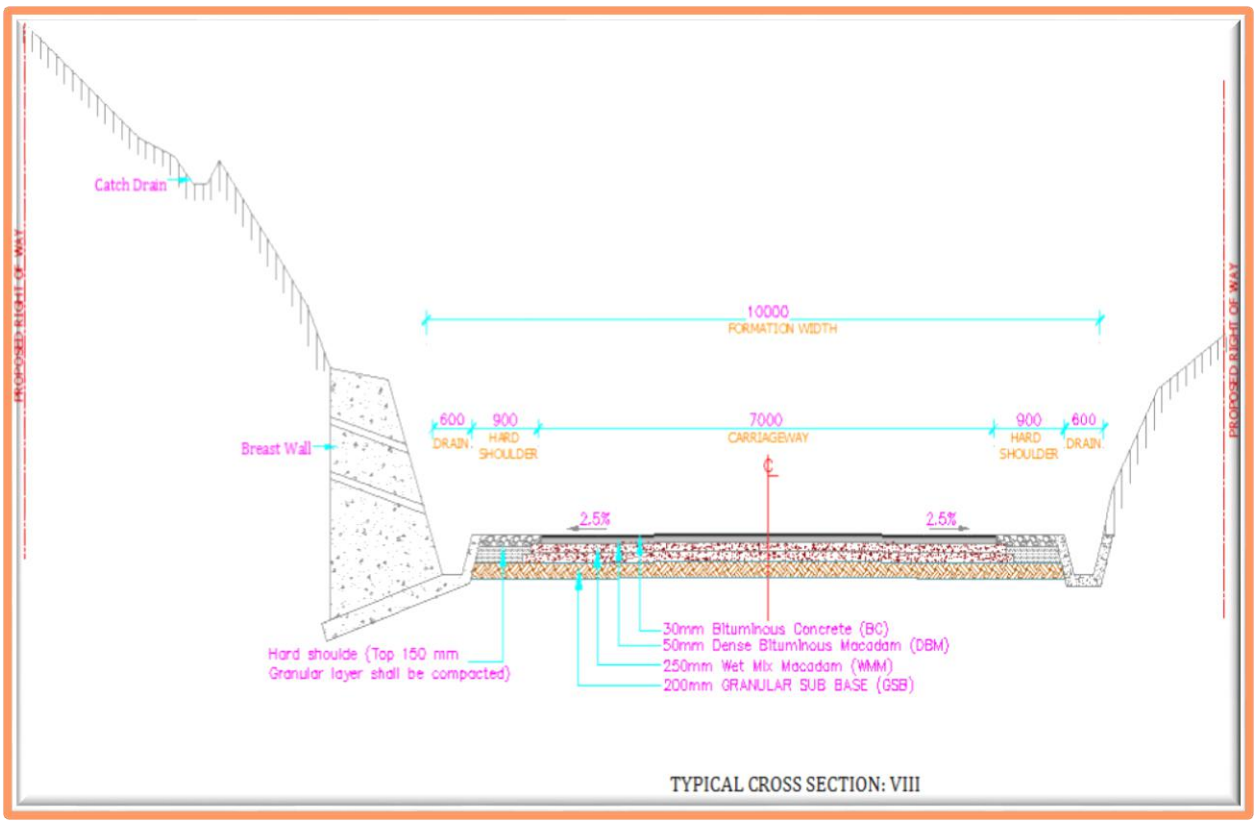


Figure 31 (i): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – IX

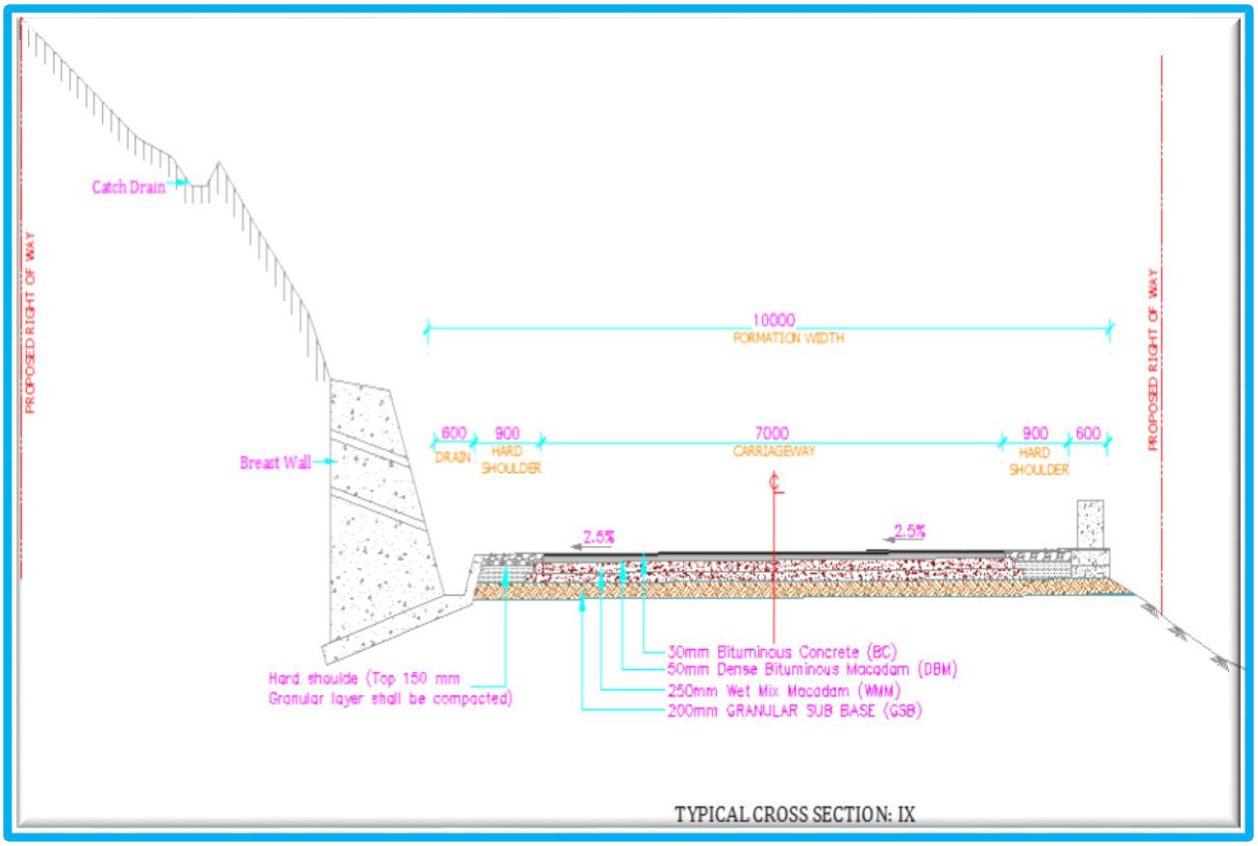


Figure 31 (j): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – X

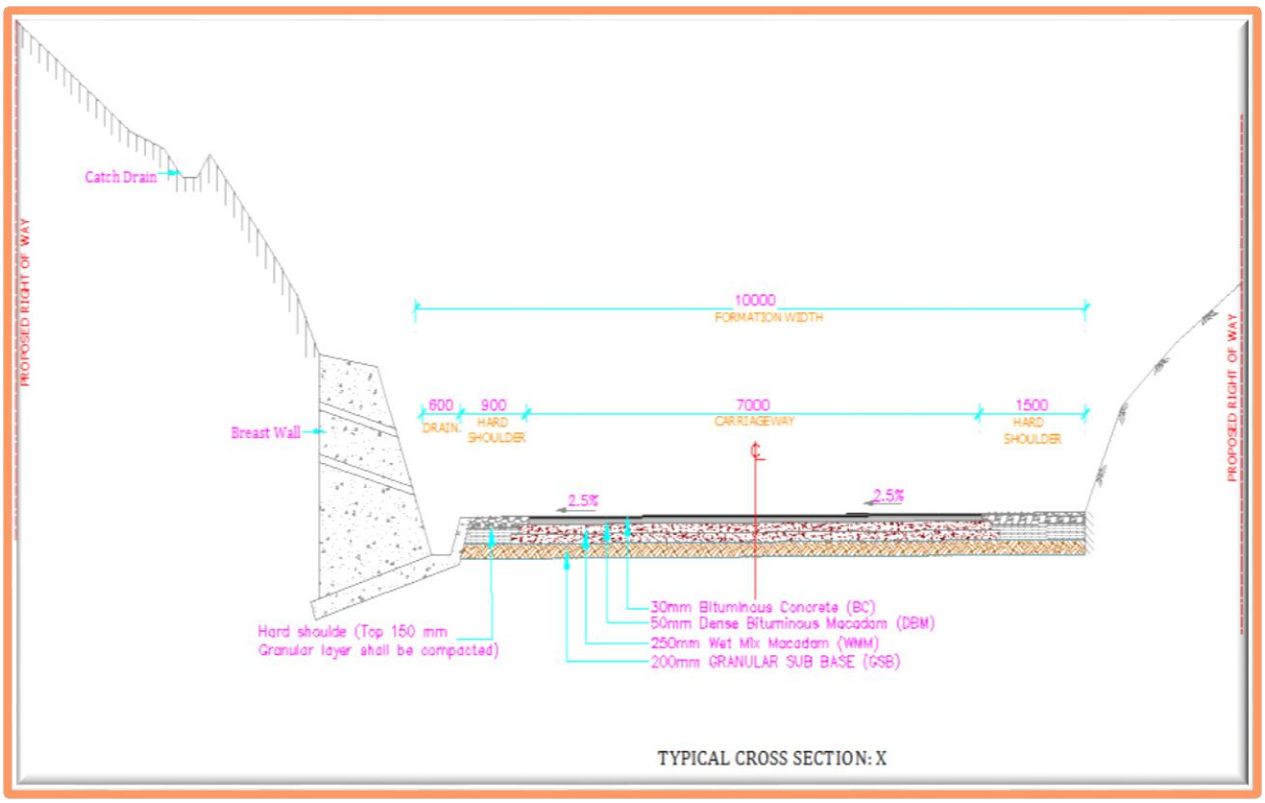


Figure 31 (k): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – XI

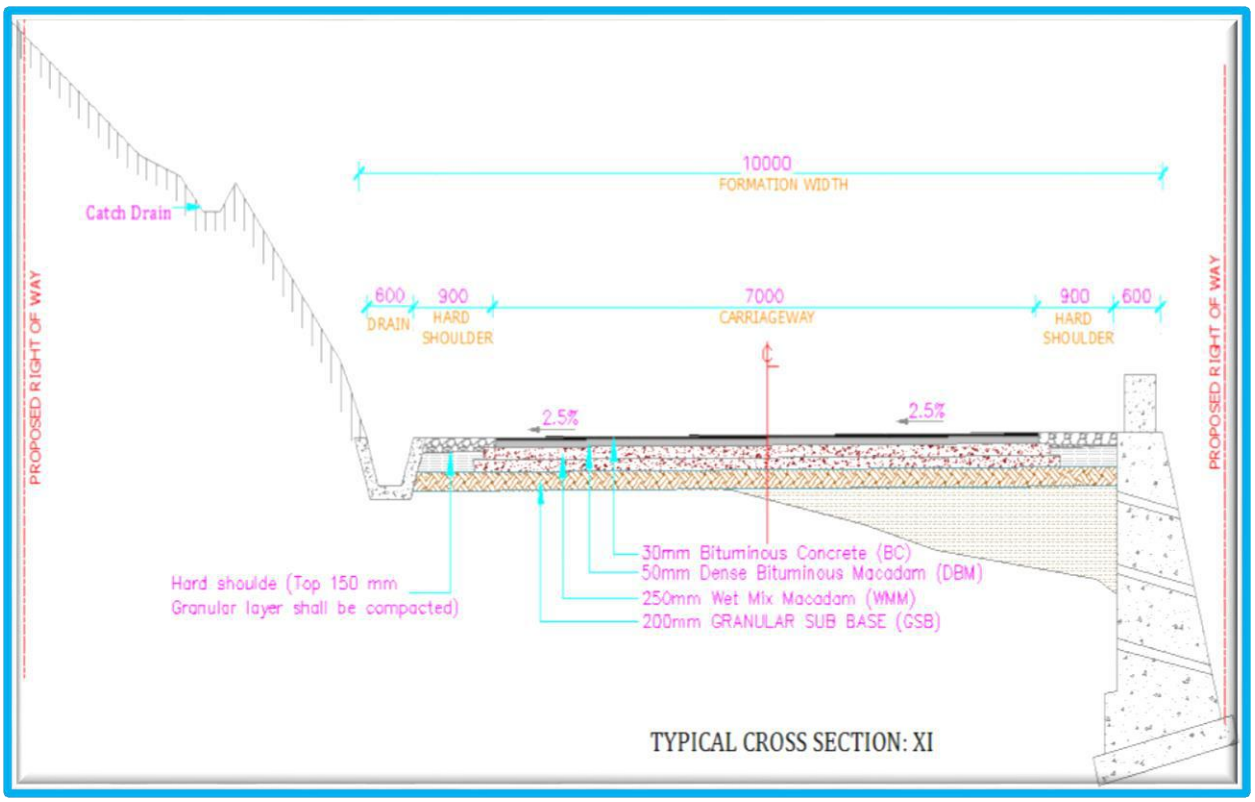


Figure 31 (l): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – XII

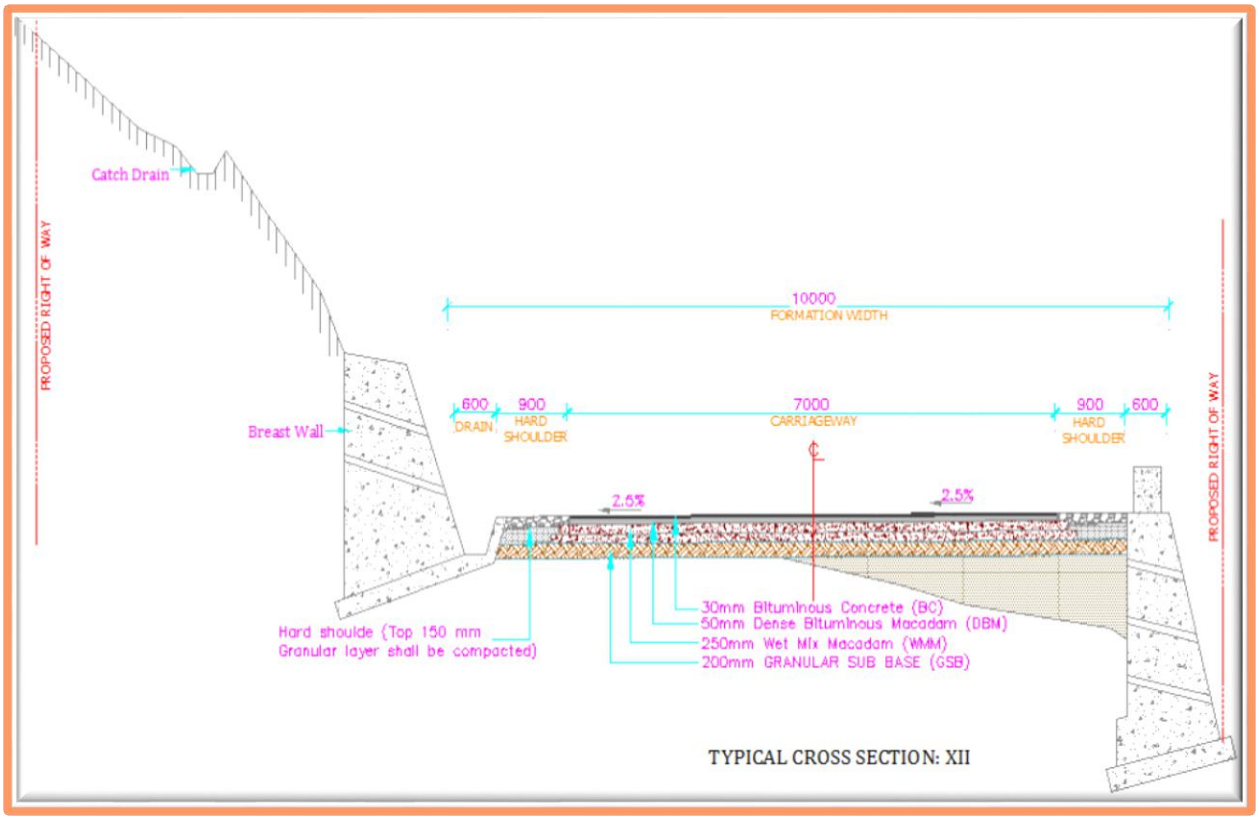


Figure 31 (m): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.

TYPICAL CROSS SECTION – XIII

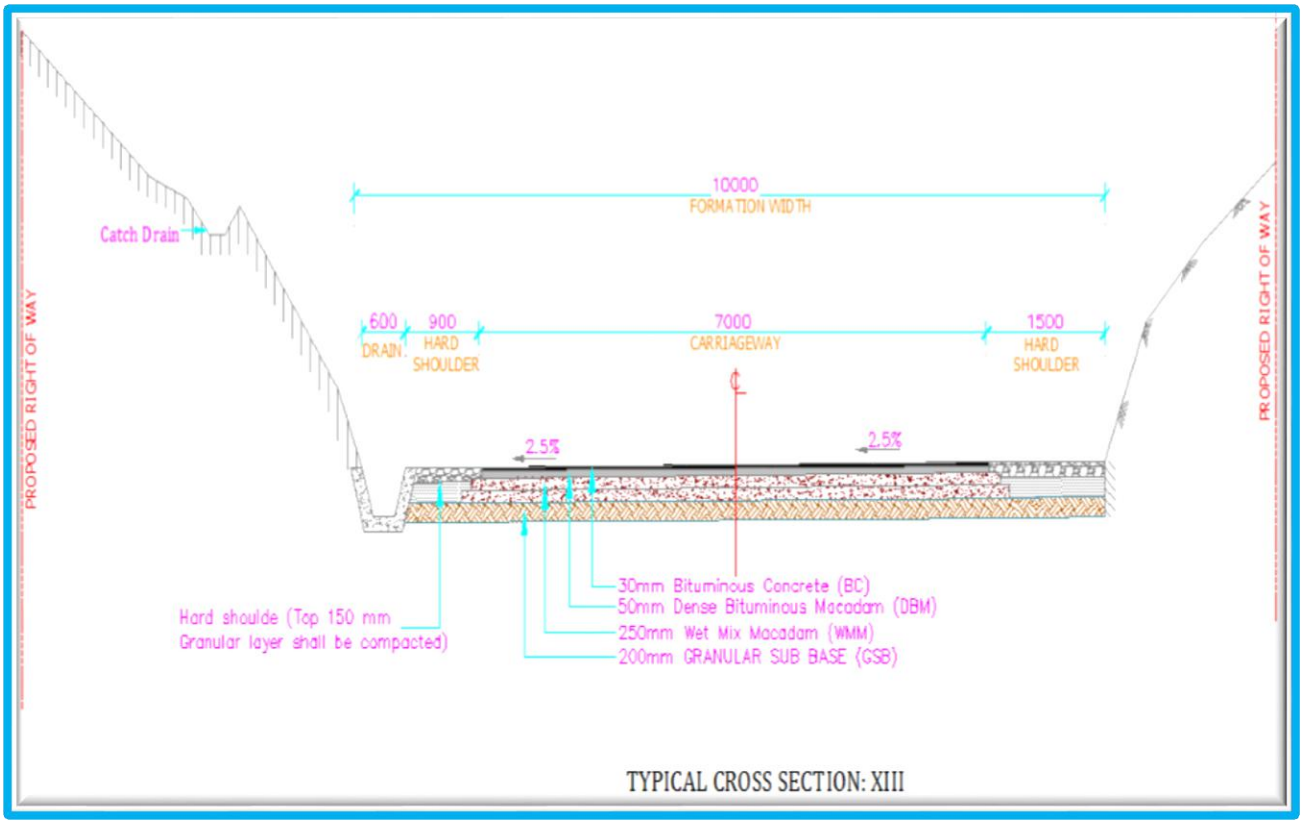


Figure 31 (n): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.

TYPICAL CROSS SECTION – XIV

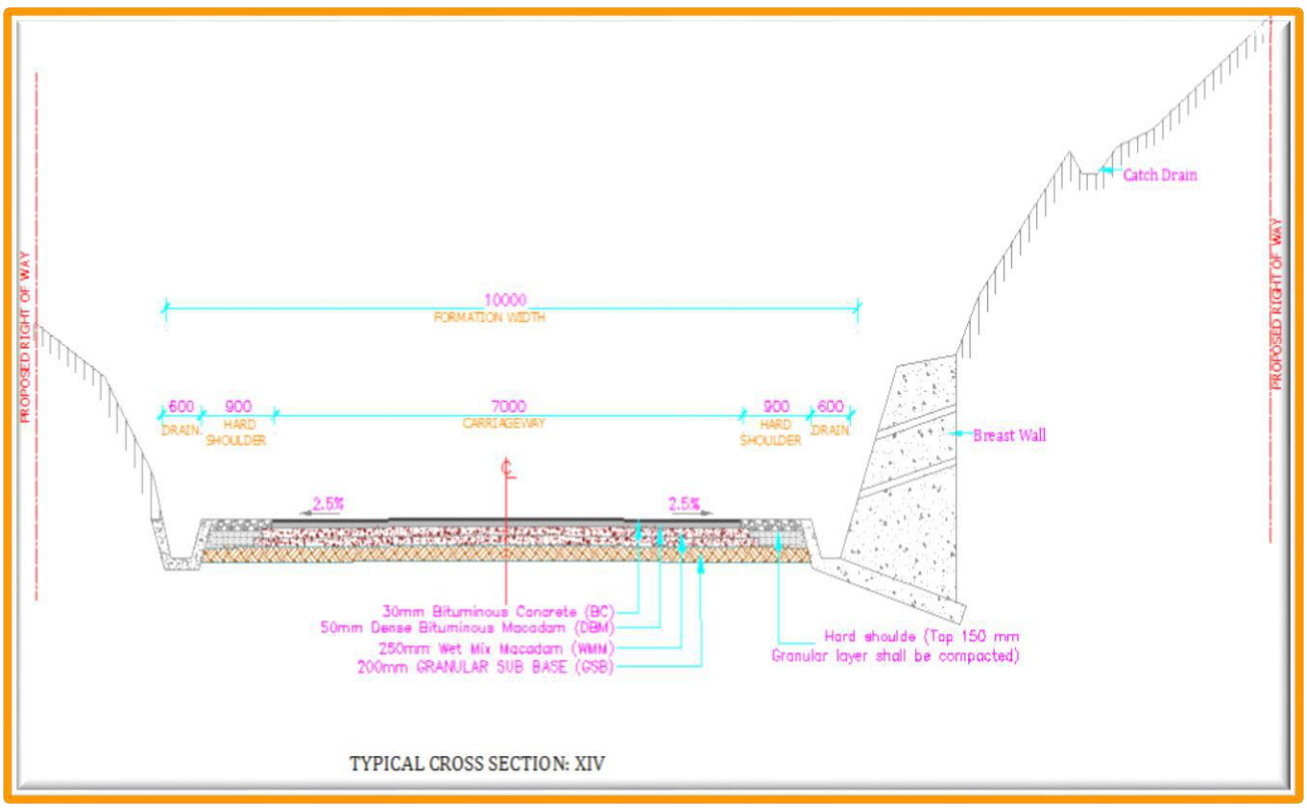


Figure 31 (o): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – XV

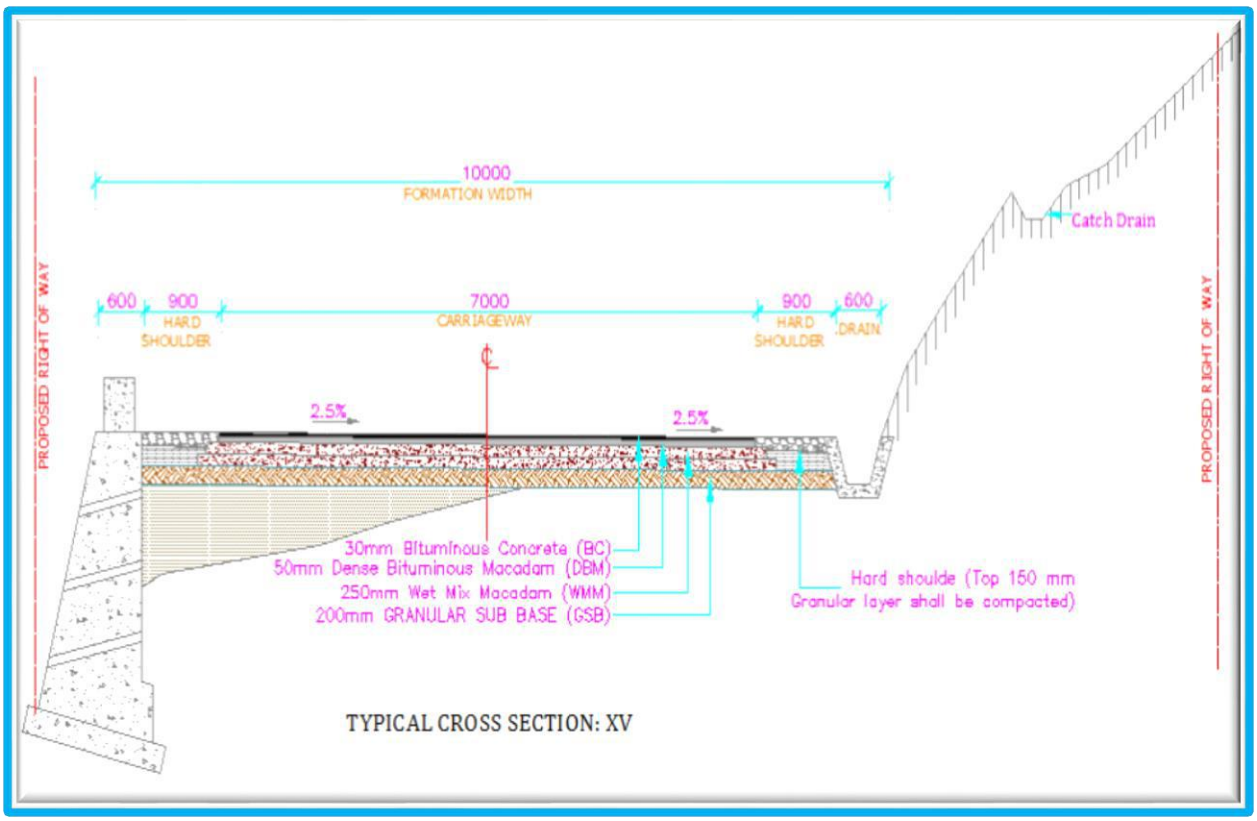


Figure 31 (p): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – XVI

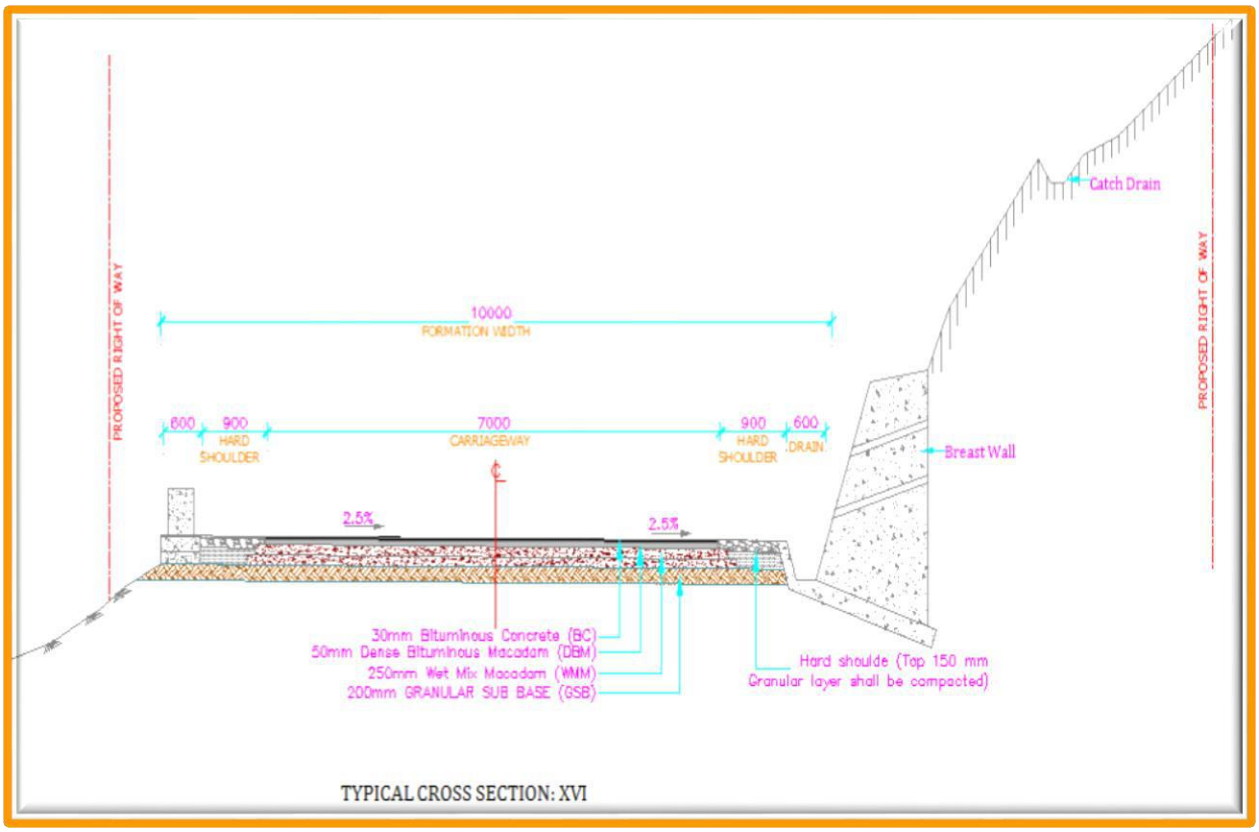


Figure 31 (q): TYPICAL CROSS SECTION: FOR 2 – LANE CARRIAGEWAY.
TYPICAL CROSS SECTION – XVII

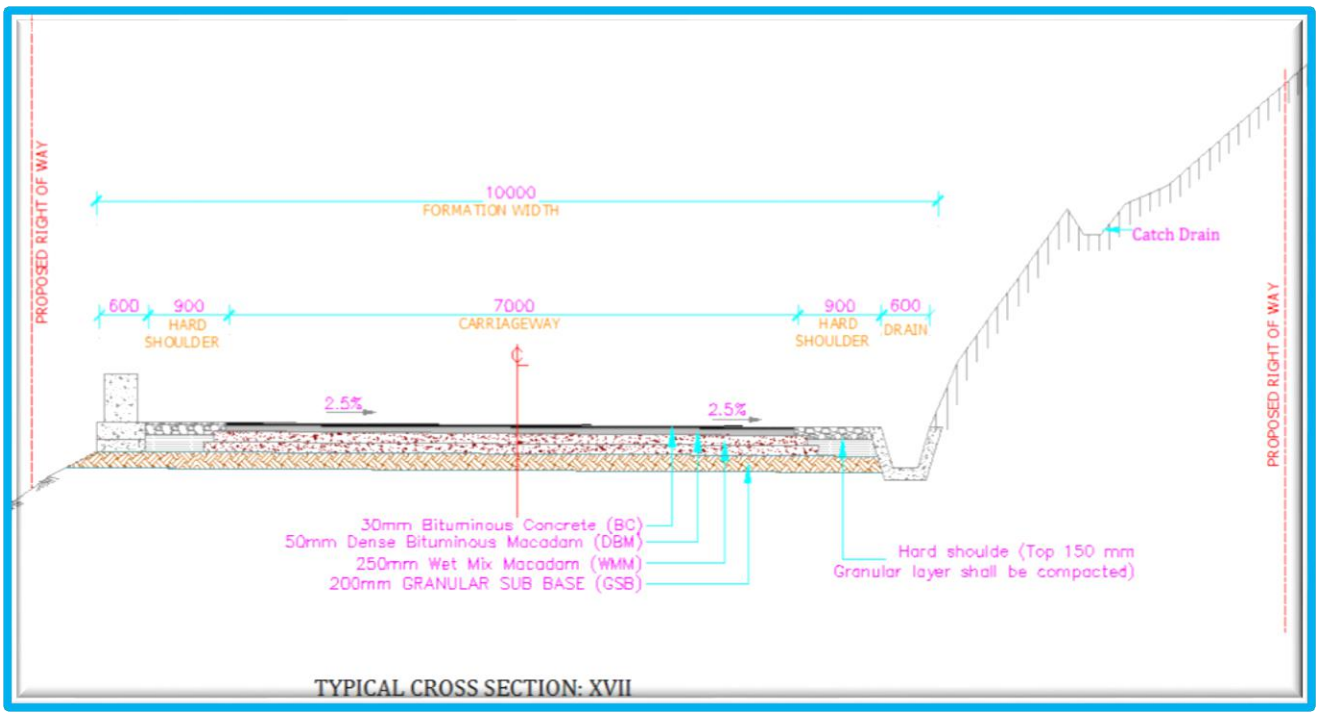


Figure 32: BOTHER... SAFEGUARD; PROTECT; CONSERVE AND PRESERVE OUR PLANET EARTH'S NATURAL – MOTHER... (ECO – NATURAL – GREEN – ENVIRONMENT)...!!!

CHAPTER – 2: ENVIRONMENT SCREENING REPORT

2.1 GENERAL DESCRIPTION

The **"Initial Environmental Examination" (IEE)** is carried out to assess the potential environmental impacts likely to be triggered by the project road. The project road will be reconstructed without any land acquisition and displacement of people. The project road belongs to Category C projects as per **BRO**'s recent Environmental Assessment Guidelines and requires an IEE to be carried out. IEE report will be prepared based on the IEE format of **"Advanced Data or Design Systems" (ADS)** with due consideration to environmental legislation *e.g.*, **"Environmental (Protection) Rules, 1986 of Government of India" (GOI)**. The Project Road for **Moying to Migging Road** is situated in Arunachal Pradesh. The alignment of the project road connects **Moying to Migging Road** respectively.

The objectives of IEE are as following:

- *To provide information about the general environmental settings around the sub project area as baseline data;*
- *To provide information on potential impacts of the project and characteristic of impacts, magnitude, distribution and their duration;*
- *To provide information on potential mitigation measures to minimize the impact;*
- *To provide information on the basis of "Environmental Management Plans" (EMPs);*
- *The field visits were made to collect the requisite information from various government departments and from other secondary sources (including limited public consultation in the form of focused group discussions).*

In the **"IEE Activities Proposed"** to be undertaken as part of this project will be considered and the potential impacts will be analyzed.

2.2 DESCRIPTION OF THE PROJECT

The Project Road for **"Moying to Migging Road"** is situated in Arunachal Pradesh. The proposed project road at present has single lane carriageway. The road will be widened for intermediate lane. It is planned to reconstruct the existing road with provisions for side drains, bridges, culverts etc. The project road will be implemented within the existing **"Right of Way" (ROW)** without any land acquisition. The terrain is flat with very minor changes in elevation, and the landscape is open and devoid of forest cover. The only noticeable changes from the flat terrain occur in the few places, where the road briefly descends through ravines carved out by streams and then climbs back to the level plain. Settlements are sparse; the road runs largely through open fields/ barren lands. Many hand pumps are placed alongside the roadways or roadside for obtaining drinking water.

2.3 BRO REQUIREMENTS

The **BRO** classifies projects such as **"Scientific Research and Experimental Development" (SRED)** into one of three categories based on a screening of their expected environmental impacts:

- **Category "A":** ***Category "A" Projects are defined by the BRO as "Projects expected to have significant adverse environmental impacts. An "Environmental Impact Statement/ Assessment" (EIS/ A) (as defined by the BRO regulations) is required to address significant impacts."***
- **Category "B":** ***Category "B" Projects are defined as "Projects judged to have some adverse environmental impacts, but of a lesser degree and/ or significance than those for Category A projects. An "Initial Environmental Examination" (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the "Final Environmental Assessment Report" (FEAR)."***
- **Category "C":** ***Category "C" projects are defined as "Projects unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed."***

2.4 GOVERNMENT OF INDIA REQUIREMENTS

The following is provided for informational purposes. The **"IEE OR FEAR"** in hand has not been prepared to meet the specific criteria/ strategies/ goals/ objectives in actual on priority basis, and does not support to meet **"Government of India" (GOI)** requirements that may ultimately be determined to be applicable to certain **"Scientific Research and Experimental Development" (SRED)** activities. As of this writing, it is not anticipated that any GOI's process/ system concerning EIAs will be required. Careful planning of those activities that of necessity occur outside the existing **"Right of Way"** (for example: placement of labour camps,

extraction of fill from borrows areas, placement of temporary approaches to river crossings during bridge replacement), combined with proper contracting and procurement measures should keep all SRED activities below the thresh – hold limit that would trigger or activate the mechanism, which is in actual practice the need for an EIA OR EIS.

2.4.1 Central Government Requirements

- Primary responsibility for administration and implementation of the GOI policy with respect to conservation, ecologically or environmentally sustainable development and pollution control rests with the **"Ministry of Environment and Forest" (MOEF)** and the regulations established pursuant to the National Conservation Strategy; National Forest Policy; the Policy for Abatement or Mitigation Strategies of Pollution (1992); and the Indian Environmental Protection Act – 1986 (29th of 1986), revised in the year 1997.
- Guidance for the preparation of **"Environmental Impact Assessments/ Statements" (EIA/ S)** within this overall framework for environmental clearance of new development proposals is provided and suggested by the GOI's Handbook of Environmental Procedures and Guidelines (1994).
- Additional guidelines for road projects are provided by the **"Ministry of Road Transport and Highways" (MORTH)** in its publication entitled Environmental Guidelines for Rail/ Road and Highway Projects. The Guidelines include the summary questionnaire to be submitted to MOEF for the preparation and planning of EIAs for domestic road projects requiring EIA as noted above in the paragraphs.
- MOEF Circular No. 21012/ 26 – 99 – la – 111 dated 22nd August, 2013 exempts linear projects with ROWs of less than 40 metros (including the existing **"Right of Way" (ROW)** and land acquisition as may be required by the project) from most review processes. Projects entirely contained within the existing **"Right of Way" (ROW)** are considered as maintenance, which is generally not subject to MOEF review.
- Thus, road projects limited to actions as per instructions such as those are proposed and implemented by **"Scientific Research and Experimental Development" (SRED)** are generally exempted from GOI/ EIA requirements. The Project will not include construction of any new high level bridges and thus will not require significant changes and variations to the existing roadsides/ ways alignment or grade level quality construction of civil work.

2.4.2 State Forest Department Requirements

Removal of Trees along the Right of Way (ROW): Trees will have to be removed within the existing **"Right of Way" (ROW)** in some places to allow for widening of the carriageway, construction of shoulders, or to meet and follow current road safety standards. It should be noted that trees within the Right of Way are considered to be within the purview of the **"State Forest Department" (SFD)**. Therefore, an application will be required pursuant to MOEF Letter Ref. No. 4 – 1/97' – FC, dated 18th February, 1998, which provides revised guidelines for applicability of the Forest Conservation Act (1980) to linear infrastructure projects such as rail and road projects. Clearance by the **"State Forest Department"** is assumed to have been granted/ decided/ approved/ fixed and established unless there is an indication to the contrary within 30 days.

Impacts to Reserved Forests: In the event of potential impacts to Reserved Forests, a **"Notice of Compliance" (NOC)** is required from the **"State Forest Department" (SFD)**. In the event that a submission to MOEF is required, the NOC must be obtained prior to action by MOEF as an esteemed organisation.

2.4.3 State Pollution Control Board Requirements (SPCB)

- Certain actions to be included in SRED (*e.g.*, the locations and operations of asphalt crushing or mixing plants) will require submission of an application to the SPCB pursuant to the water (Prevention and Control of Pollution) Act of 1974, Cass Act of 1977, and Air (Prevention and Control of Pollution) Act of 1981.
- The SPCB generally establishes a review panel or board/ section/ group/ jury members and circulates the application for public review and comment in each affected district. At least one public hearing is held in each affected district following not less than 30 days notice in local and regional newspapers/ media network/ news channels etc.
- A state – level hearing is also required, taking all comments received from the districts into account and assuming acceptability of the SPCB issues as per NOC status and standard maintained for civil construction road network.
- The SPCB's NOC, as well as the Forest Department's NOC is required before MOEF action on any required EIA can be considered complete or whole comprehensive and inclusive report work.

2.5 DESCRIPTION OF THE ENVIRONMENT

Data and information required for preparation of the **"Initial Environmental Examination" (IEE)** report have been collected from various government departments or agencies/ well established organizations, secondary sources and through actual field visits/ tours/ on site/ area/ location fieldworks etc. Environmental conditions for applicability index of the area are discussed below one by one in detail:

(i) Physical Resources

✓ **Weather and Climate Index**

Moying – Migging (मोईंग – मिगगिंग)

- Arunachal Pradesh is nestled in the upper Himalayan range and because of the altitude, experiences a tundra or alpine weather patterns. The temperature range hence remains between 8°C – 35°C. Visiting Arunachal can be a pleasant experience for visitors who generally face the heat of the mainland when travelling to other parts of India. The weather in Arunachal can be cool and refreshing and here are listed the details on the best time to visit Arunachal Pradesh. Arunachal is an ideal summer vacation destination for families, solo travellers and even adventure seeking honeymooners. With the temperatures ranging from 20°C – 35°C, it makes an ideal summer vacation for family, honeymooners and even for solo travellers. If travelling in summer, trek and go sightseeing around places like Tawang, Roing, Ziro, Namdapha National Park etc. and this is also the time to see wildlife in abundance in the wildlife reserves or bask in nature around the beautiful waterfalls and find peace in the many temples and monasteries around. Since summer is considered off – season, one can get the best deals on hotels and travel on budget. After summer in the hills, the monsoon season cools the land and nature is bountiful and beautiful. Though monsoon is short – lived, the overall region receives quite a bit of rainfall, close to 2,000 mm to 4,000 mm. At times there can be a sudden change in weather patterns though and often heavy showers and landslides are common. The adventure – seeking type, some tourist attractions that are not to be missed and experienced include Nuranang Falls and Bap Tenges Kang Waterfall. This is the ideal time to visit Arunachal as the weather is cool and pleasant; just the perfect season to go for a sightseeing expedition. Winter is surprisingly the ideal time to go as there is the special attraction of the winter festival. Nyokum Yullo and Chalo Loku are agricultural festivals celebrated during the month of February. Another draw is the Pangsau Pass Winter Festival, celebrated during the month of January, which is one of the most popular tourist attractions of the region.

✓ **Climate and Temperature Index**

- There is no meteorological observatory in the district and on the basis of records of the observatories in the districts where similar climatic conditions prevail. It is very cold in summer also. North District summer highest day temperature is in between 12°C to 21°C. Average temperatures of January is 5°C, February is 7°C, March is 11°C, April is 14°C, May is 15°C for specific regions. The mean temperature in the lower altitudinal zone, it varies from 1.5°C to 9.5°C. Temperature varies with altitude and slope of mountainous/ hilly region and the maximum temperature is recorded usually during July and August and minimum during December and January. Fog is a common feature in the entire Arunachal Pradesh from May to September. Biting cold is experienced at high altitude places in the winter months and snowfall is also not uncommon during this period. Humidity varies from 80 to 90% and wind flows at 16 KPH from West to East on an average. **"Transmission Windows" (TWs)** for malaria *i.e.,* the appropriate conditions of temperature and humidity in which a vector thrives, is projected to increase (temperature ranges between 14 – 40°C, and RH > 50%) with **"Climate Change" (CC)**.

✓ **Rainfall and Temperature Index**

- **PHYSICAL ASPECTS:** With an annual average rainfall of 2,068 mm, it is one of the highest rainfall receiving regions on the planet, which makes it an important site from a meteorological perspective. Analysis of rainfall data plays an important role for any water resource planning as well as for hydrological modeling. The mean monthly rainfall data for all districts of Arunachal for 102 years (1901 – 2002) were used for the present study displays the annual rainfall behavior recorded for whole Arunachal for the duration 1901 – 2002. The average annual rainfall recorded is 1069 mm for the whole duration. During this period, the highest amount of rainfall was about 1982.15 mm in 1936, whereas the lowest amount of rainfall recorded was about 559.98 mm during 1987. The dark line in the figure represents the annual average rainfall. If the annual rainfall in a year departs from the average annual rainfall by greater than or equal to 25%, then it is declared as a drought (meteorological drought) year. On the basis of 25% departure from the average annual rainfall, 30.4% times there were dry years. There was sufficient rainfall from July to September to meet evapotranspiration demand and vice versa from the October to June.

  - ***(i)** Moderate rainfall (more than 800 mm) receiving region in the Northern and South – Eastern parts of the district/ region/ locality;*

- ***(ii)*** *Low rainfall (700 mm to 800 mm) in the extensive Eastern and Southern parts of the district/ region/ locality;*
- ***(iii)*** *Very low rainfall (less than 700 mm) in the Western part of the district/ region/ locality.*

- Climate projections for 2030s (2021 – 2050) and 2080s (2071 – 2098) have been derived from **"PRECIS" (Providing Regional Climate for Impact Studies)**, which is a desktop version of the HadRM3 model with a grid resolution of 0.44°×0.44° Angles. PRECIS simulation dataset is provided by the "**Indian Institute of Tropical Meteorology" (IITM), Pune**. The **"Climate Change Scenarios" (CCS)** are driven by the **"Green House Gases" (GHG)** Emission Scenario, which assumes a future world of very rapid economic growth, a global population that peaks in midcentury and declines thereafter and assumes rapid introduction of new and more efficient technologies/ innovations in this scenario or field. Change in precipitation and temperature in 2030s and end of the century 2080s have been derived with respect to 1970s (1961 – 1990).

✓ **Humidity Index**

- ***Humidity is found to be 47% along with West wind flow at 9.00 Km/ Hr towards NNW and Wind Gusts is 11 Km/ Hr. Arunachal's current Weather and Temperature on an average is 26.9°C to 29.0°C and there is found to be overcast clouds, few clouds, clear sky, scattered clouds, broken clouds, along with moderate rain and light rain. Arunachal Live Weather Temperature has been found to be (30°C × 9/ 5) + 32 = 86°F in summer and Weather Forecast for next 3 days may varies between 8.0°C to 35°C with heavy intensity rain. Pressure level is observed to be 1008.00 mb and Ultra – Violet Index is near about 2 (Low) with Cloud Cover 42%. Ceiling point is 5,639 m and dew point is found to be 14°C with visibility 15 Km. Arunachal is home to several Himalayan glaciers. It became renowned for the quality of the tea grown on the hills around the town, and today tea and tourism are still the main income earners for the area in Arunachal Pradesh.***

- Since the study region lies far away from the sea coast area/ region, it experiences continental type of climate zone. It has the Tropical monsoon climate with five distinct/ dissimilar/ divergent seasons namely…!!!

  - ***i.*** *Monsoon season extending from June to September month;*
  - ***ii.*** *Retreating monsoon season extending from October to November month;*
  - ***iii.*** *Winter season – December to February month;*
  - ***iv.*** *Summer season – March to May month.*
  - ***v.*** *The temperature during spring season ranges between 6°C at night to 17°C during day in the month of December the sky generally remains clear in Arunachal Pradesh;*
  - ***vi.*** *Autumn season falls on the months of September and October in Arunachal Pradesh;*

- Other minor effects are increased incidences of skin disorders, such as prickly heat and fungal skin disorders such as ringworm and athlete's foot as a result of increased temperature and humidity. Some of the viral diseases like **"Peste des Petits Ruminants" (PPR)** are an acute or sub – acute viral disease of goats and sheep characterized by fever, necrotic stomatitis, gastroenteritis, pneumonia etc. may also re – appear affecting small ruminant population as well. **"Temperature Humidity Index" (THI)**, representing the combined stress of temperature and humidity, affects the productivity of livestock. In addition to these inherent problems increasing temperature and humidity are also affecting the quality of these produce. For value addition, processing units and marketing of products need to be developed for rural clusters in different **"Agro – Climatic Zones" (ACZ)**. This would also help in reducing the wastage of the produce. Beside the vector borne diseases that could expand its occurrences, other infections that are related to varying temperature and humidity indices are also imminent threats to human health and its well beings.

✓ **Ambient Air Quality Index**

- The air quality along the roadsides/ ways is good as there is less flow of traffic. No major source of emission of exhaust gases exist along the roadways or roadsides except some

commercial and residential establishments concerns, enterprises, shops etc., which burn wood as a fuel for commercial and domestic purposes/ reasons or functions.

- As existing road is in narrow condition, dust due to wind – blown and movement of vehicles on earthen shoulder portion is observed experimentally, physically and practically along the roadside. However, such dust particles are settled or mend or resolved within short distances from the road.

✓ **Noise Levels Index**

- In the area along the projected road, noise levels are moderate as there is less traffic flow. Therefore, the contribution of traffic, an increase of ambient noise levels can be considered insignificant or unimportant and immaterial.

✓ **Seismological Index**

- As per seismic zonal map of India, the sub project area is located in seismic zone – II. The bridges, culverts and other structures, therefore, need to be designed accordingly as per specific record of civil construction work.

(ii) Ecological Resources Index

✓ **Terrestrial Ecology**

- Impacts to flora will be minimal throughout most of the projected areas. Most of the length of the **"Right of Way" (ROW)** lies in rural areas as well as some parts of urban areas also. Insofar as can be determined, no threatened or endangered plant species are located within or adjacent to the affected ROWS and no adverse impacts to special status of species/ varieties/ groups are likely to occur due to these activities. Virtually all rehabilitation and resettlement applicable processes or activities will be confined to the existing ROWS, and both direct and indirect impacts to threatened or endangered plant species are unlikely. Plant species present within the **"Right of Way" (ROW)** are either introduced species or ubiquitous native species, which are highly tolerant of grazing, compaction, and other physical disturbances. Construction activities will have direct impact only in a narrow band of vegetation adjacent to the existing roadways. Potential impacts to flora, in both the forested and non – forested land areas will be avoided by ensuring that roadside activities such as asphalt crushing and hot mixing plants, construction camps and other ancillary features are properly sited. Right of Way, both inside and outside of forested areas is lined by mature trees overarching the roadways/ roadside. In some portion trees will have to be cut to permit rehabilitation and resettlement of the roads to current/ recent applicable safety measure standards.

✓ **Wildlife**

- The road does pass through any wildlife area in the projected region. And wildlife zone occurs in the region/ area or state.

✓ **Fisheries**

- No fishing activity is observed in the drains of sub – projected area. And no fisheries zone occurs in the region/ area or state.

(iii) Economic Development

✓ **Industries**

- No major/ minor industrial activity is observed along the projected roadside. Therefore no industrial zone occurs in the region/ area or state.

✓ **Commercial Activities**

- Commercial activities observed mostly near the inhabitation portion, along the projected road. These commercial activities are in the form of shops/ malls or complexes in the region/ area or site.

✓ **Infrastructure Facilities**

- Infrastructure facilities are adequate/ sufficient and satisfactory in the area along the projected roadside.

✓ **Agricultural Development**

- The climate of the area is more suitable for growing agricultural *i.e.*, wheat, soya bean, Zwaar (Heavy), Bazra or Pearl Millet (Pennisetum Glaucum) is the most widely grown type of millet as a part of plants and vegetables. There exists huge potential as far as the agriculture development is concerned. Soils are Medium to Deep – Black with relatively high clay content. The major agricultural crops are wheat, gram soybeans and cotton seeds for cotton generation/ production etc.

2.6 SOCIAL IMPACT ASSESSMENT (SIA): GENERAL DESCRIPTION

As part of the project, to ascertain the Resettlement and **"Social Development and Improvement Component" (SDIC)** of the project, the scopes of the present study as defined by the **"Terms of References" (TORs)** are involved with several elements, parameters and factors, which are in order as below:

- To examine and assess the overall social and poverty profile of the project area on the basis of the primary and secondary data sources such as statistical handbooks, poverty data, land use patterns and prototype models and sample areas/ site visits/ field visits are key stakeholder's interviews and preparation of a socio – economic profile of the state of **"Arunachal"** and the project districts.
- Preparation of social and poverty or scarcity and deficiency index analysis, taking into account socio – economic and poverty status of the projected area of influence, including the nature, extent and determinants of poverty in the project area including assessment of the risk of human trafficking and HIV/ AIDS due to the project. In addition, estimation/ judgment/ inference/ evaluation/ assessment of the likely socio – economic and poverty or deficiency index reduction impacts of the project also constituted an important as well as significant aspect of the study.
- Consultations with relevant officials from the governments, NGOs and other relevant officials, including consultation with **"Affected Persons" (APs)** and affected communities to assess responses to the project and ascertain the nature and scope of local participation in project planning and implementation stage.
- To identify, analyze and where appropriate, quantify the potential resettlement impacts of the proposed project on the area and the population.
- To suggest measures to enhance benefits and mitigate adverse impact on socio – economic profile in the region.

The report is based on the findings of the socio – economic surveys, field visits or site/ area visits and small group meetings/ discussions with the project populations in the projected area.

2.7 METHODOLOGY

The study will be conducted with a participatory approach that aimed at putting the community at the center with a collective process of reflection, discussion and consultation with all major stakeholders in the Project. The primary stakeholders, such as farmers, shopkeepers, daily wage labourers, Panchayat members, women and other socio – economically deprived groups like Scheduled Caste (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), health workers, school teachers, General Category (GC) people and Non – Government Organizations (NGOs) will be consulted individually, in homogenous sub – groups and mixed groups to understand the local needs and responses to the proposed sub – projects and also to ascertain the impact or contact of the proposed project on the communities, the area and the overall regional state.

Site or field visits will be made by the team to the respective projects and all the villages getting affected by the proposed project intervention, in order to ascertain the socio – economic profile of the area, **"Participatory Rural Appraisal" (PRA)** Methodologies and Techniques like social mapping, resource mapping, transect walk and mobility maps etc. will be used during the course of the field investigation work.

Community meetings shall be initiated to obtain, acquire and achieve the views, responses and possible solutions from the local people.

"Focus Group Discussions" (FGD's) will be organized at the village level with different potential affected groups of people, more importantly, women, indigenous/ native/ local/ original and other socio – economically deprived people to ascertain the impact of the project on them.

Meetings with village Panchayats, Non – Government Organizations, health workers, and school teachers, social workers will also be held during the course of field/ site and area visits with emphasis on project impact, poverty, road safety and related issues.

"A Socio – Economic Survey" (SES) covering 20% of the total households/ businesses along the alignments of each of the sub – projects shall be conducted and carried out and accomplished by means of a detailed questionnaire as opinion poll.

A detailed analysis of secondary data sources shall be carried out and accomplished to understand the social, economic and demographic situation in the projected area and will be submitted along with **"Initial**

Environmental Examination" (IEE) OR "Final Environmental Assessment Report" (FEAR) as shown in the columns with the **Flow Diagrams 33 (a, b, c and d respectively)**.

2.8 SOCIO – ECONOMIC CHARACTERISTICS

On the basis of socio – economic data collected from the **"District – Handbooks"** and other departmental publications and brochures relevant to the project roads, as stated earlier, a **"Project Road Influence Area Profile" (PRIA)** has been prepared. The profile consists of demographic features, land utilization, occupation structure, agriculture production, acreage intensity irrigation facilities, and concentration of infrastructure facilities, such as, availability of banks, hospital beds, primary schools, electrified villages, drinking water facilities, status of accessibility (paved/ unpaved road), number of hat/ bazaar, primary health centers, government public distribution shops, post offices and family planning center etc. The compiled data have been used in the present project for several analyses during the study. A summary with salient features are presented in and **Flow Diagrams 33 (a, b, c and d respectively)** as given below.

Since the time series data are not available for the above socio – economic parameters, it is difficult to establish any trend analysis report work. However, the data available reveal the salient features of the **"Project Road Influence Area Profile" (PRIA)** as well as the concentration of different activities occurs in the projected area/ region. The status of a **"Project Road Influence Area" (PRIA),** thus identified, in a specific activity would be useful to appreciate the relative importance of that particular projected road. The information collected and compiled for all the projected roads has been utilized for establishing, launching, ascertaining the relative potential, possible, probable, prospective for future development and growth and in turn an increase in traffic of the state or region.

2.9 IMPACT ON THE INDIGENOUS PEOPLE

The indigenous/ local/ native/ original people who are presently confined to local area only shall look – after the development of road and thus transportation infrastructure will get more exposure to education, health, markets and other informative and innovative activities etc. The area is not vulnerable to migration settlements from external people. Since the major occupation of people in local area is agricultural based and there are no proper warehousing facilities for storage of agricultural product in the area the indigenous people will be benefited by road development projects. **The Column 15 of Table 52: "ENVIRONMENTAL MANAGEMENT PLAN" (EMP) for "Moying to Migging Road" in the State of Arunachal**.

Figure 33 (a): Overview of the Environment and Social Framework.

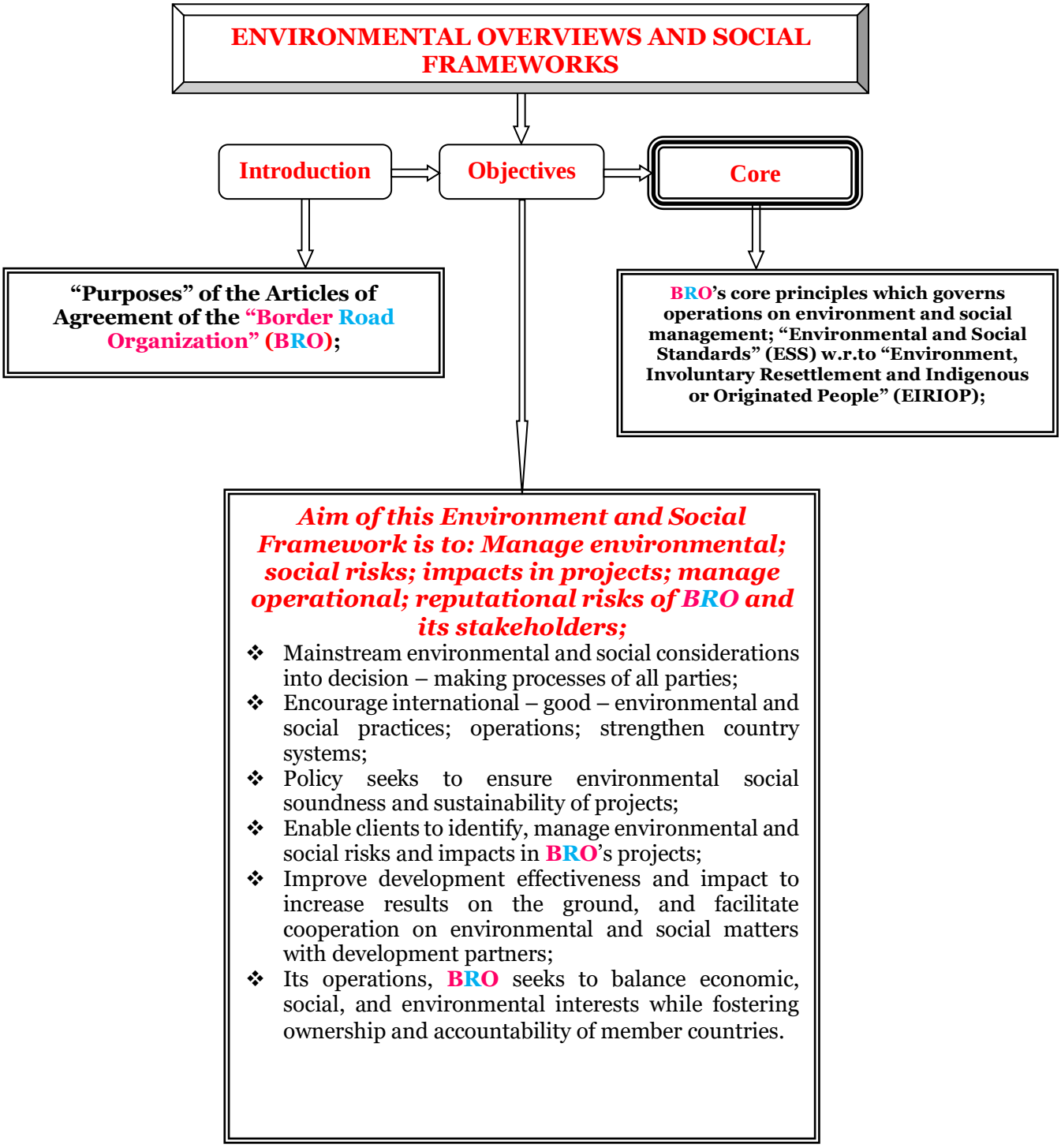


Figure 33 (b): Core Principles of the Environmental and Social Framework.

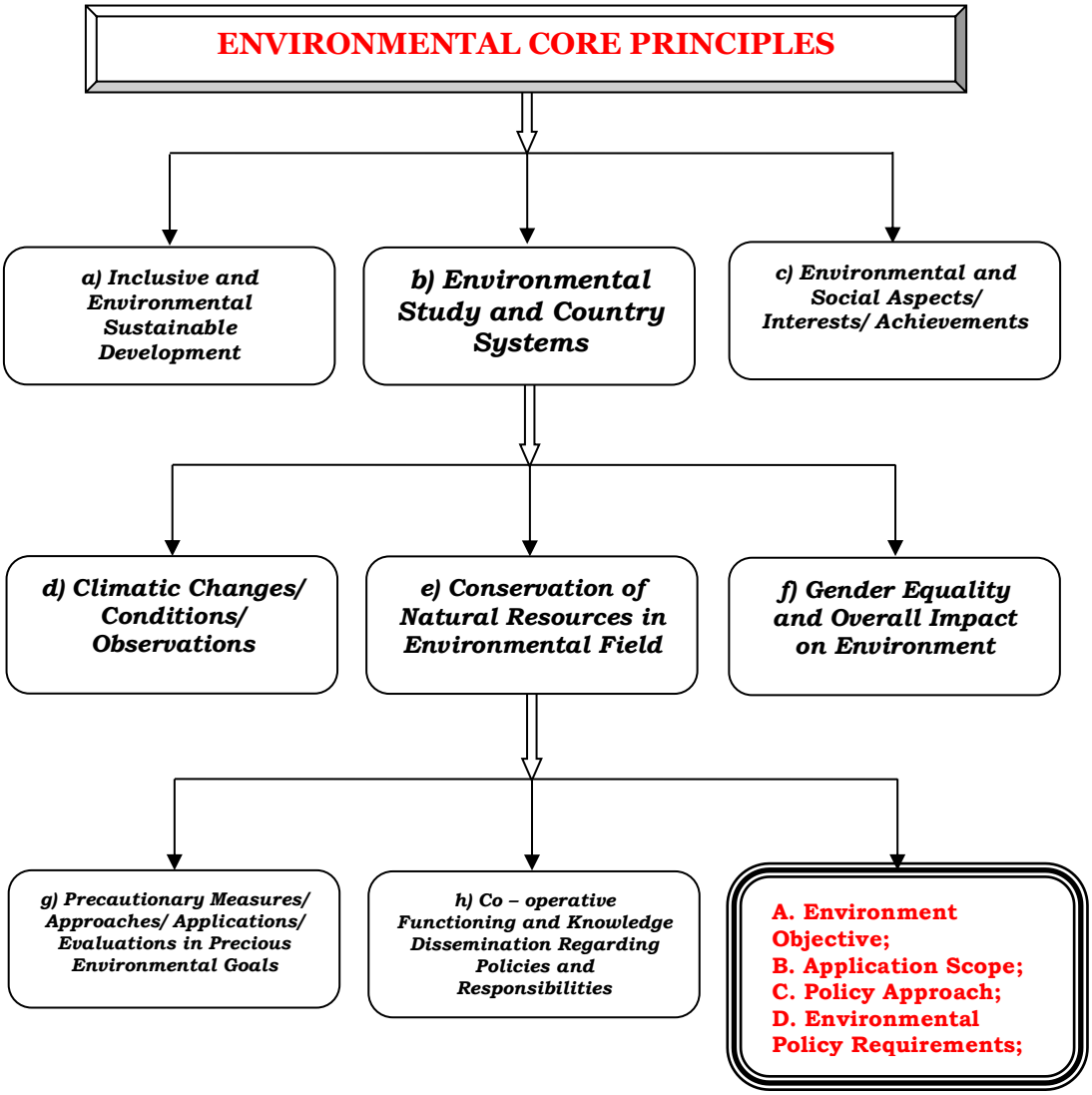


Figure 33 (c): The Environmental Objectives; Application Scope; Policy Approach of the Environmental and Social Framework.

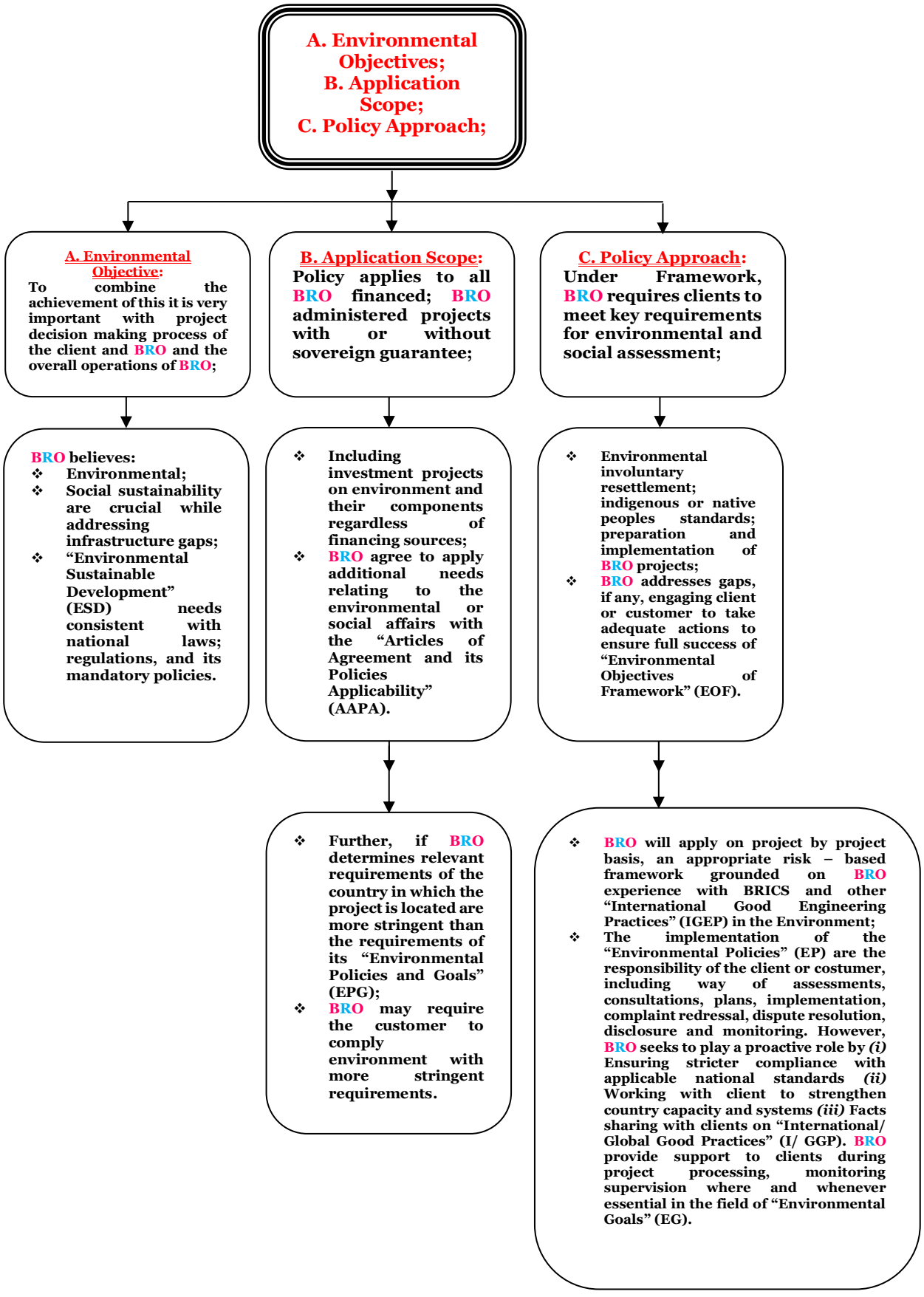
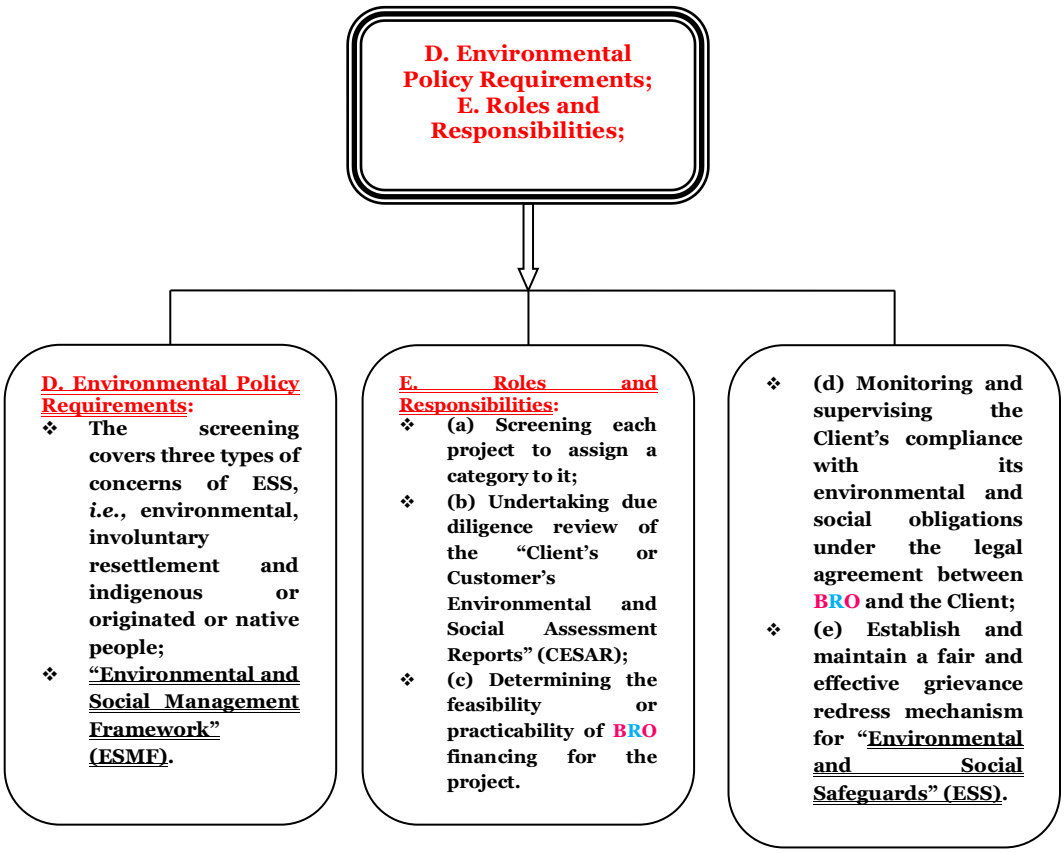


Figure 33 (d): The Policy Requirements; Roles and Responsibilities of the Environment and Social Framework.



15. ENVIRONMENTAL MANAGEMENT PLAN (EMP) for Moying to Migging Road in the State of Arunachal

Table 52: Environmental Management Plan (EMP).

Environmental Issues/ Components	Remedial Measure Statements	Reference to Laws/ Guidelines	Locations/ Areas	Monitoring Indicators	Monitoring Methods	Mitigation Coast	Institutional Responsibility and Requirement	
							Implementation	Supervision
A. Pre – Construction and Design Stage								
1. Alignment								
1.1: Pavement Damage and Inadequate Drainage Provisions in Habitat Areas.	• Construction of concrete pavement in habitat areas considering alignment level and drainage. • Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (drained by habitats occasionally) to prevent damage to road and rain water entry to habitats' houses. • Provision of adequate no. of cross drainage structures based on drainage pattern around the alignment.	Design Requirement.	All habitat areas throughout the alignment.	Design of both cross and side drains no. 57 of slab/ box culverts, Hume pipes.	Review of detail design documents and drawings.	Included in construction cost.	Design Consultant.	**BRO/ (CSC)**
1.2: Loss of Tree and Vegetation.	• Restricting tree cutting within construction limit. • Avoid tree cutting at ancillary site. • Martian compensatory tree plantation of 8,480 trees @ 1: 10.	Design Requirement.	Throughout the alignment.	848 No. of tree will be cut.	Observation	Included in construction cost	Design Consultant.	**BRO/ (CSC)**
1.3: Protection of Sensitive Receptors.	• Careful selection of alignment to the sensitive receptor. • Timely schedule ling of construction activity • Provision of noise suitable barriers.	Project Requirement.	Location of sensitive receptors (Refer Table).	Design and alignment plan	Review of design	Included in construction cost	Contractor.	**BRO/ (CSC)**
1.4: Safety along the Proposed Alignment.	• Make provisions of crash barriers at accident prone areas as identified in the road safety studies. • Provision of rumble strips in habitat areas to regulate speed. • Provision of retro – reflective warning sign boards nears school, hospital, and religious places and forests areas. • Provision of proper sidewalks/ pedestrian zone along the road near habitat areas, school, hospital, religious places and forests. • Compliance with norms specified in IRC codes for state highway for curvature and grading. • Provision of safety curve at all bridges. • The design should attempt to equalize cut and fill. • Minimize the cutting in hill areas. Incorporate slope stabilization measures to prevent any land slide situation. • Incorporate slope stabilization measures to	Design Requirement.	Places where height of embankment is more than 3.0 m.	No. of accident and vehicle collision.	Field observation, interview of locals.	Included in construction cost.	Design Consultant.	**BRO/ (CSC)**

	prevent any land slide situation.							
2. Natural Hazards								
2.1: Protection for Damage from Earthquake.	• Design considering relevant seismic standard in the clause under IRC 6 – 2014 for earthquakes in bridges.		Throughout the stretch.	Incorporation of IRC 6 – 2014 guidelines for earthquake in bridge design.	Review of bridge design.	Project preparation cost.	Design Consultant.	**BRO**
2.2: Protection of Road Embankment in Flood Prone Areas.	• Raise embankment height above the HFL levels in the flood prone areas. • Provision of adequate balancing culverts. • Improvement in existing culverts/ bridges to increase their carrying capacity.	IRC: 34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT and H guidelines for Design of High Embankments (DHE).	All the existing culverts/ bridges.	Design of both cross and side drains, no. of slab/ box culverts, no. and size of Hume pipes.	-------	Included in construction cost.	Design Consultant.	**BRO**
3. Shifting of Utility Structures								
3.1: Disruption of Utility Services to Local Community.	• All telephone and electrical poles/ wires and underground cables should be shifted before start of construction. • Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services. • Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any.	Project Requirement.	Throughout the corridor.	Utility shifting plan. Complaints from local people. Status of local utility services.	Interaction with concerned utility authorities and local public.	Included in construction cost.	Contractor.	**BRO/ CSC**
B. Construction Stage								
1. Air Quality								
1.1: Dust Generation due to Construction Activities and Transport, Storage and Handling of Construction Materials.	• Transport, loading and unloading of loose and fine materials through covered vehicles. • Paved approach roads. • Storage areas to be located downwind of the habitation area. • Water spraying on earthworks, unpaved haulage roads and other dust prone areas.	MORT and H Specifications for Road and Bridge Works Air (P and CP) Act – 1981 and Central Motor and Vehicle Act – 1988.	Throughout Project corridor.	PM_{10} level measurements dust pollution or complain of locals.	Standards CPCB methods observations public consultation.	Included in project cost.	Contractor.	**BRO/ CSC**
1.2: Emission of Air Pollutants (HC, SO_2, NO_X, CO etc.) from Vehicles due to Traffic Congestion and use of Equipment and Machinery.	• Regular maintenance of machinery and equipment. • Batching, asphalt mixing plants and crushers at downwind (1 Km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used. • DG sets with stacks of adequate height and use of low sulphur diesel as fuel. • Ambient air quality monitoring. • Follow traffic management plan as given in Section – 8.	The Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules1982.	Asphalt mixing plants, crushers, DG sets locations.	Monitoring of ambient air quality and checking PUC certificates.	Standards CPCB methods.	Included in project cost.	Contractor.	**BRO/ CSC**
2. Noise								
2.1: Noise from Construction Vehicle, Equipment and Machinery.	• All equipment to be timely serviced and properly maintained. • Bottlenecks to be removed. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities.	Legal requirement noise Pollution (Regulation and Control) Rules, 2000 and amendments there of + Clause No. 501.8.6. MORT and Highway Specifications for Road and Bridge Works.	Throughout project section especially at construction sites, residential and identified sensitive locations.	Noise levels measurements. Complaints from local people.	As per noise rule, 2000. Consultation with local people.	Included in Project Cost Plantation Cost is Separate.	Contractor.	**BRO/ CSC**

	• The regulation near residential, built up and forest area construction shall be restricted to daylight hours. • Timing of noisy construction activities shall be done during night time and weekends near schools and selected suitable times near temples when there are no visitors, concurrent noisy operations may be separated to reduce the total noise generated, and if possible re – route traffic during construction to avoid the accumulation of noise beyond standards. Else provision of temporary noise barrier at sensitive locations or near sources.							
3. Land and Soil								
3.1: Land use Change and Loss of Productive/ Top Soil.	• Non – agricultural areas to be used as borrow areas to the extent possible. • If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion.	Project Requirement.	Throughout the project section and borrow areas.	Borrow pit locations. Top soil storage area.	Review borrow area plan, site visits.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
3.2: Slope Failure and Soil Erosion due to Construction Activities, Earthwork, and Cut and Fill, Stockpiles etc.	• Bio – turfing of embankments to protect slopes. • Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees. • The side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. • The earth stockpiles to be provided with gentle slopes to prevent soil erosion.	IRC: 56 – 1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT and Highway Specifications for Road and Bridge Works Guidelines IX for Soil Erosion.	Throughout the entire project road Especially along hilly areas.	Occurrence of slope failure or erosion issues.	Review of design documents and site observation.	Included in Construction Cost.	Design Consultant and Contractor.	**BRO/ CSC**
3.3: Borrow Area Management.	• Non – productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/ consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • IRC recommended practice for borrow pits (IRC – 10: 1961). • Borrow areas not to be dug continuously. • To the extent borrow areas shall be sited away from habituated areas. Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond in consultation with fishery department and land owner/ community.	IRC Guidelines on borrow areas and for quarries (Environmental Protection Act And Rules – 1986; Water Act, Air Act) + Clause No. 305.2.2 MORT and Highway Specifications for Road and Bridge Works Guidelines V for Borrow Areas Management.	Borrow sites location.	Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Incidents of accidents. Complaints from local people.	Review of design documents and site observation.	Included in Construction Cost.	Design Consultant and Contractor.	**BRO/ CSC**

	• Rehabilitation of the borrow areas as per guidelines for redevelopment of borrow areas.							
3.4: Quarry Operations.	• Aggregates will be sourced from existing licensed quarries. • Copies of consent/ approval/ rehabilitation plan for a new quarry or use of existing source will be submitted to Environmental Officer (EO), BRO. • The contractor will develop a Quarry redevelopment plan, as per the mining rules of the state and submit a copy of approval to Executing Agency (EA).	Clause No. 111.3 MORT and Highway Specifications for Road and Bridge Work Guidelines VI for Quarry Areas Management.	Quarry area locations.	Existence of licenses for all quarry areas from which materials are being sourced existence of a quarry redevelopment plan.	Review of design documents, contractor documents and site observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
3.5: Compaction of Soil and Impact on Quarry Haul Roads due to Movement of Vehicles and Equipment.	• Construction vehicles, machinery, and equipment to be stationed in the designated Right of Way (ROW) to avoid compaction. • Approach roads/ haulage roads shall be designed along the barren and hard soil area to reduce the compaction. • Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/ minor roads. • Load of haulage trucks will be monitored to ensure they do not exceed the standard limits to avoid safety issues and excessive damage on the roads. • Land taken for construction camp and other temporary facility shall be restored to its original conditions.	Design Requirement.	Parking areas, haulage roads and construction yards.	Location of approach and haulage roads presence of destroyed/ compact ted agricultural land or land which has not be restored to its original condition.	Site observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
3.6: Contamination of Soil due to Leakage/ Spillage of Oil, Bituminous and Non–Bituminous Debris Generated from Demolition and Road Construction.	• Construction vehicles and equipment will be maintained and refuelled in such a fashion that oil/ diesel spillage does not contaminate the soil. • Fuel storage and refuelling sites to be kept away from drainage channels. • Unusable debris shall be dumped in ditches and low lying areas. • To avoid soil contamination Oil – Interceptors shall be provided at wash down and refuelling areas. • Waste oil and oil soaked cotton/ cloth shall be stored in containers labelled "Waste Oil" and "Hazardous" sold off to MoEF/ SPCB authorized vendors. • Non–bituminous wastes to be dumped in approved borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. • Bituminous wastes will be disposed off in an identified dumping site approved, appropriately designed, compliant waste management facilities (land–fills).	Design Requirement.	Fuelling station, construction sites, and construction camps and disposal location.	Quality of soil near storage area. Presence of spilled oil or bitumen in project area.	Site observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
4. Water Resources								

4.1: Sourcing of Water during Construction.	• Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority (CGA). • Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected.	-------	Throughout the project section.	Approval from competent Authority. Complaints from local people on water availability.	Checking of documentation on. Talk to local people.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
4.2: Disposal of Water during Construction.	• Provisions shall be made to connect road side drains with exiting nearby ponds otherwise make provision of water harvesting pits intermittently.	Clause No. 1010 EP Act – 1986 MORT and Highway Specifications for Road and Bridge Works.	Throughout the project section.	Design of road side drains existence of proper drainage system for disposal of waste water.	Standards methods site observation and review of documents.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
4.3: Alteration in Surface Water Hydrology due to Embankment.	• Existing drainage system to be maintained and further enhanced. • Provision shall be made for adequate size and number of cross drainage structures especially in the areas where land is sloping towards road alignment. • Road level shall be raised above High Flood Level (HFL); level wherever road level is lesser than HFL.	Design Requirement, Clause No. 501.8.6. MORT and Highway Specifications.	Near all drainage channels, river crossings etc.	Design of road side drains.	Review of design documents. Site observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
4.4: Siltation in Water Bodies due to Construction Activities/ Earthwork.	• Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. • Provision of silt fencing shall be made at water bodies. • Silt/ sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re – vegetated. • Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system.	Design Requirement, Clause No. 501.8.6. MORT and Highway Specifications for Road and Bridge Works (CP and CP) and Worldwide Best Practices.	Near all water bodies, river embankment slopes.	Siltation of rivers, streams, ponds and other water bodies in project area.	Field observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
4.5: Deterioration in Surface Water Quality due to Leakage from Vehicles and Equipments and Waste from Construction Camps.	• No vehicles or equipment should be parked or refuelled near water – bodies, so as to avoid contamination from fuel and lubricants. • Oil and grease traps and fuelling platforms to be provided at re – fuelling locations. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean – up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors. • Construction camp to be sited away from water bodies. • Solid wastes shall be collected, strong and taken to the approved, appropriately designed, compliant waste management facility (landfills) only.	The Water (Prevention and Control of Pollution) Act – 1974 and Amendments Thereof.	Water bodies, refueling stations, construction camps.	Water quality of ponds, streams, rivers and other water bodies in project. Presence of oil floating in water bodies in project area.	Conduction of water quality tests as per the monitoring plan. Field observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**

	• Water quality shall be monitored periodically. • All equipments operators, divers, and ware house personal will be trained in immediate response for spill containment and eventual cleanup. Readily available, simple to understand and preferably retain in the local language emergency response procedure, including reporting, will be provided by the contractor.							
5. Flora and Fauna								
5.1: Vegetation Loss due to Site Preparation and Construction Activities and Structure Development.	• Minimize tree cutting to the extent possible. • Roadside 848 trees to be removed with prior approval of competent authority. • Compensatory plantation at 1: 10 basis and additional plantation as per the IRC: guidelines in consultation with Forest Department (FD). • Regular maintenance of all trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting, wherever possible. • Plantation of trees on both sides of the road. Integrate Vegetation Management (IVM) with the carriage way completely clear of vegetation. From the edge of the road to the boundary of Right of Way (ROW), vegetation structured with smaller plants near the line and larger trees further away to avoid costly and provide habitats for a wide variety of plants and animals. Additional plantation near river banks to check erosion as part of compensatory plantation. • In the event of design changes during the construction stages additional assessments including the possibility to save trees shall be made by the Executing Agency (EA). • Road side Plantation Strategy as per IRC specifications including manuring.	Forest Conservation Act – 1980 and IRC: SP: 21 and IRC: SP: 66.	Throughout project corridor.	Right of Way (ROW) width 848 number of trees for felling. Compensatory plantation plan 8,480 number of trees replanted.	Review of relevant documents – tree cutting permit, compensatory plantation plan. Field observations.	Road side Plantation Cost is Included in Project Costs.	Relevant agency specialized in a forestation.	**BRO/ CSC**
6. Construction Camps								
6.1: Impact Associated with Location.	• All camps should maintain minimum distance from following: **I.** 500 m from habitation; **II.** 500 m from forest areas where possible; **III.** 500 m from water bodies where possible; **IV.** 500 m from through traffic route where possible; • The average distance between two camps should be 50 Km.	Design Requirement.	All construction camps.	Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and other construction camps.	On site observation. Interaction with workers and local community.	Included in Construction Costs.	Contractor and Environmental Officer (EO).	**BRO/ CSC**
6.2: Worker's Health in Construction Camp.	• The location, layout and basic facility provision of each labour camp will be submitted to SQC prior to their	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service)	All construction camps.	Camp health records.	Camp records. Site observation.	Part of the Contractors Cost.	Contractor.	**BRO/ CSC**

	construction. The construction shall commence only after approval of SQC. • The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner as approved by the Executing Agency (EA). • Adequate water and sanitary latrines with septic tanks attached to soak pits shall be provided. • Preventive medical care to be provided to workers including a First – Aid – Kit (FAK) that must be available in the camp. • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste must be carried out. • The contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides, which should comply with local regulations. • No alcoholic liquor or prohibited drugs will be imported to, sell, give, and barter to the workers of host community. • Awareness rising, to immigrant workers/ local community on communicable and sexually transmitted diseases.	Act – 1996 and The Water (Prevention and Control of Pollution) Act – 1974 and Amendments Thereof.		Existence of proper First – Aid – Kit (FAK) in camp site. Complaints from local people.	Consultation with local people living nearby.			
7. Management of Construction Waste/ Debris								
7.1: Selection of Dumping Sites.	• Unproductive/wastelands shall be selected for dumping sites. • Away from residential areas and water bodies. • Dumping sites have adequate capacity equal to the amount of debris generated. • Public perception and consent from the village Panchayats has to be obtained before finalizing the location.	Design Requirement and MORT and Highway Guidelines.	At all dumping sites.	Location of dumping sites. Public complaints.	Field survey and interaction with local people.	Included in Construction Costs.	Contractor.	**BRO/ CSC**
7.2: Reuse and Disposal of Construction and Dismantled Waste.	• The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. • Unusable and non – bituminous debris materials should be suitably disposed off at pre – designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal MORT and Highway guidelines should be followed. • Unusable and surplus materials, as determined by the Project Engineer (PE), will be removed and disposed off – site. • All excavated materials from roadway, shoulders, verges, drains, cross drainage	MORT and Highway Guidelines.	Throughout the project corridor.	Percentage of reuse of existing surface material. Method and location of disposal site of construction debris.	Contractor records. Field observation. Interaction with local people.	Included in Construction Costs.	Contractor.	**BRO/ CSC**

	will be used for backfilling embankments, filling pits, and landscaping.							
8. Traffic Management and Safety								
8.1: Management of Existing Traffic and Safety.	• Temporary traffic diversion shall be planned by the contractor and approved by the "Engineer". • The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of "IRC's: SP: 55 – Document". • The Contractor will ensure that the diversion/ detour are always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road. • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer".	Design Requirement and IRC: SP: 55.	Throughout the project corridor especially at intersections.	Traffic management plan. Safety signs on site. Number of traffic accidents.	Review traffic management plan field observation of traffic management and safety system. Interaction with people in vehicles using the road.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
8.2: Pedestrians, Animal Movement.	• Temporary access and diversion, with proper drainage facilities. • Access to the schools, temples and other public places must be maintained when construction takes place near them. • Fencing wherever cattle movement is expected. • To avoid the need for cattle underpasses, some of the proposed culverts `near habitations may be widened to facilitate cattle movement.	Design requirement And IRC: SP: 27 – 1984; IRC: SP: 32-1988; Road Safety for Children (5 – 12 Years Old) IRC: SP: 44 – 1994 Highway Safety Code IRC: SP: 55 – 2001; Guidelines for The Building and other Construction Workers Act – 1996 and Cess Act of 1996 Factories Act – 1948.	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	Road signage and drainage as per IRC – guideline. Complaints from local people.	Field observation interaction with local people.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
8.3: Safety of Workers and Accident Risk from Construction Activities.	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retro – flectory signage, in local language at the construction sites. • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials.	-------	Construction sites.	Availability of safety gears to workers. Safety signage training records on safety. Number of safety related accidents.	Site observation. Review records on safety training and accidents. Interact with construction workers.	Included in Construction Cost.	Obligation of Contractor.	**BRO/ CSC**

	• The contractor will not employ any person below the age of 18 years for any work. • Use of hazardous material should be minimized and/ or restricted. • Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. • Accident Prevention Officer (APO) must be appointed by the contractor.							
8.4: Accident Risk to Local Community.	• Restrict access to construction sites to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement.	-------	Construction sites.	Safety signs and their location. Incidents of accidents. Complaints from local people.	Site Inspection. Consultation with local people.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
9. Site Restoration and Rehabilitation								
9.1: Clean–up Operations, Restoration and Rehabilitation.	• Contractor will prepare site restoration plans, which will be approved by the "Engineer". • The clean – up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road – side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/ affected by the project will be left clean and tidy, at the contractor's expense, to the satisfaction of the Environmental Officer (EO). • All the opened borrow areas will be rehabilitated and "Engineer" will certify in this regard.	Project Requirement.	Throughout the project corridor, construction; camp sites and borrow areas.	Clean and restored camp sites. Presence/ absence of construction material/ debris after completion of construction works on construction site.	Site observation. Interaction with locals. Issue completion certificate after restoration of all sites are found satisfactory.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
C. Operation Stage								
1. Air quality								
1.1: Air Pollution due to Vehicular Movement or Vehicles Playing on the Road.	• Roadside tree plantations shall be maintained. • Regular maintenance of the road will be done to ensure good surface condition. • Vehicular air pollution will be managed and monitored. • Ambient air quality monitoring. If monitored parameters are above the prescribed limit, suitable control measures must be taken. • Technological and behavioural changes. • Road signs shall be provided reminding the motorist to properly maintain their vehicles to economize on fuel consumption and unprotect the environment.	Environmental Protection Act – 1986; The Air (Prevention and Control of Pollution) Act – 1981.	Throughout the corridor.	Ambient air quality (PM_{10}, CO, NO_X) survival rate of trees planted.	As per CPCB requirements site inspection.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**
2. Noise								
2.1: Noise Pollution due to Movement of Traffic.	• Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch and speed limitation and honking	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof.	Sensitive receptors.	Noise levels.	Noise monitoring as per noise rules, 2000.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**

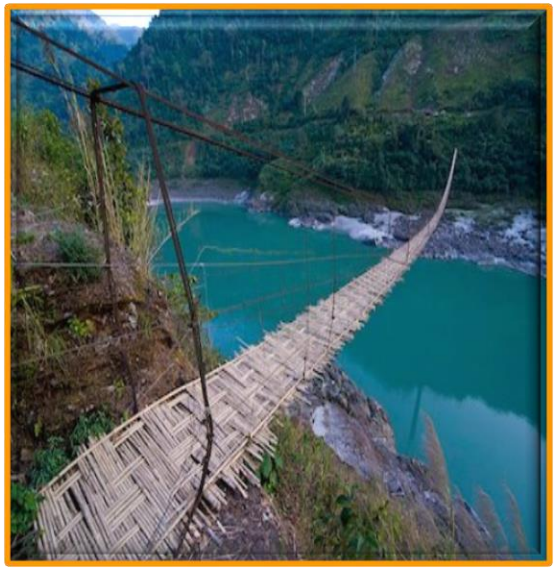
	restrictions may be enforced near sensitive locations. • The effectiveness of the multi – layered plantation should be monitored and if needed solid noise barrier shall be placed. • Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building close to the road.				Discussion with people in sensitive receptor sites.			
3. Land and Soil								
3.1: Soil Erosion at Embankment during Heavy Rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. • Necessary measures to be followed wherever there are failures.	Project Requirement.	At bridge locations and embankment slopes and other probable soil erosion areas.	Existence of soil erosion sites. Number of soil erosion sites.	On site observation.	Included in Construction Cost.	Contractor.	**BRO/ CSC**
4. Water Resources/ Flooding and Inundation								
4.1: Siltation.	• Regular checks shall be made for soil erosion and turfing conditions of river training structures for its effective maintenance.	Project Requirement.	Near surface water bodies.	Water quality.	Site observation.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**
4.2: Water Logging due to Blockage of Drains, Culverts or Streams.	• Regular visual checks and cleaning of drains shall be done along the alignment to ensure that flow of water is maintained through cross drains and other channels/ streams. • Monitoring of water borne diseases due to stagnant water bodies.	Project Requirement.	Near surface water bodies.	Presence of flooded areas or areas with water stagnation.	Site observation.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**
4.3: Road Inundation due to Choking of Drainage Channels.	• **BRO** will ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding.	Project Requirement.	Flood prone sections.	Incidents of flooding and road inundation with details on change.	Field observation Interaction with local community.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**
5. Flora								
5.1: Vegetation.	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survivalist audit to be conducted at least once in a year to assess the effectiveness.	Forest Conservation Act – 1980.	Project tree plantation sites.	Minimum of 70% of tree survival.	Records and fields observations.	Operation and Maintenance Cost.	Contractor.	**BRO/ CSC**
6. Maintenance of Right of Way and Safety								
6.1: Accident Risk due to Uncontrolled Growth of Vegetation.	• Efforts shall be made to make shoulder completely clear of vegetation. • Regular maintenance of plantation along the road side. • Invasive plant not to be planted near the road.	Project Requirement.	Throughout the project route.	Presence of and extent of vegetation growth on either side of road. Accident data.	Visual inspection. Accident records.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**
6.2: Accident Risks Associated with Traffic Movement.	• Traffic control measures, including speed limits, will be enforced strictly. • Further encroachment of squatters within the Right of Way (ROW) will be prevented. • No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law.	IRC: SP: 55	Throughout the project route.	Police records on accident. Condition and existence of safety signs, rumble strips etc. on the road.	Review accident records. Site observation.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**

	• Monitor/ ensure that all safety provisions included in design and construction phase are properly maintained. • Highway patrol unit(s) for round the clock patrolling. Phone booths for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. • Tow – away facility for the break down vehicles if possible.			Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law.				
6.3: Transport of Dangerous Goods.	• Existence of spill prevention and control and emergency responsive system. • Emergency plan for vehicles carrying hazardous material.	-------	Throughout the project stretch.	Status of emergency system – whether operational or not.	Review of spill prevention and emergency response system.	Included in Operation/ Maintenance Cost.	Contractor.	**BRO/ CSC**

Note: EA: Executing Agency, BRO: Border Road Organisation, EO: Environmental Officer, IRC: Indian Road Congress.

a) The **"Project Engineer"** or **"The Engineer"** is the team of **"Construction Supervision Consultants" (CSC)** responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (**BRO**). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the **"CSC – Team Members/ Jury Members"**.

b) The **"Environmental Officer"** is the **"Environmental Specialist or Expert"** under the CSC who is responsible for providing recommendations to the **"CSC – Team Leader"** for approving activities specific to **"Environment Safeguards"** on behalf of **"The Engineer" or "Project Engineer".**


Arunachal State

EA: Executing Agency, BRO: "Border Road Organisation" (BRO); Government of India (GOI), EO: Environmental Officer, IRC: Indian Road Congress, CSC: Construction Supervision Consultant, JFM: Joint Forest Management Committee, CPCB: Central Pollution Control Board.

The **"Project Engineer"** or **"The Engineer"** is the team of **"Construction Supervision Consultants" (CSC)** responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer **(BRO)**. It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The **"Environmental Officer"** is the **"Environmental Specialist or Expert"** under the CSC who is responsible for providing recommendations to the **"CSC – Team Leader"** for approving activities specific to **"Environment Safeguards"** on behalf of **"The Engineer" or "Project Engineer"**.

"Joint Forest Management" (JFM) Committee's exist at the village level. Each **"Joint Forest Management"** committee has 15 members of which 3 to 5 members are mandated to be women. The member secretary of each committee is the local Forester or Beat Officer, who oversees the accounts and activities of the **"Joint Forest Management"** committee. Respective **"Joint Forest Management"** committee's will be identified and confirmed by the contractor under the guidance of the **"Environmental Specialist or Expert"** of the CSC during construction **Moying to Migging Road** in the **State of Arunachal**.

16. CONCLUSIONS AND BUDGET

ENVIRONMENTAL MONITORING PLAN AND COST (EMPC): {Moying to Migging Road in the State of Arunachal}

Based on the field survey and data available from secondary sources, it can be concluded that the project will not have significant negative environmental impacts. The issues of concern in the project are construction of bypasses, re – alignments, and bridges and acquisition of private land and forest land etc. Proper **"Environmental Management Plans" (EMPs)** compliance needs to be ensured. The issues related to land acquisition and re – settlement has been evaluated and adequate compensation has been suggested in **"Resource Allocation Program" (RAP)** document. The Environmental Mitigation and Monitoring Requirements are given in the **Table 53**.

Table 53: Environmental Mitigation and Monitoring Requirements.

Particulars	Estimated Rate	Total Cost (₹ in Lakhs)
Environmental Monitoring during Construction and Implementation Phase	*Lump Sum*	**5.0**
Environmental Training Programs	*Lump Sum*	**2.0**
Plantation of 12,150 Trees Including Maintenance Cost for 3 Years	*Rs. 1,000 per Tree Including Maintenance*	**260**
Water Sprinkling for Dust Emission Suppression	*80,000 per Km.*	**54.4**
Solid Noise Barrier Installation by Trees in Places	*Lump Sum*	-------
Enhancement of Water Bodies Sources and Resources	*Rs.1 Lakh Each*	-------
Safety Signs and Provisions at Different Locations/ Sites/ Areas	-------	**Provided in Civil Works Contract**
Cost to be Included in Engineering	-------	-------
All Underpasses OR Bypasses/ Roads/ Ways	*Included in Civil Works*	-------
Dust Emission Suppression by Watering	*Incidental to Work with in Contractor*	-------
Environmental Measures at Workers' Camps during Site Visit	*Incidental to Work with in Contractor*	-------
Vegetation Turf at Slopes along Roadsides/ Roadways	*Civil Works*	-------
Operation Phase		

Environmental Monitoring and Evaluation Plans	-------	**1.0 per Annum**
Tree Maintenance and Monitoring Plans	*Included Above*	-------
Training for Segregation; Mitigation and Monitoring etc.	-------	**2.0 per Annum**
Road Maintenance Cost not Considered as Per Specific Targets OR Proposed Work	-------	-------
Sub Total	**For Contract Period = (3.0×3)**	**9 for 3 Years**
Total	**Twenty Seven Lakhs**	**27.00 Lakhs**
Grand Total	-------	**425.4 Lakhs**

Based on the environmental assessment and surveys or visits conducted for the project, associated potential or prospective adverse environmental impacts can be mitigated to an acceptable/ satisfactory level by adequate implementation of the measures/ methods/ ways/ processes as stated in the **"Environmental Impact Assessment" (EIA)** Report. Adequate provisions have been made to cover the environmental mitigation and monitoring requirements (including a forestation cost), which is approximately **₹ 4.25 Crores or ₹ 425.4 Lakhs**.

Cost Estimate

Cost estimate for the projected road is finalized based on the improvement proposals are summarized/ recapitalized/ reviewed/ abridged/ précised respectively. The existing **"Right of Way" (ROW)** along the project road varies from **8 m to 10 m**. Therefore, land acquisition is required for widening of the project road, Improving and black spots. Hence the project will have social impact in terms of loss of livelihood or shelter, which will have to be studied and a suitable mitigation/ alleviation/ easing/ improvement plans has to be prepared.

Construction of project is proposed in Two Phases. Phase – I include intermediate lane/ two lanes of existing road from **Existing Length = 92+250 Km.** and **Proposed Length = 189+100 Km.** Cost estimate for the project Road is finalized/ finished/ concluding/ ending with ultimate approach based on the improvement proposals in **Table 54 (a)** and **(b)**.

Table 54 (a): Details of Moying to Migging Road.

<table>
<tr><th>Description</th><th></th><th>Existing</th><th>Proposed</th></tr>
<tr><td>Terrain</td><td>:</td><td>Hilly Mountainous and has Steep Gradients</td><td>Hilly Mountainous and has Steep Gradients</td></tr>
<tr><td>Designed Length</td><td>:</td><td>Existing Length = 92+250 Km.</td><td>Proposed Length = 189+100 Km.</td></tr>
<tr><td>Alignment</td><td>:</td><td>The Existing Alignment is almost Poor Except at few Locations.</td><td>The New Alignment with Geometric Improvements.</td></tr>
<tr><td>Design Speed</td><td>:</td><td>Average = 20 – 30 Km/ Hr.</td><td>20 Km/ Hr to 30 Km/ Hr, As per IRC: SP: 48 – 1998, Sub Clause: 6.3.1</td></tr>
<tr><td>Cross – Section</td><td>:</td><td>C/ W Width – Varying = b/ w 7 m
Shoulder = 0.9 m</td><td>Flexible Pavement
Two – Lane (Class – 9: Road)
0.6 m Drain + 0.9 m Shoulder + 7 m C/W + 0.9 m Shoulder + 0.6 m Extra Widening
<table>
<tr><th>Sr. No.</th><th>From</th><th>To</th><th>Length (Km)</th></tr>
<tr><td>1.</td><td>92.250</td><td>189.100</td><td>189.100</td></tr>
<tr><td></td><td></td><td>Total</td><td>189.100</td></tr>
</table></td></tr>
<tr><td>CBR Considered</td><td>:</td><td>-------</td><td>10%</td></tr>
</table>

Description		Existing	Proposed
Traffic (2017)	:	Nil	On Basis of Projected Traffic* From **Km. 92.250 to Km. 189.100.**
Pavement Design Life	:	Nil	15 Years, As per IRC: SP: 48 – 1998, Clause: 10.6, Sub Clause: 10.6.1
Design MSA	:	-------	**MSA – 5**
Pavement Crust Thickness for Widening and New Construction	:	**Existing Structure** = 70 Nos.	**Flexible Pavement** **Sr. No. / Type of Structure / Length (mm)** 1. *Bituminous Concrete* – *40 mm* 2. *Dense Bituminous Concrete* – *60 mm* 3. *Crusher Run Macadam* – *200 mm* 4. *Granular Sub Base* – *200 mm* **Total** – **500 mm**
Bridges	:	**Major Bridge** = 00 Nos.	00 Nos. of Major Bridge is at **Moying to Migging Road** Bypasses and Newly Proposed Parallel To Existing Bridge.
		Minor Bridges = 05 Nos. on Project Road	**Widening** = 00 Nos. **Reconstruction** = 00 Nos. **Retained** = 00 Nos. **New Proposed** = 00 Nos.
Culverts	:	**Total Culvert** = 100 Nos. **HPC** = 00 Nos. **Slab Culvert** = 92 Nos. **Box Culvert** = 00 Nos. **FCW** = 03 Nos.	**Retained** = 00 Nos. **Widening** = 00 Nos. **Reconstruction** = 00 Nos. **New Proposed** = 00 Nos. See Proposals in **Table 54 (b)**
Forest Reserves	:	**Approximately 189.100 Km (100%) Forest Area Existing in the Moying to Migging Road Regions**	**Not Applicable**
"Right of Way" (ROW)	:	-------	Proposed ROW in Open Area – 24.0 m Proposed ROW in Built – up Area – 15.0 m
Land to be Acquired	:	-------	**07.49 Hectare Private and 15.54 Hectare Government**
Tentative Total Civil Cost (₹) Project:			**₹ *316.078***
Tentative Total Cost Including Land Acquisition:			**₹ 4,987.254**
Tentative Total Civil Construction Cost:			**₹ 14.77 Crores Per Km**

Table 54 (b): Tentative Cost of Moying to Migging Road.

SECTION	PROPOSED LENGTH (KM)	BASE COST PER KM (₹)	BASE COST PER KM (CRORE)
Moying to Migging Road	**21.400**	**₹ *316.078***	**14.77**

17. CONCLUSIONS AND RECOMONDATIONS

The **"Remote Sensing Technology" (Stereo Photogrammetric) OR "Geographical Information System" (GIS)** has been proven a fastest method of carrying out the topographical survey within the hilly terrain areas, thus considering the same advantages the RS technology has been used in **BRO** Road DPR projects. Even though the areas are of very complex geography and terrain, the RS technology was able to provide fast and reliable DEM – Digital Elevation Model, Topographical features and base data to prepare such complex geography road DPR projects. In the project, 50 cm Very High Resolution Multispectral Satellite Imagery (World View – 2) from Digital Globe – USA has been used. This imagery was procured through National Remote Sensing Agency – INDIA. The processing of the above imagery was undertaken in software's such as SOCETSET, ERDAS, and Global Mapped. After satellite image processing the products delivered are DTM/ DEM, 3D – Topographical Features, Ortho – photo, which has further been used in finalization of road alignment as per IRC guidelines. The products from RS has also been played a very critical role in identifying the water bodies crossing the alignments in order to provide cross drainage works to cater for the runoff. Details of the structures for the same are mentioned above in Project details. As per contract agreement the current stage of corridor comprises preparation of **"Final Feasibility Report" (FFR)** for re – habilitation and upgrading of existing road to 2 – lane with paved shoulder. We have conducted Classified Traffic Volume counts at 2 No. locations for analyzing the capacity. As per analysis of the traffic surveys total number of PCUs at all two locations has crossed the threshold limit (15,000 PCU) of design service volume for 2 lane roads with paved shoulder configuration as per the IRC in year 2041. The project road is not only an important transport link for en – route habitations within **"Arunachal Pradesh/ Region",** but it is also an important inter – state link. The existing road has stretches whose geometrics do not conform to **"Indian Road Congress" (IRC)** standards will need to be improved by means of re – alignments and by re – construction. The road passes through ribbon development at 5 Nos. locations, where travel speed does not meet **"National Highway" (NH)** Standards, hence bypasses have been proposed for them. The soil conditions along the projected road are generally good and the construction materials like soil and aggregates are available nearby area/ region of the state.

The existing **"Right of Way" (ROW)** along the projected road varies from **8 m to 10 m** and also we proposed **Moying to Migging Road**. Therefore, land acquisition is required for widening of the project road, improving and black spot points. Hence the project will have social impact in terms of loss of livelihood or shelter, which will have to be studied and a suitable mitigation plan must be prepared thoroughly for Survey, Investigation and Preparation of Detailed Project Report for improvement of Road and Bridges etc. for construction of High Altitude Hill Roads to Indo – China Border under Phase – II in the state of Arunachal using satellite imagery of **Existing Length = 92+250 Km.** and **Proposed Length = 189+100 Km.** It is recommended that the project to be undertaken with paved in the immediate future. The project can be constructed within 24 months' period with strategic planning and through two construction packages.

One ROB is Proposed at **Moying to Migging Road,** where track project road is to be designed for 20 Km/ Hr to 30 Km/ Hr speed in project road length, but two locations **(Km 92.250 to Km. 189.100)** designed for 30 Km/ Hr. It is recommended that the project be undertaken for Foot Track/ Two Laning with Paved in the immediate future. The estimated total capital cost of Projected Road is **₹ 316.078 OR 14.77 Crores per Km** for **Moying to Migging Road in the State of Arunachal.**

"Public Consultation Meeting" (PCM)

Appendix – 1

Public Consultation and Focus Group Discussions in Moying to Migging Road

"Moying" Start from **"Janbo Basti"** Tehsil of **"Mosing"** district/ village the grade junction of new and old Road. This is recommended by **"Public Consultation Meeting" (PCM)** and **"Arunachal Pradesh Government"**. Hence, it is proposed to other like **Moying to Migging** town to avoid acquisition of the land and disturbance to the local people. The details of the options studied and recommended are given below:

Project Beneficiaries and Benefits

Focus Group Discussion of Public Consultation were arranged in the three villages. From the Public Consultation, an understanding on the positive as well as negative impacts of the improvement of the road was gathered. Following **Tables 55 (a)** to **(d)** gives the details of **"Public Consultation Method" (PCM)** conducted:

Table 55 (a): Focus Group Discussion Public Consultation.

Village Name	Place of PC/ Meeting	Number of Participants
Moying	*Anganwadi Kendra*	47
Ramsingh	*Projected Road*	57
Yingkiong	*Anganwadi Kendra*	37
	Grand Total	**141**

Source: *Socio – Economic Survey, December 2019 by L. N. Malviya Infra Projects Pvt. Ltd.;*

IMPACTS

During the Mixed FGD, information from the respondents was elicited on the pros and cons of the road construction. Summarized below are positive and negative impacts, as per the respondents:

Table 55 (b): Positive Impacts.

Beneficiary	Benefits Anticipated
Road Service Providers	1. *Increase in sale expected;* 2. *Trade improvement.*
Road Passengers	1. *Due to better roads lesser journey time, thus time saving; and* 2. *Smooth and safe riding on the road.*
Drivers	1. *Convenience in vehicle driving;* 2. *More number of trips.*
Residents along the Road	1. *There will be lesser dust;* 2. *Lesser noise.*
Transport Operators, Owners, and Managers	1. *Improved business in terms of reduced maintenance and operational cost; Fuel saving;* 2. *Longer Vehicle life; and* 3. *More number of trips and routes to ply along.*
Agro – Industrial Producers/ Farmers	1. *Agricultural marketing will be easy; as more buyer sellers will be available;* 2. *Arrangements of seeds, fertilizers and other agricultural input items and services will be easy to approach; and* 3. *Better values for the agricultural crops.*
Women	1. *Comfort in travel, due to better road conditions.*
Migration	1. *Due to construction of road, reduction in seasonal migration is expected, as people will get employment opportunities, in the lean seasons (non – farm period).*

Vulnerable Groups like Pensioners, Unemployed, Disabled	1. *Smooth travelling, due to pucca road;* 2. *Comfort in travel; and* 3. *Better connectivity to banks / post offices / government offices.*
Health Services Providers	1. *Easy to reach patients, thus faster delivery of health services;* 2. *Similarly patients will be able to reach health service providers in time thereby saving medical attention time.*
School Children/ Teachers	1. *Convenience and easy approach to School and Collages.*

Source: *Socio – Economic Survey, December 2019 by L. N. Malviya Infra Projects Pvt. Ltd.;*

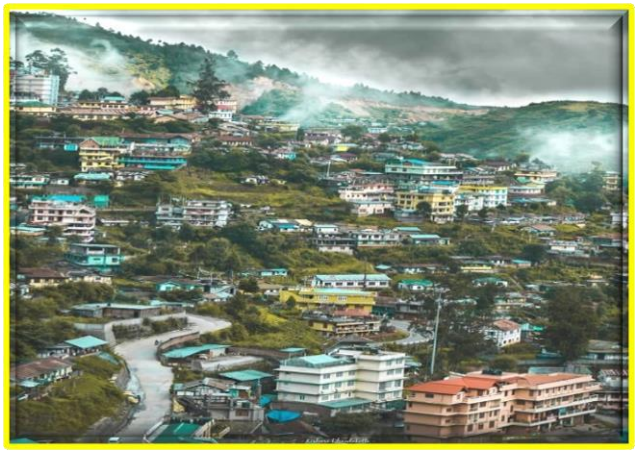



Table 55 (c): Negative Impacts.

Issues	Nature of Problems Anticipated
Pollution (Especially during Construction)	1. *More noise and dust;* 2. *Water logging, due to flow of excessive water.*
Diseases	*Temporary effect due to;* 1. *Dust; and* 2. *Possible water borne (due to water logging, if, it is there).*
Road Safety	1. *It may lead to more accidents, (as the speed of vehicles on the pucca road will be higher) if proper safety measures are not adopted. However, it could be minimized by constructing speed breakers near populous places;* 2. *Installing warning boards and safety signs;* 3. *Construction of railing at desired places.*
Migration/ Displacement	1. *Road widening, if takes place, shall lead to displacement of people, living along the road.*

Agriculture	1. *Barring a temporary effect of dust accumulation on the grown crop, no major negative impact on the agriculture and allied sector is anticipated;* 2. *Road widening, if takes place, shall require possession of agricultural land, which will negatively impact the livelihood of the farmer.*

Source: *Socio – Economic Survey, December 2019 by L. N. Malviya Infra Projects Pvt. Ltd.;*

Table 55 (d): Public Consultation and Focus Group Discussions in Moying to Migging Road.

Village: Moying		
Place/ Road Name: Anganwadi Kendra		
Date/ Month/ Year: 24/ 03/ 2020		
Time: 1: 45 PM		
"Focus Group Discussions" (FGD) Number: 01		
Sr. No.	**Name**	**Village**
1.	*Mr. Ram Pal Sharma*	
2.	*Mr. Punnu Chhazta*	
3.	*Mr. Sita Ram Thapa*	
4.	*Mr. Sukhdev Jha*	
5.	*Mr. Prabhudev Kuthyal*	
6.	*Mr. Prakash Singh Badal*	
7.	*Mrs. Shveta Dangi*	
8.	*Miss Chulbul Rani*	
9.	*Miss Priya Agarwal*	
10.	*Miss Shushma Swaraj*	
11.	*Mrs. Lajwanti Notyal*	

		Place Name: Anganwadi Kendra **Village: Moying**

Village: Ramsingh		
Place/ Road Name: Projected Road		
Date/ Month/ Year: 25/ 03/ 2020		
Time: 2: 45 PM		
"Focus Group Discussions" (FGD) Number: 02		
Sr. No.	**Name**	**Village**
1.	*Mr. Deepak Malhotra*	
2.	*Mr. Kuldeep Raina*	
3.	*Mr. Hiranand Verma*	
4.	*Mr. Kulbhushan Rajak*	
5.	*Mr. Gyan Prakash Gupta*	
6.	*Mr. Hari Naryan Handa*	
7.	*Mr. Praful Kumar Mishra*	
8.	*Miss Sakshi Chauhan*	
9.	*Miss Kangna Rainawat*	
10.	*Miss Pritty Zinta*	
11.	*Mrs. Ram Payari*	
12.	*Mrs. Prabha Davi*	
13.	*Miss Kanchan Kumari*	
14.	*Miss Sheetal Matwali*	
15.	*Miss Sonakshi Sinha*	 **Place Name: Projected Road** **Village: Ramsingh**

Village: Yingkiong		
Place/ Road Name: Anganwadi Kendra		
Date/ Month/ Year: 26/ 03/ 2020		
Time: 3: 45 PM		
"Focus Group Discussions" (FGD) Number: 03		
Sr. No.	**Name**	**Village**
1.	*Mr. Sudhanshu Kumar*	
2.	*Mr. Shyam Lal Gupta*	
3.	*Mr. Manish Gupta*	
4.	*Mr. Vinod Bundela*	
5.	*Mr. Karan Ojha*	
6.	*Mr. Vishal Agarwal*	
7.	*Mr. Shubham Sharma*	
8.	*Miss Kavita Saxena*	
9.	*Miss Surbhi Singh*	
10.	*Miss Rosey Punjabi*	
11.	*Miss Kanya Kumari*	
12.	*Mrs. Lilawati Devi*	
13.	*Mrs. Kalawati Shukla*	
14.	*Miss Sweety Agarwal*	
15.	*Miss Preeti Das Mohan*	 **Place Name: Anganwadi Kendra** **Village: Yingkiong**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Thank you!
To Study Report