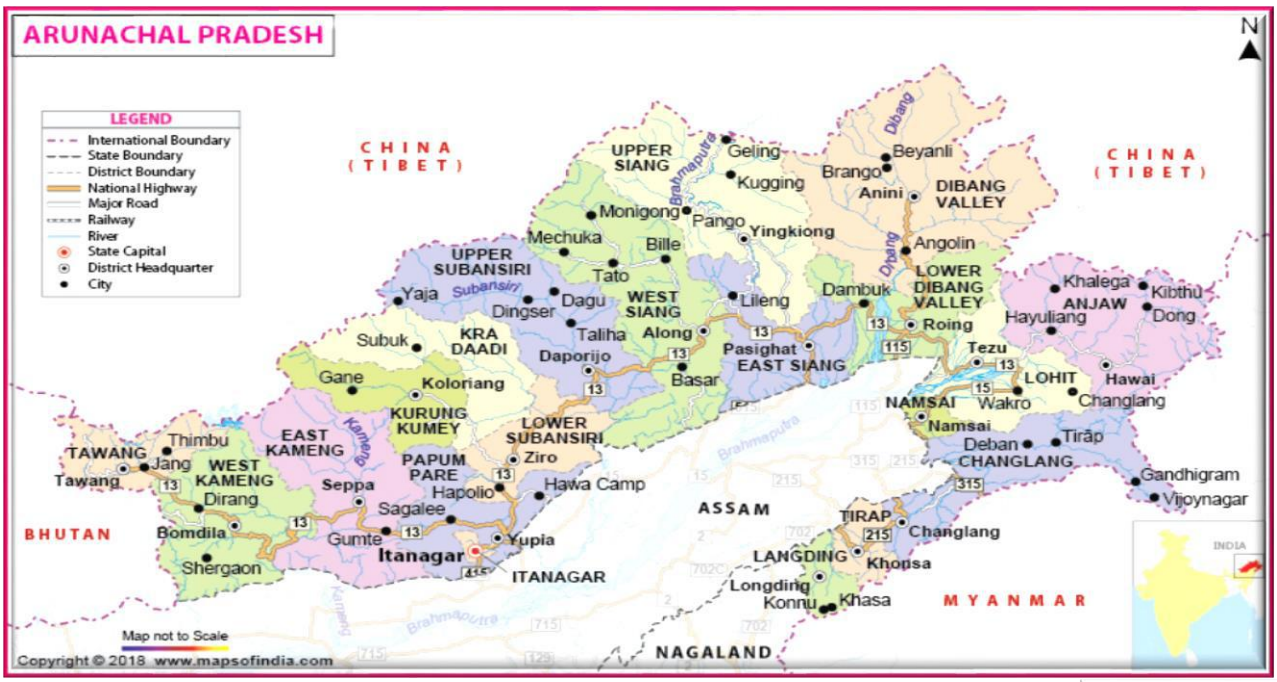
Environmental Impact Assessment Report

Safeguard Policies for Environment

With

Environmental Checklist, Management and Monitoring Plan

EIA/ IEE for BRO – Ditte – Dimme – Migging Road, Arunachal Pradesh State



BRO: Border Road Organization,

April – 2020

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TABLE OF CONTENTS

Sr. No.	LIST OF FIGURES	Page Nos.
CHAPTER – 1: ENVIRONMENTAL IMPACT ASSESSMENT AND EMP FOR ARUNACHAL PRADESH		

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) has been entrusted preparation of "Initial Environmental Examination" (IEE) of Ditte – Dimme – Migging from 142.020 Km to 167.100 Km (167.100 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 **Ditte – Dimme – Migging** from 142.020 Km to 167.100 Km (167.100 Kms) to NH double lane specifications in East and Upper Siang District in State of Arunachal Pradesh area under Project **BRAHMANK** the assignment for **"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 142.020 Km to 93.000 Km and 93.000 Km to 167.100 Km). As per topographic survey which are given below.

- ***Part – I***: ***Starts*** *from* ***Moying*** *(Chainage 142+020) and* ***Ends*** *at* ***Migging*** *(Chainage 167+100).*
- ***Part – II***: ***Starts*** *from* ***Ditte – Dimme*** *(Chainage 142+020) and* ***Ends*** *at* ***Moying*** *(Chainage 142+020).*

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 **Ditte – Dimme – Migging** Road **Starts** from **Ditte Road** and **Terminates** at **Dimme – 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.


INDIAN RAILWAYS

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.

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

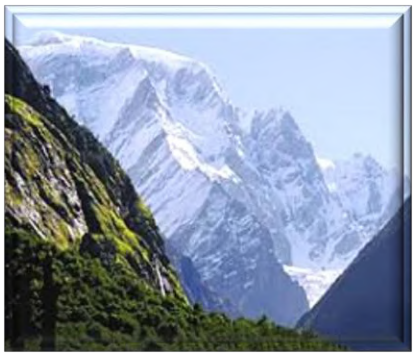





Figure 1 (e): Mountain Ranges, Meandering Rivers and Miles of Forests Supporting Wealthy and Rich Biodiversity.

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 Ditte – Dimme – Migging from 142.020 Km to 167.100 Km (167.100 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 **Ditte – Dimme – Migging** from 142.020 Km to 167.100 Km (167.100 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 **Ditte – Dimme – Migging Starts** at **Ditte** and **Terminates** at **Dimme – Migging**. The design length of proposed alignment is **191.00 Km.** and the route plan of **Ditte – Dimme – Migging Road** is given in **Table 1**.

Table 1: The Route Plan of Ditte – Dimme – Migging Road.
Road Direction and Route Plan

Place Name		Distance	Approximate Time for Journey	Mode of Vehicle
From	To			
Ditte	Dimme – Migging	*167.100 Km.*	*20.57 Hrs*	By Road with 4 Wheeler Drive
	Total	167.100 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).*

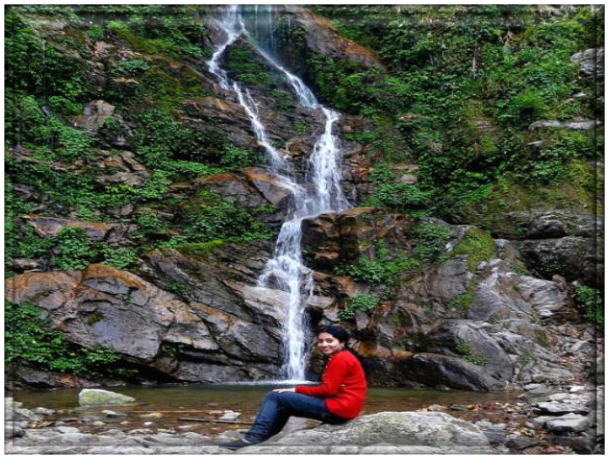
Waterfalls

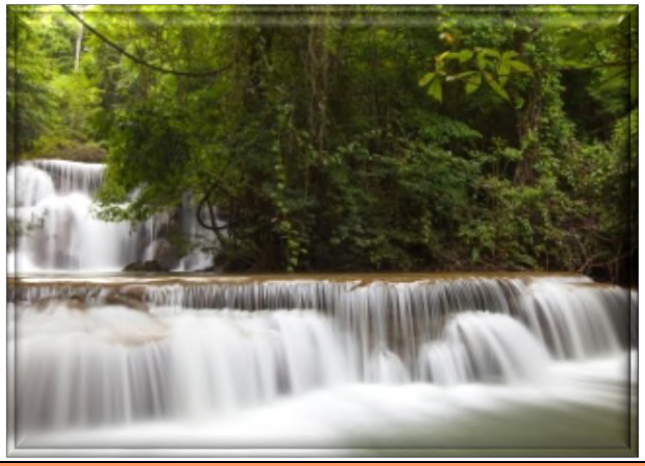
Arunachal Pradesh is primarily a land of sky scraping mountains and hills. The lush green vegetation on the mountain sides presents an **"Eye – Soothing View"** and this sight is made more panoramic by the waterfalls in Arunachal Pradesh. Mostly perennial in nature, waterfalls abound in Arunachal Pradesh, 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.

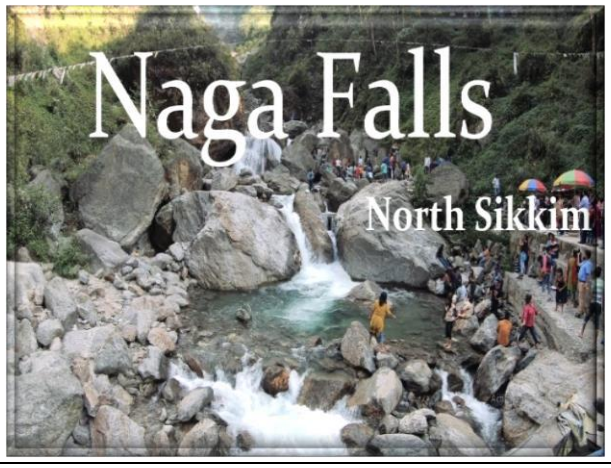
- ***Rimbi Waterfalls:*** *Flowing in the outskirts of Pelling, this waterfall forms an important sight scene to the tourists in Pelling.*





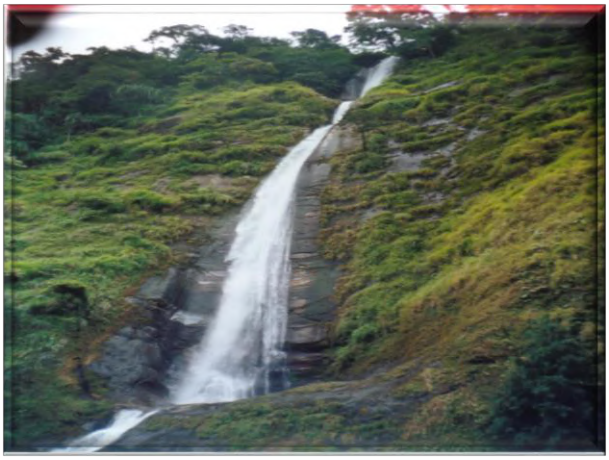
The Rimbi Waterfalls of Arunachal Pradesh State.

- ***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

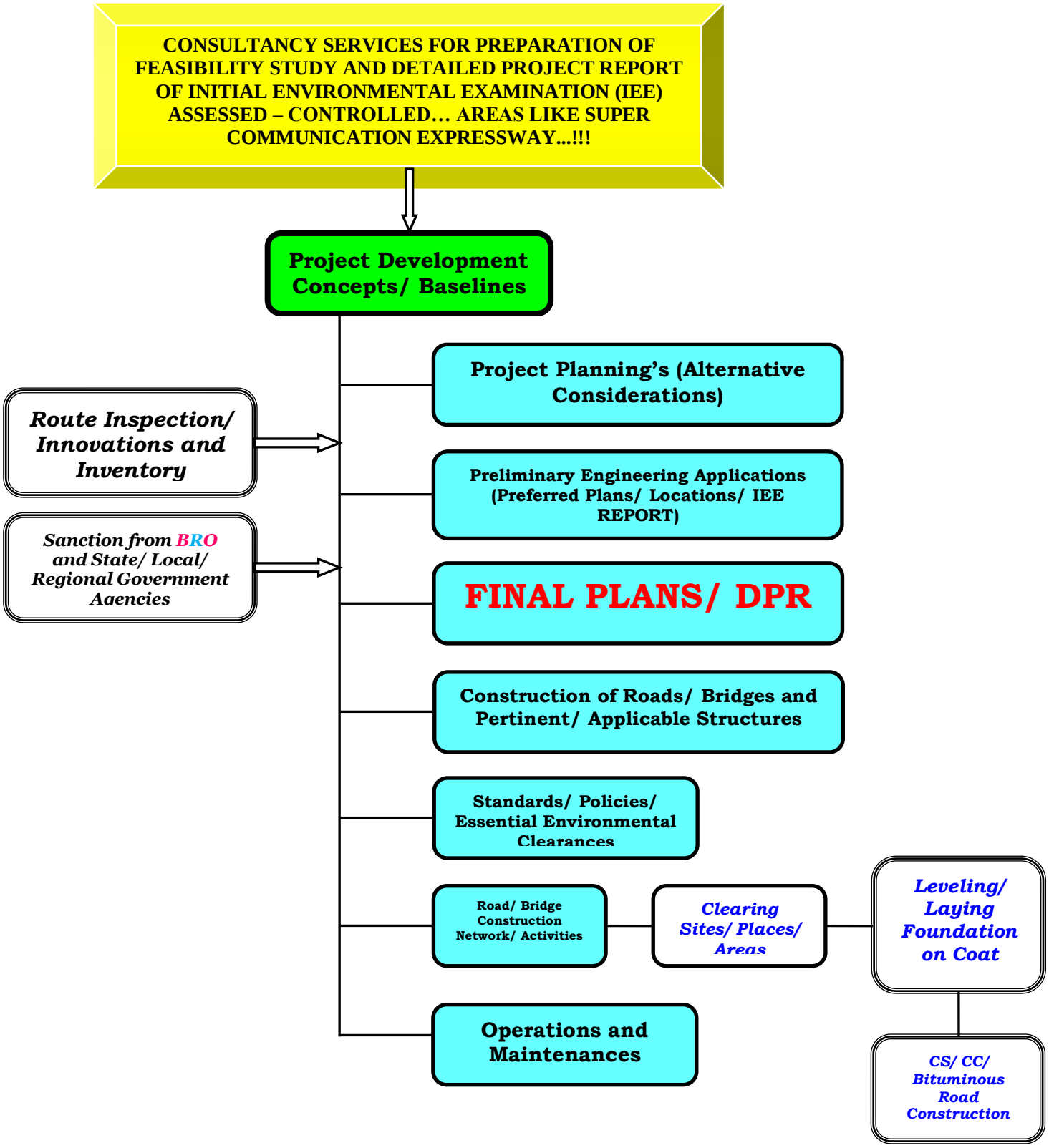
The construction of high altitude hilly/ mountainous roads to Indo – China Border road under phase – II in the state of Arunachal has been entrusted to **"Border Road Organisation" (BRO)** by Ministry of Home Affairs, Department of Border Management, and Government of India. The work is of National importance 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 **Ditte – Dimme – 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 **Ditte – Dimme – 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 Ditte – Dimme – Migging in the State of Arunachal and the **"Total Length of Proposed Road is 167.100 Km".** The Coordinates of Project roads at **Starting Point, Ditte** are **Latitude of 21.3199° (North) and Longitude of 82.5646° (East)**. Coordinates at the **End Point, Dimme – Migging** are **Latitude of 30.7776° (North) and Longitude of 79.8412° (East)**. ***"Length provide by ITBP for the road is 16.00 Km., whereas the designed length is 167.100 Km".***

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.

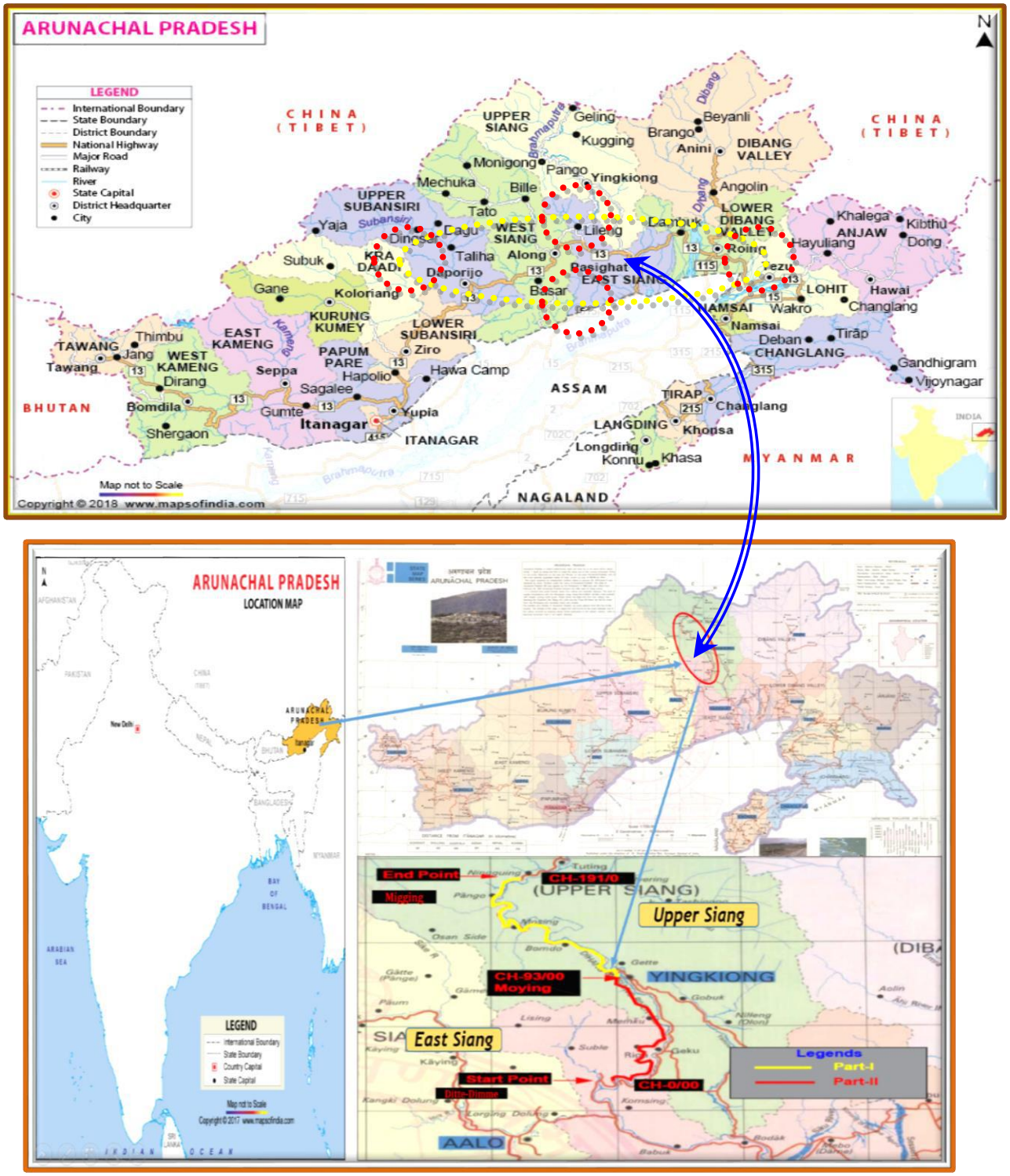
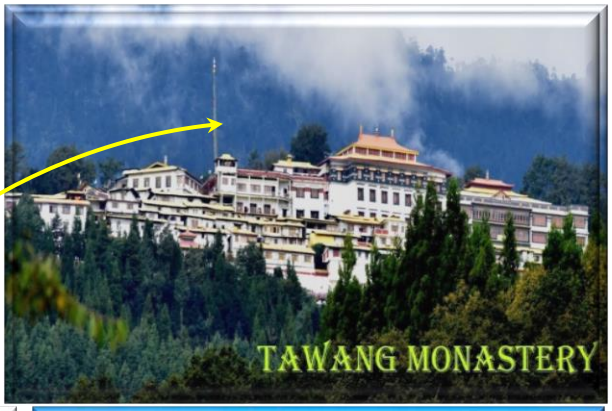


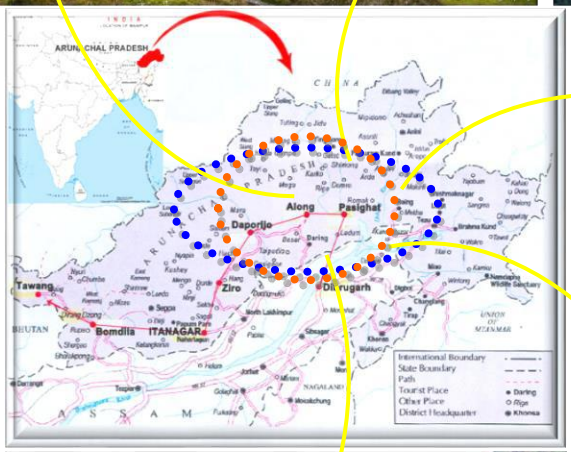
Figure 3: Index Map Showing Projected Road.

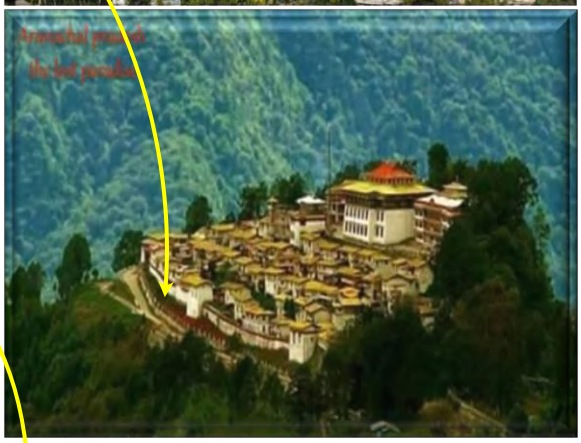
Arunachal Pradesh Demographic Index

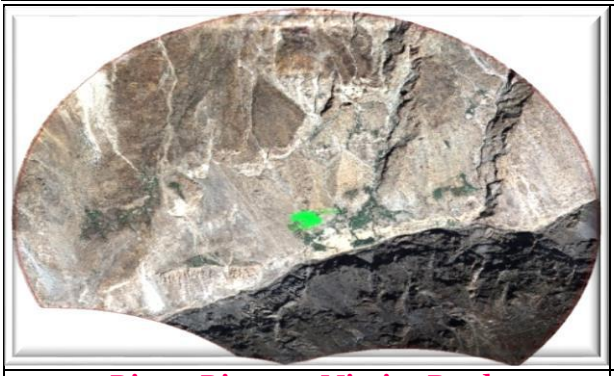
"Arunachal" is a **"Multi – Ethnic State"** and broadly, the population can be divided into tribal and non – tribal groups. Lepchas, Bhutias, Sherpas are categorized as Scheduled Tribes. The Lepchas are the original inhabitants of the state and compared to other ethnic groups, the Lepchas still maintain 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 *Ditte – Dimme – Migging (167.100 Km)* Projected New Road at *Ditte* Latitude of *29.9831°* (North) and Longitude of *78.5278°* (East); *Dimme – Migging* Latitude of *30.7776°* (North) and Longitude of *79.8412°* (East). Vetting/ Geology and Slope Stability are observed by Environmental Team Experts. (Part – III)**

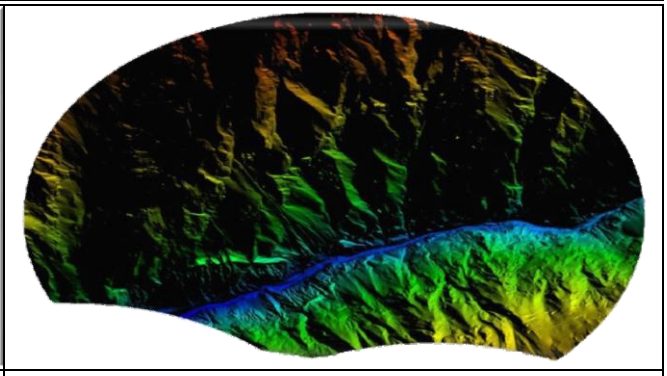

TAWANG MONASTERY


ARUNACHAL PRADESH
Along
Pasighat
Daporijo
Ziro
Tawang
Bomdila
ITANAGAR
Dirugarh
International Boundary
State Boundary
Tourist Place
Other Place
District Headquarter

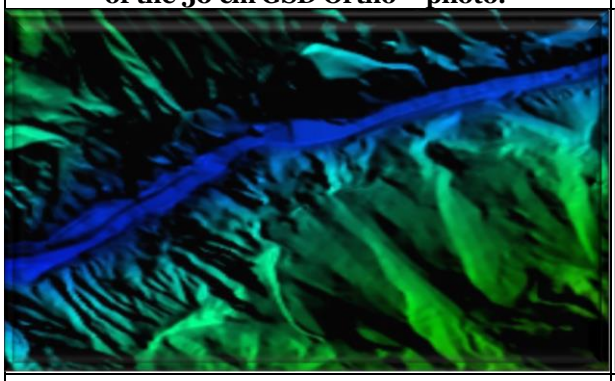




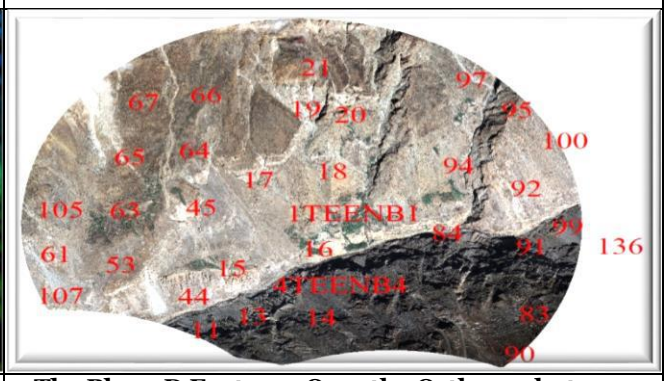
Ditte – Dimme – Migging Road, Village (UK) Area – 37.625 Sq. Km. Overview of the 50 cm GSD Ortho – photo.



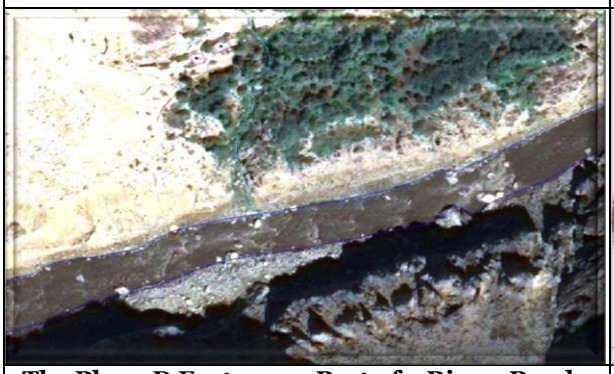
The 5 m Grid DEM a Relief View (An Overview for the Whole Area of Interest).



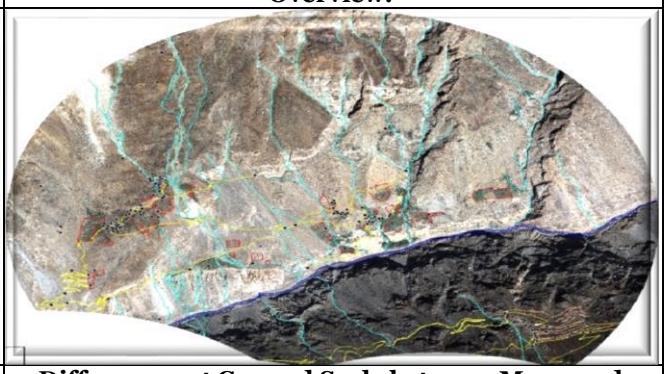
The DEM in Relief View for a Part of a River.



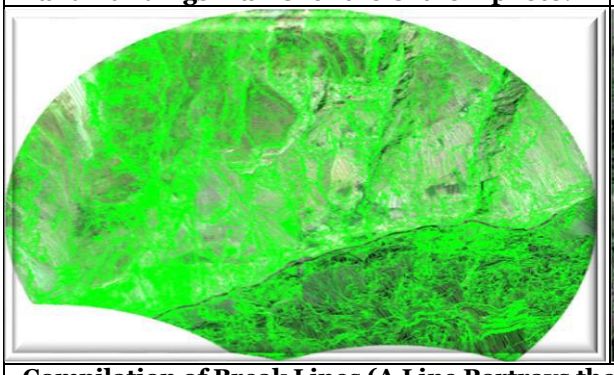
The Plan 3D Features Over the Ortho – photo an Overview.

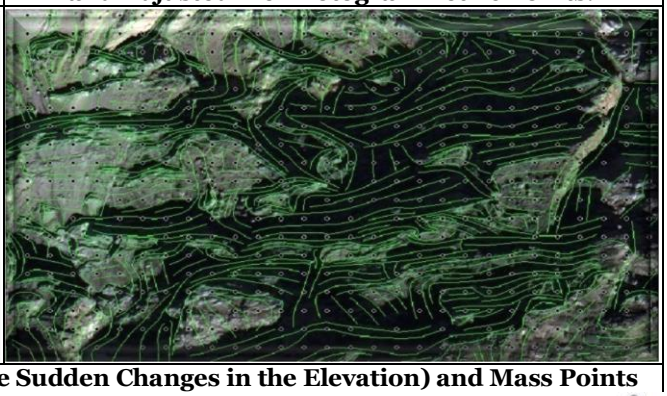


The Plan 3D Features – Part of a River; Roads and Buildings Plan Over the Ortho – photo.



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:	**Ditte – Dimme – Migging, Road (UK) Part – I**
Total Length of the Road as per Remote Sensing:	**167.100 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 *Ditte – Dimme – Migging Road, Village (167.100 Km)* Projected New Road at *Ditte* Latitude of 30.7116° (North) and Longitude of 79.8381° (East); *Dimme – Migging* Latitude of 30.7776° (North) and Longitude of 79.8412° (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.

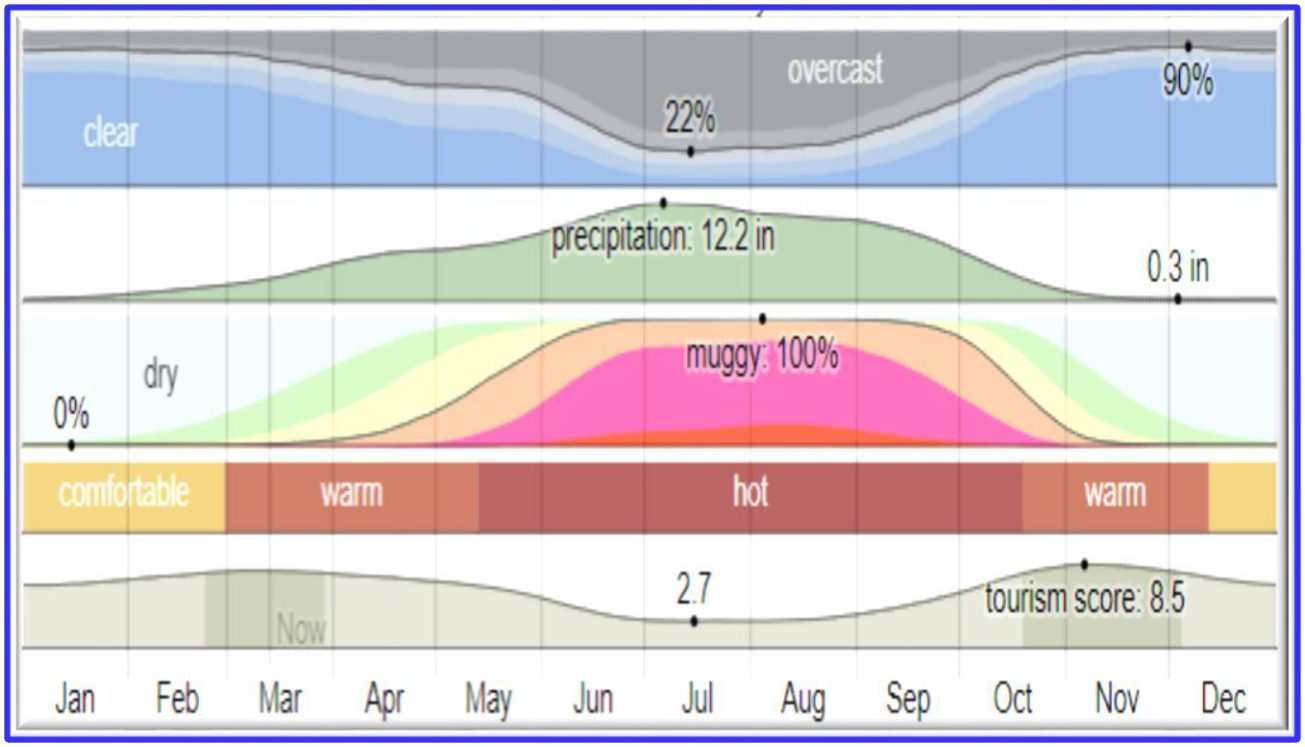
The average temperature for the year in Arunachal is 23.5°C or 74.3°F. The warmest month, on average, is June with an average temperature of 31.1°C or 88.0°F. The coolest month on average is January, with an average temperature of 13.3°C or 55.9°F. The average amount of precipitation for the year in 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	489	438	325	156	27	13

Source: India Meteorological Department Weather Base.

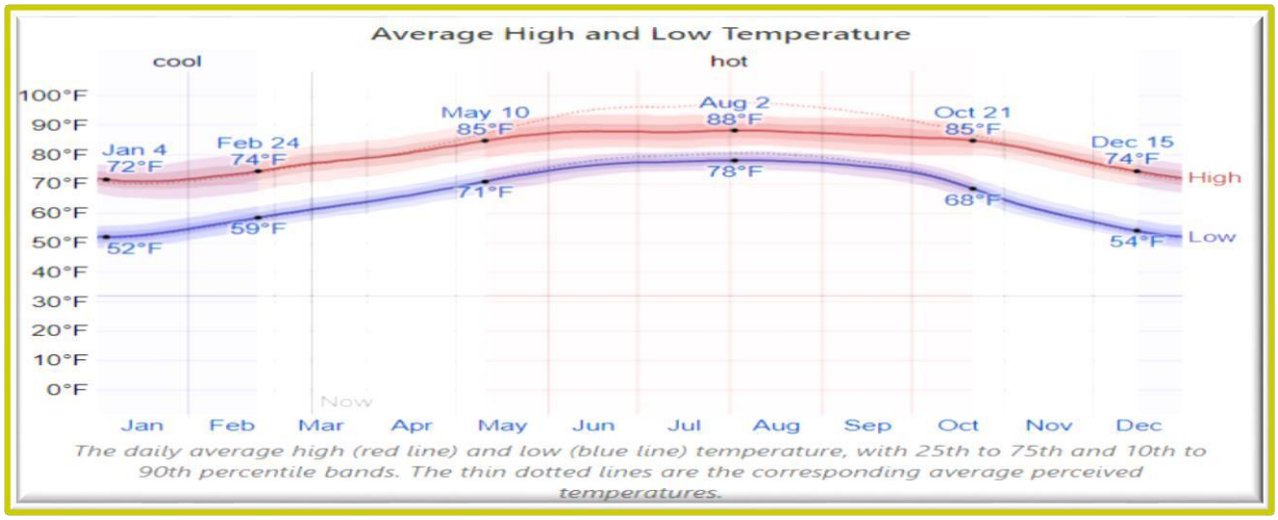
Figure 5 (a): Climate Summary Data for Arunachal Pradesh.



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)**.

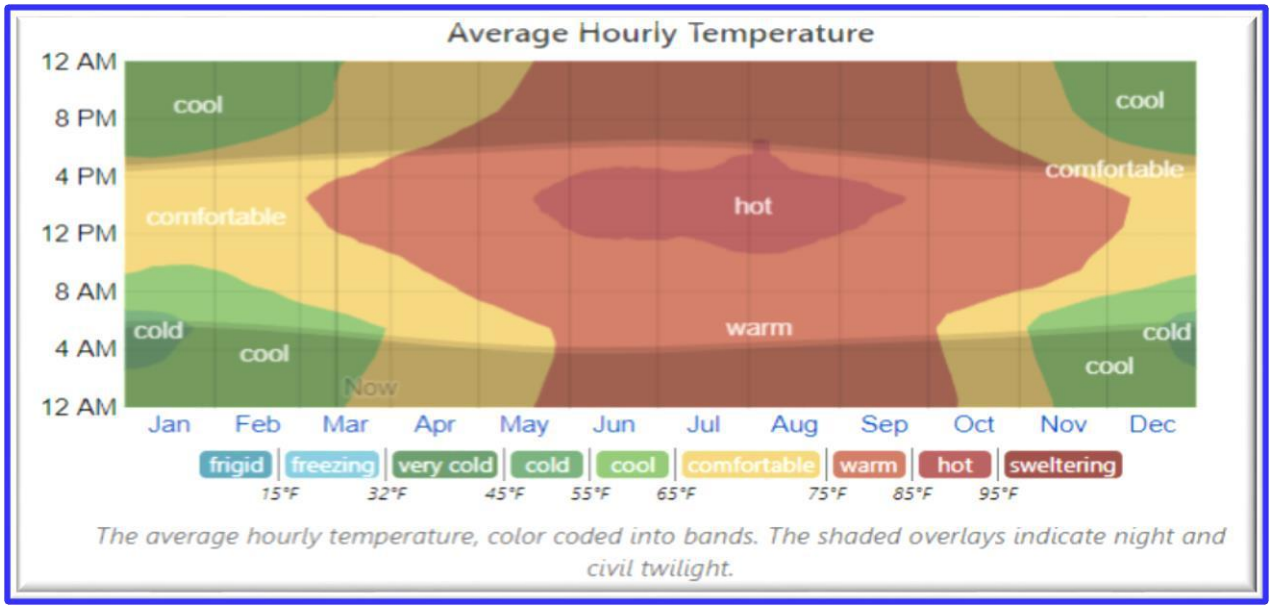
Figure 5 (b): Average High and Low Temperature Summary for Arunachal Pradesh.



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.

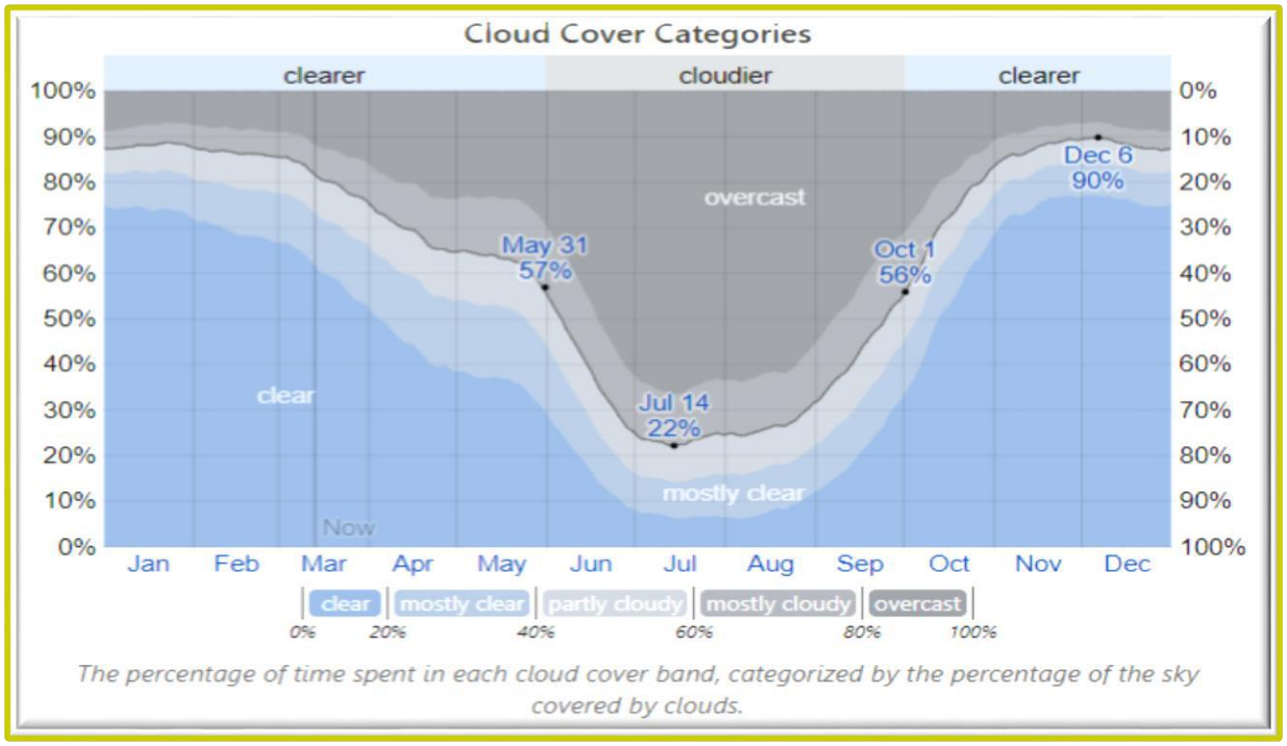
Figure 5 (c): Average Hourly Temperature Summary for Arunachal Pradesh.



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)**.

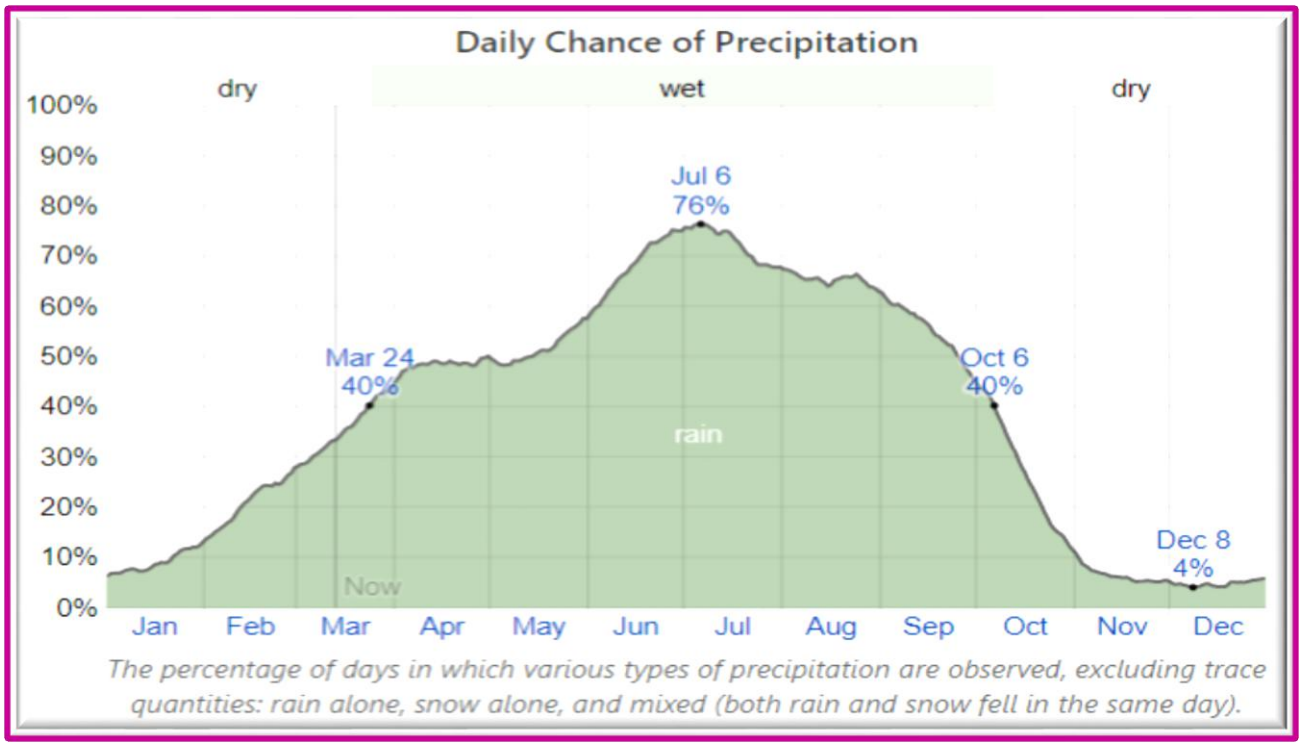
Figure 5 (d): Cloud Cover Categories for Arunachal Pradesh.



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.

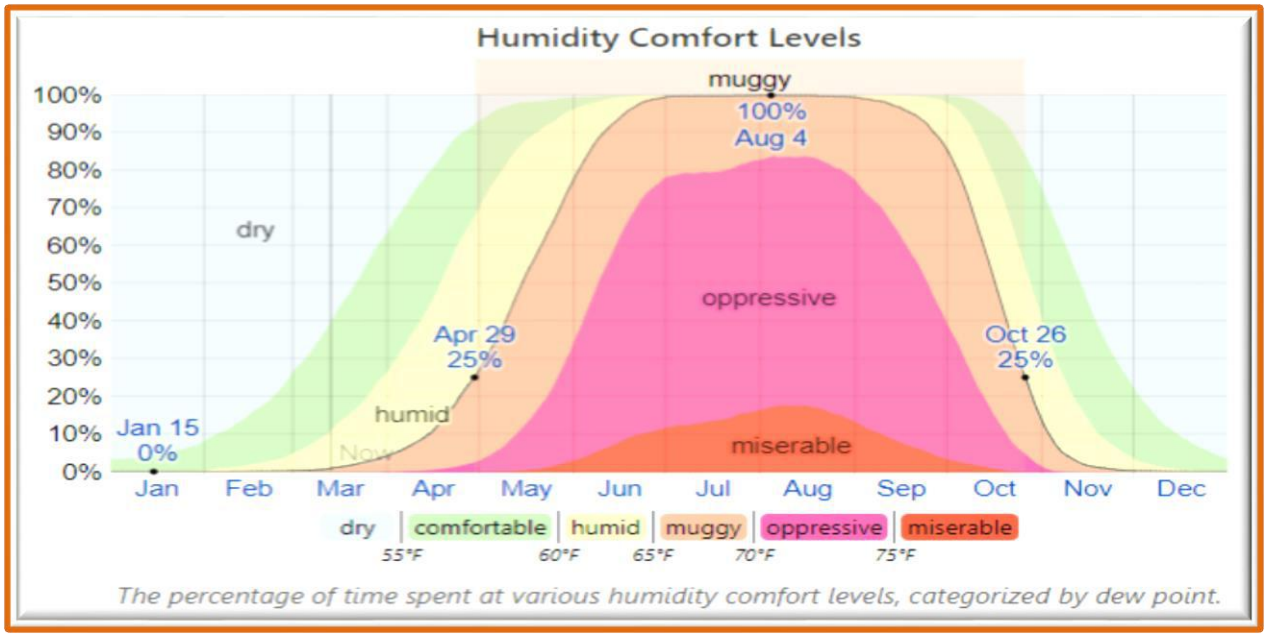


Humidity Index

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 Ditte – Dimme – 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)**.

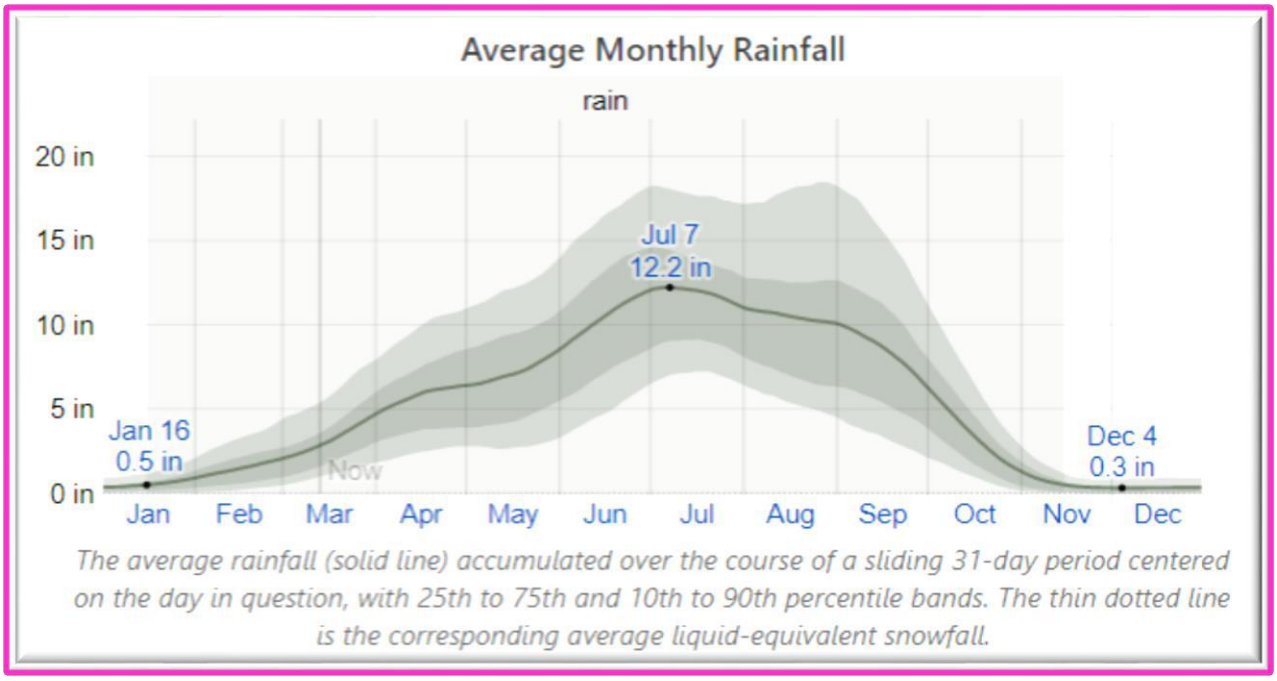
Figure 5 (f): Humidity Comfort Levels for Arunachal Pradesh.



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)**.

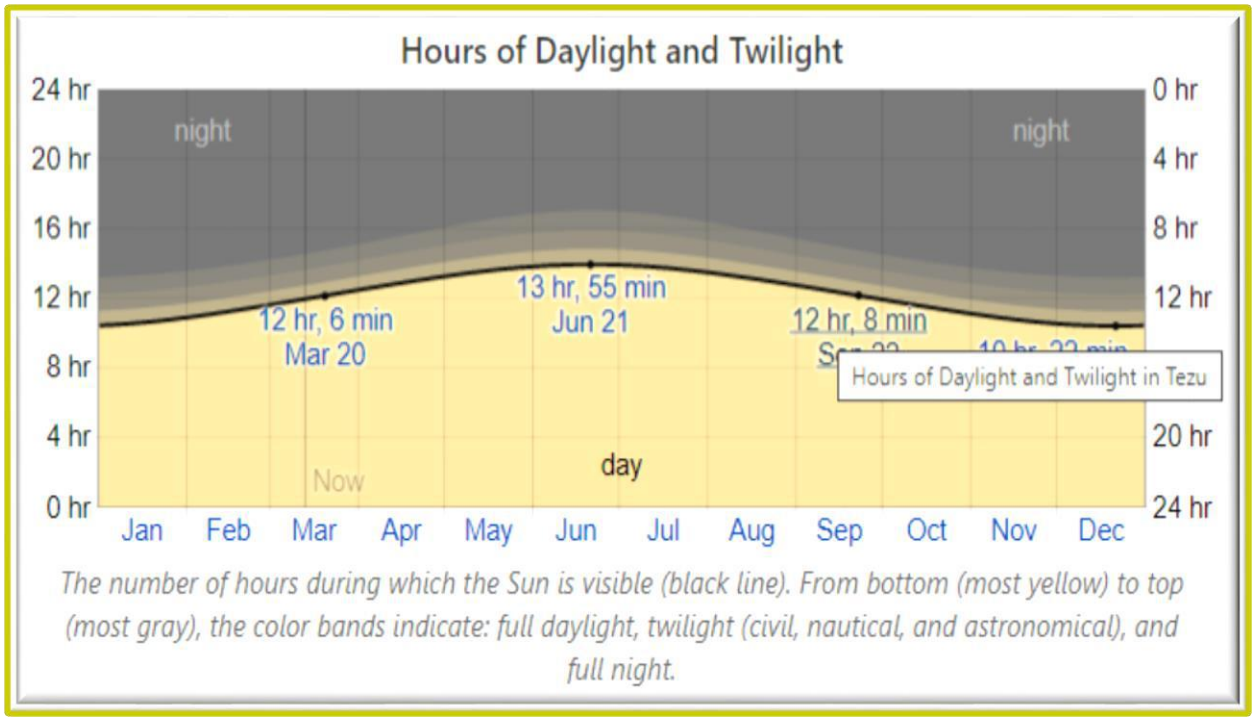
Figure 5 (g): Extreme Seasonal Variation in Monthly Rainfall for Arunachal Pradesh.



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.

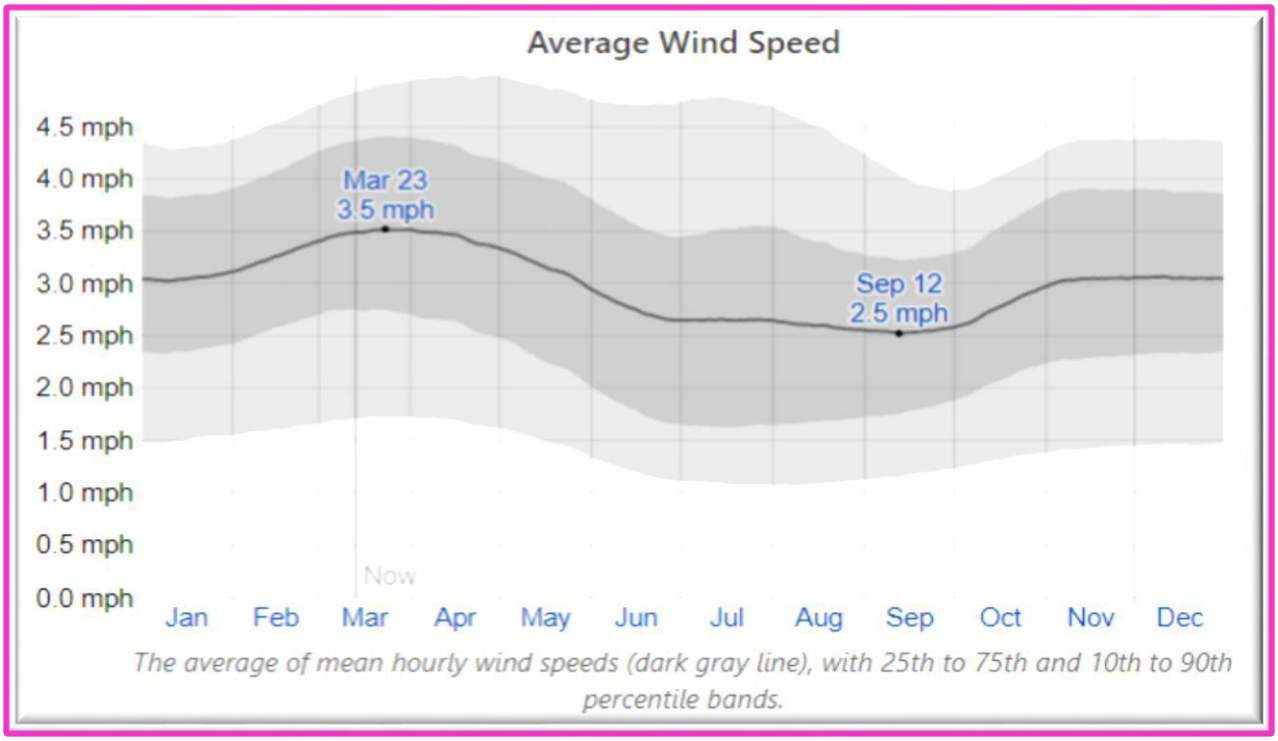
Figure 5 (h): Hours of Daylight and Twilight for Arunachal Pradesh.



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.

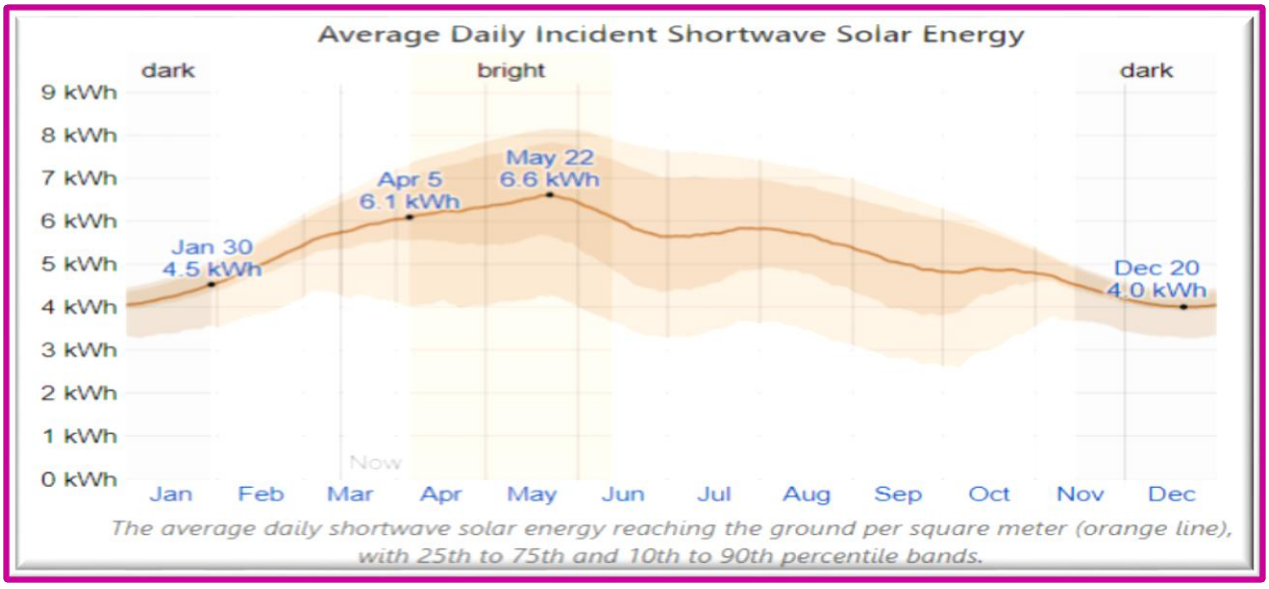


Topography and Solar Energy Index

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 **Ditte – Dimme – 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 **167.100** Km and as per design is 25.080 Km. The alignment of the project road is connecting Ditte (Defence Check Post) and Dimme – Migging Pass (Near China Border). The project road Ditte – Dimme – Migging having length of ***167.100 Km*** and the project stretch is traversing in hilly terrain from ***Ditte at (21.3199° N Latitude and 82.5646° E Longitudes)*** and ***Ends*** at ***Dimme – Migging Village (30.7776° N Latitude and 79.8412° 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 142+020 Km to 167+100 Km"***.

Start/ End Points, Terrain and Land Form

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

Dimme – 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 ***Dimme – 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 ***Ditte*** towards **Dimme – 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 ***Dimme – Migging*** and ***Ends*** at **Dimme – Migging**. This stretch is for an approximate length of **167.100 Km** and the place ***Ditte*** 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. ***Ditte – Dimme – Migging,*** starts from Ditte and terminates at Dimme – Migging. The actual design length of the proposed alignment is **25.080 Km**. On the project road (***Ditte – Dimme – 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 ***Ditte – Dimme – Migging***. The pattern on both side of road is barren land. The details of land use pattern along the project road are **(Figure 6)**:

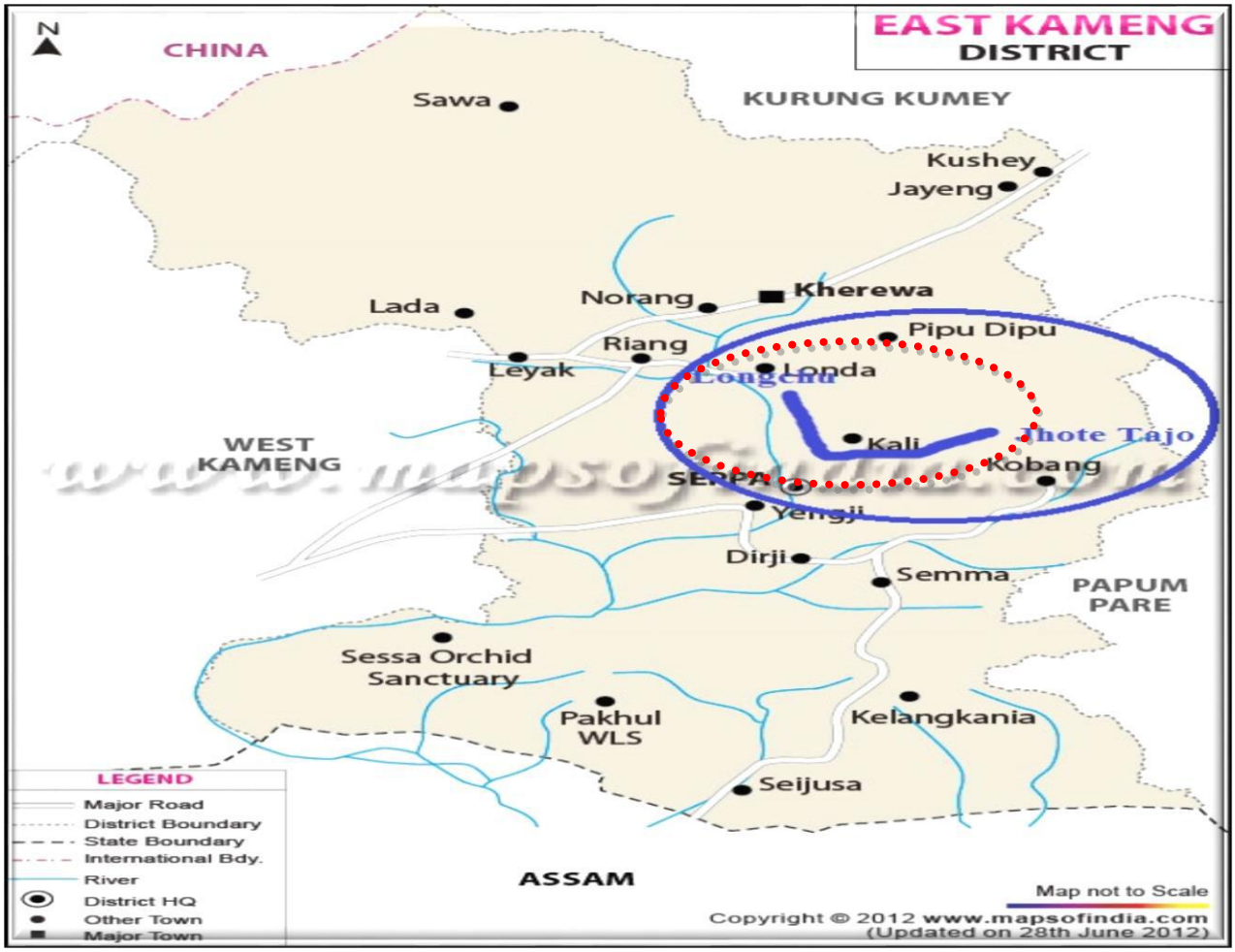


Figure 6: Approved Project Alignment of Ditte – Dimme – Migging Road Projected as per Inception Report by IIT Delhi/ Roorkee Team Experts.

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 ***Ditte – Dimme – Migging*** in the state of Arunachal and the total length of the proposed alignment is **167.100 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 **Ditte – Dimme – Migging** is having length of ***167.100 Km.*** The project stretch is traversing in hilly terrain from **Ditte (3,139 m or 10,298.56 Feet in Height)** and ends at **Dimme – 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 ***167.100 Km.*** (As shown above in yellow colour) given in **Figure 6**. The Projected Corridor **Ditte – Dimme – Migging, Road** in North Arunachal is a newly declared under **Part: 1,** connecting link NH/ SH in the Arunachal Pradesh.

Ditte (दिते) 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 Ditte – Dimme to Pasighat – Mariyang Road.

About Ditte (दिते)

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.

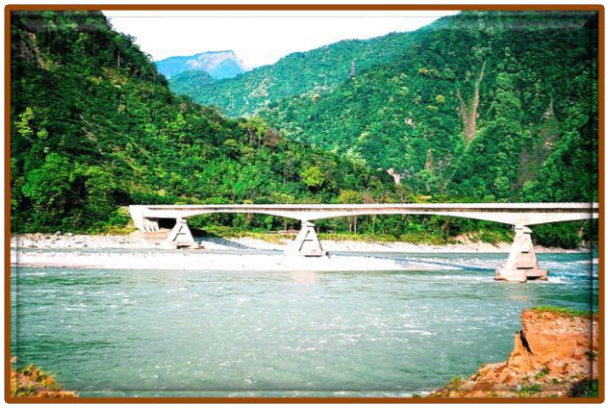
The state's economy is largely agrarian, based on the terraced farming of rice and the cultivation of crops such as maize, millet, wheat, pulses, sugarcane, ginger, oilseeds, cereals, potato, and pineapple. In 2018 – 19* total horticulture production reached 213.87 thousand metric tonnes. Some of the 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.

Dimme – Migging (डिम्मे – 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: Dimme – Migging (डिम्मे – 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

Dimme – 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: Dimme – 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


Arunachal Pradesh

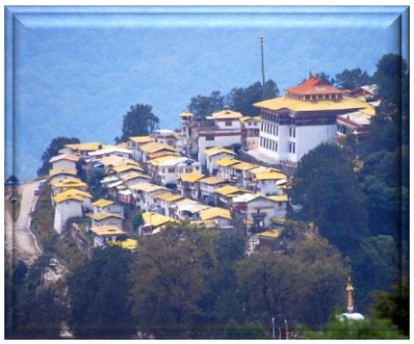


Figure 7: Tawang Landscape and Sage Parshuram Kund Landscape Reflection of Himalayas' Highaltitude Highland.

- *The Existing Alignment of **Ditte – Dimme – Migging, Road** is Newly Declared as NH/ SH; is connecting to Newly Declare Road. The Total Existing Length of the Projected Road is approximately **167.100 Km.***
- *The Actual Design Length of the Project Road is around **25.080 Km.***
- *The project road section between **Ditte – Dimme – 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 Ditte – Dimme – Migging Project Road.

ROAD INVENTORY																		
Road Name: Ditte – Dimme – Migging																		
Section : From Km 142+020 To 167+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)	
142+020	167+100	Hilly Terrain	Barren and No Use of Forest Land	Ditte – Dimme – 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 – Ditte	Ditte, Arunachal	Ditte – Dimme – Migging, Arunachal	C/ W Width – Varying = b/ w 7 m	Foot Track

- *The Existing road **Starts from 142+020 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 167+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 **Ditte – Dimme – Migging** is situated in the State of Arunachal Pradesh. Project corridor is from Km 142+020 to Km 167+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 Ditte – Dimme – Migging Road Projected"** are presented in the **Figure 8** below:*

Start Point at Moying Village Chainage = 142+020 Km.

End Point at Migging Village Chainage = 167+100 Km.

Figure 8: Approved Project Alignment of Ditte – Dimme – 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 **"167.100 Km of Ditte – Dimme – 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

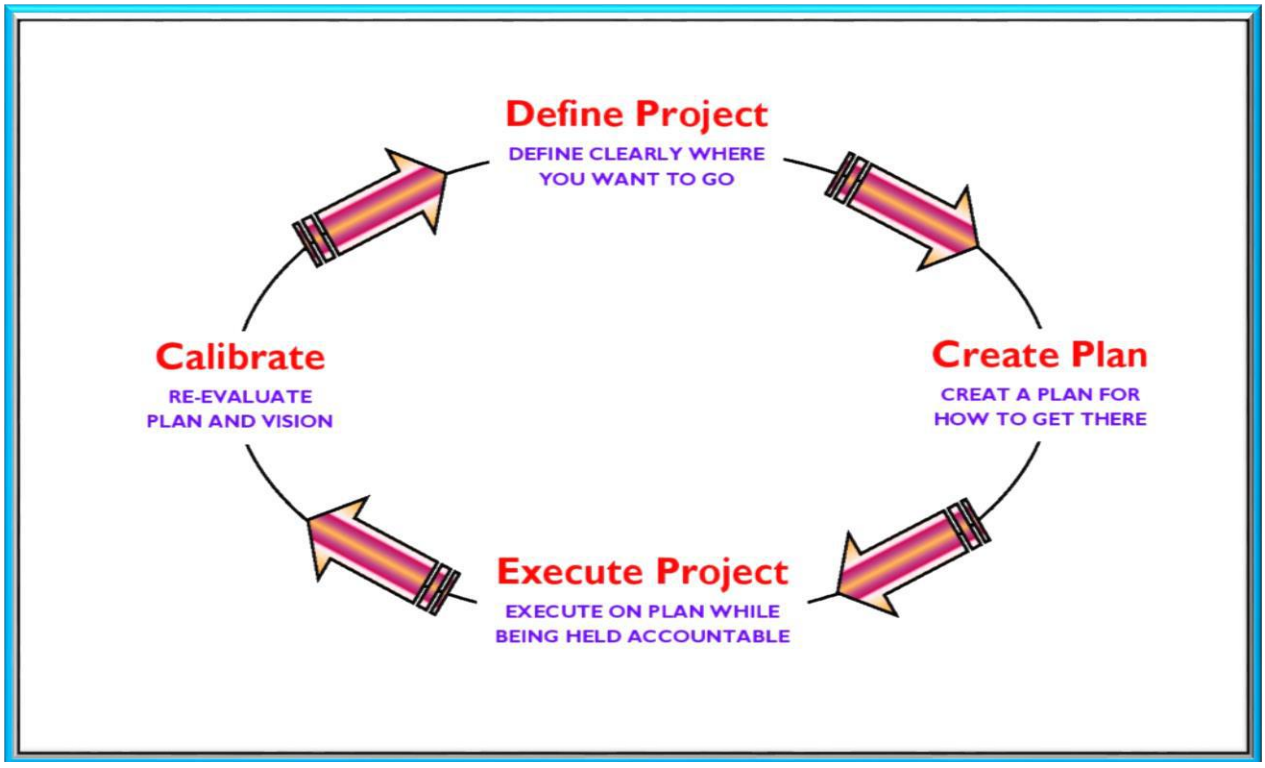
4) Detailed Project Report; "Initial Environmental Examination" and Bid Documents

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...!!!



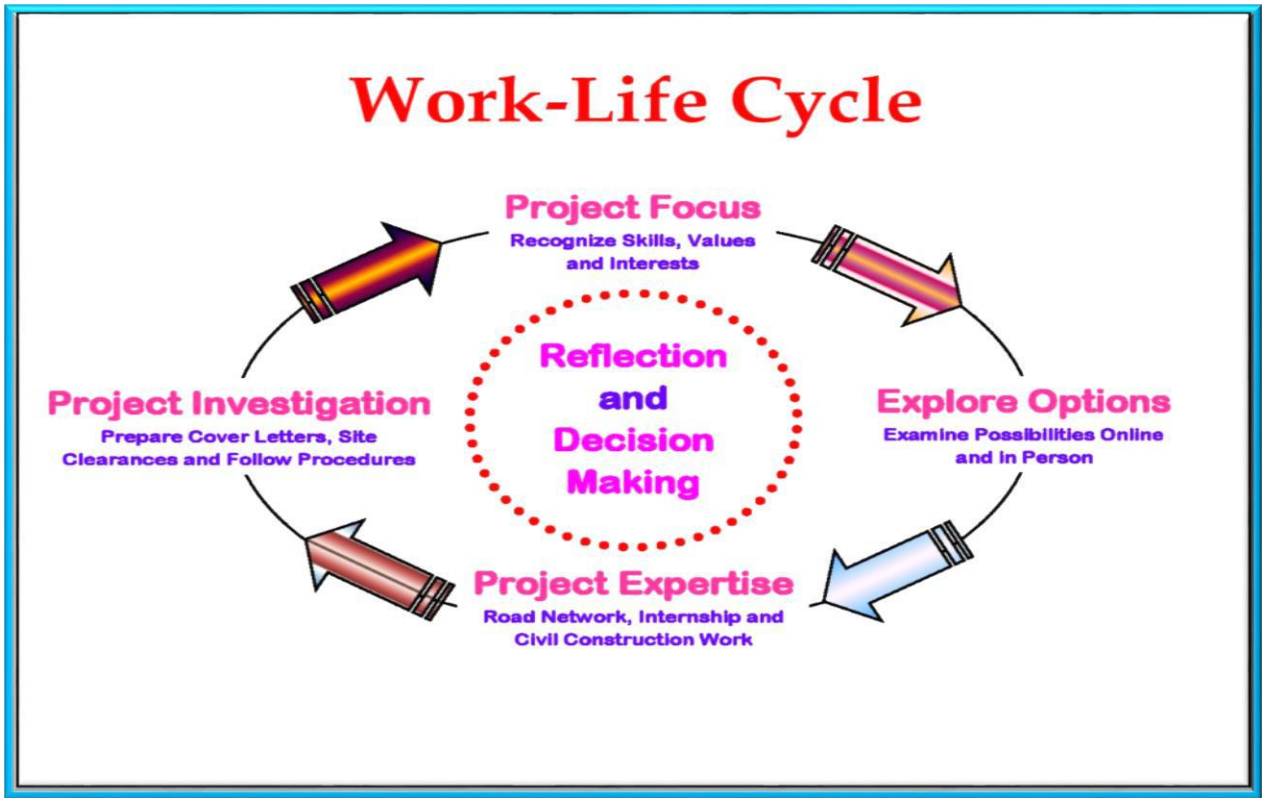


Figure 9: Project Execution Objectives and Decision Making Work – Life Cycle.

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.

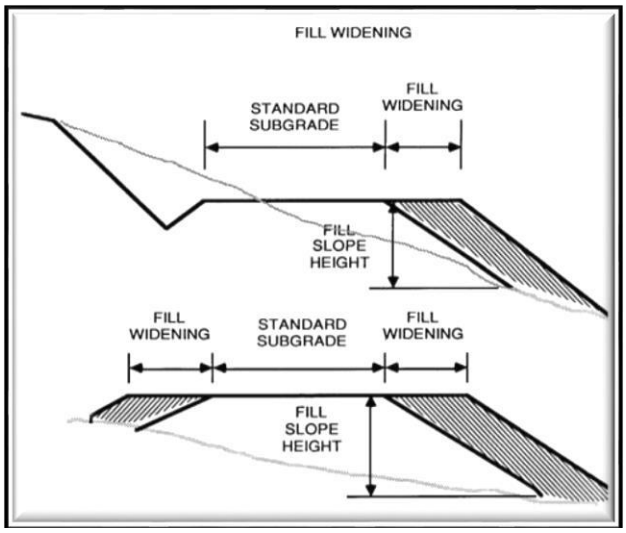
Soil and Material Investigations: Prospective sources of construction materials have been located by the Consultants to add in list of sources of materials. To estimate the quantities of available suitable materials; the Consultants have prepared quarry/ material source charts including lead distances 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.

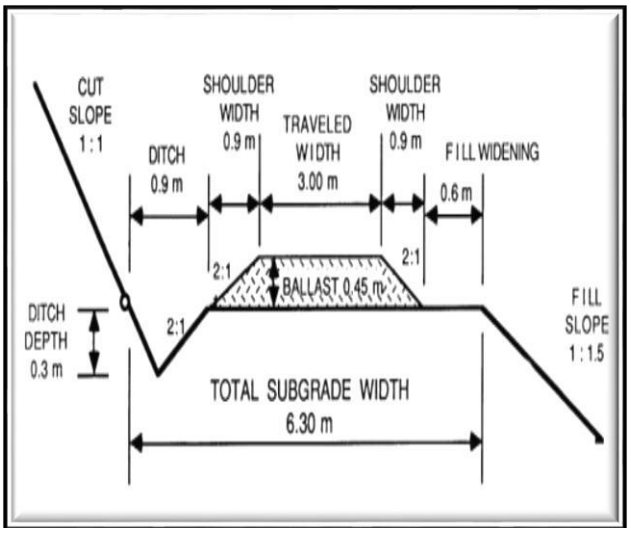
For the completion of this environmental report the data was collected from different sources including government department and our DPR as well as **"Initial Environmental Examination" (IEE) "Report, Expert/ Specialist Team"**. The main aim of this report is to produce a smart; innovative/ informative/ 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 **Ditte – Dimme – 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**.





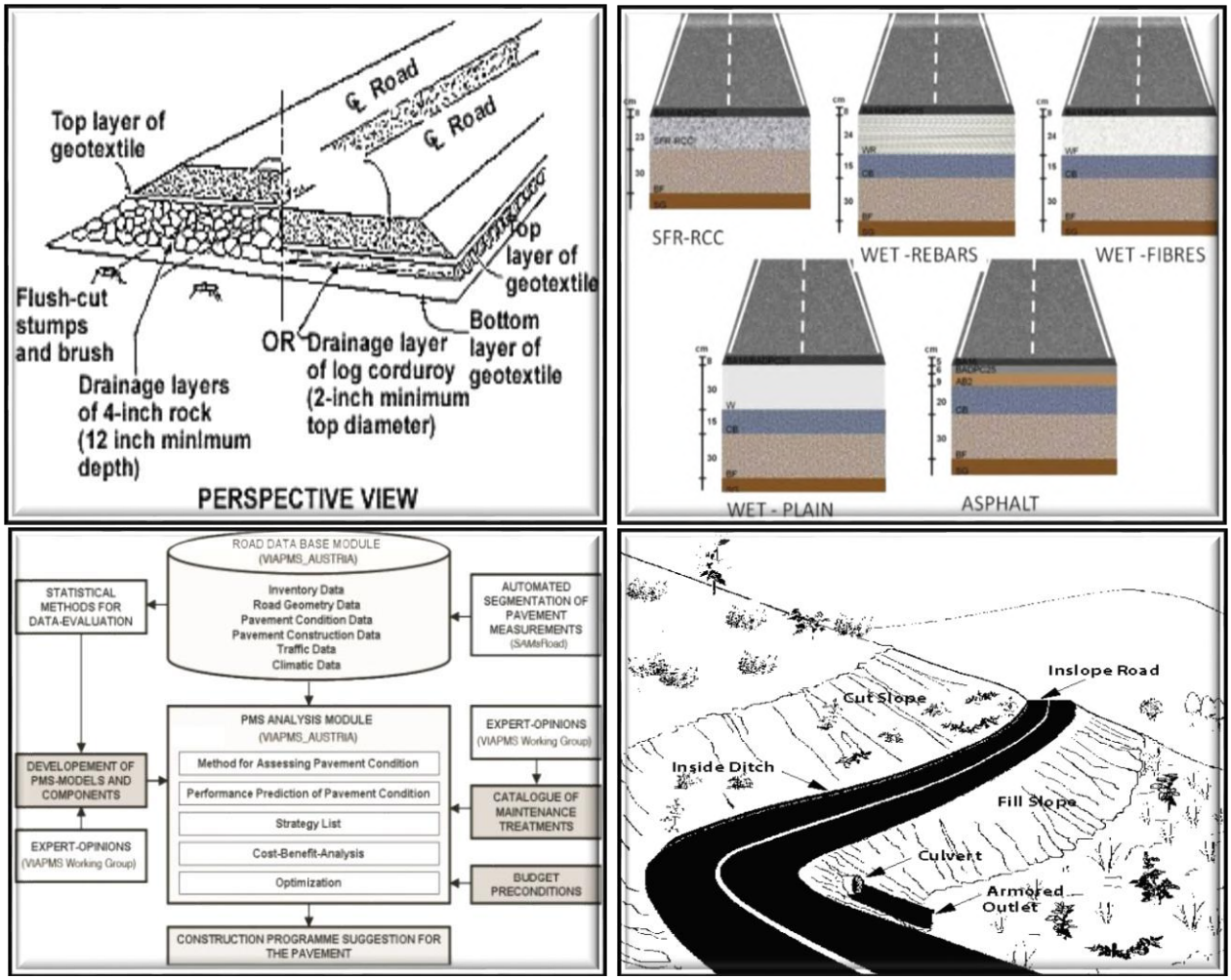


Figure 10: Methodological Perspective Over – View of Road Date Base Construction Photographs.

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.










don a traditional Monpa jacket!

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;

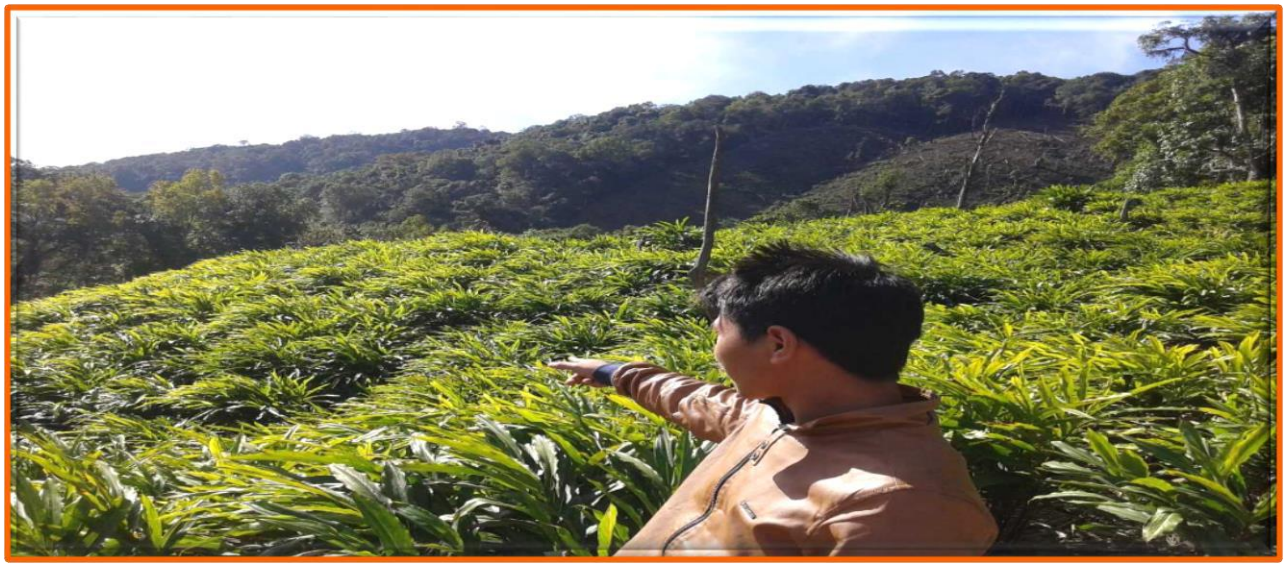
The state is home to **26 major tribes and 100 distinct sub – tribes**, which brings into the picture a plethora of religious and superstitious beliefs. 40% of the population in Arunachal Pradesh follow Donyi Polo and Rangfrah religions, while the remainder is a majority of Buddhists.

- ***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 142+020 and Ends at Migging Chainage 167+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.	Ditte – Dimme – Migging Road	*142+020*	167+100	*142+020*	167+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**.

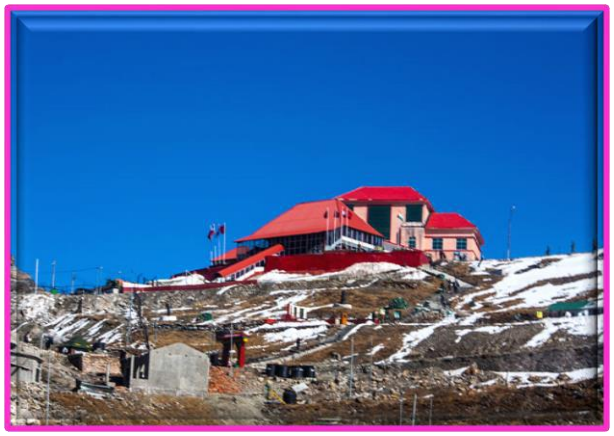
<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Nathu La Pass – Indo – China Border at East Sikkim State.</td><td>Kailash Mansarovar Yatra through Nathu La Pass – Indo – China Border at East Sikkim State.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Nathu La Pass – Indo – China Border.</td><td>Kirateshwar Mahadev Temple in Legship is Dedicated to Hindu God Shiva.</td></tr>
</table>

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

Arunachal: Week – Long Gumkum Gumpa Festival of Puroik Community.

Puroik Girls Dancing on the Occasion of 35th Gumkum Gumpa, Seppa.

The Traditional Gumpa Dance being performed in Lachung during the Buddhist Festival of Losar.

The Traditional Buddha – New Dance being Performed in Lachung during the Buddhist Festival of Losar.

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**.

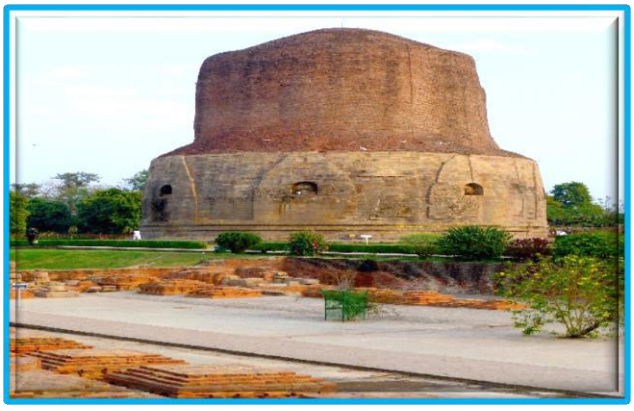
Noodle – based Dishes such as Thukpa, Chow – Mein, Thanthuk, Fakthu, Gyathuk and Wonton are Common in Arunachal Pradesh. Momos – Steamed Dump Lings filled with Vegetables, Buffalo Meat or Pork.

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.

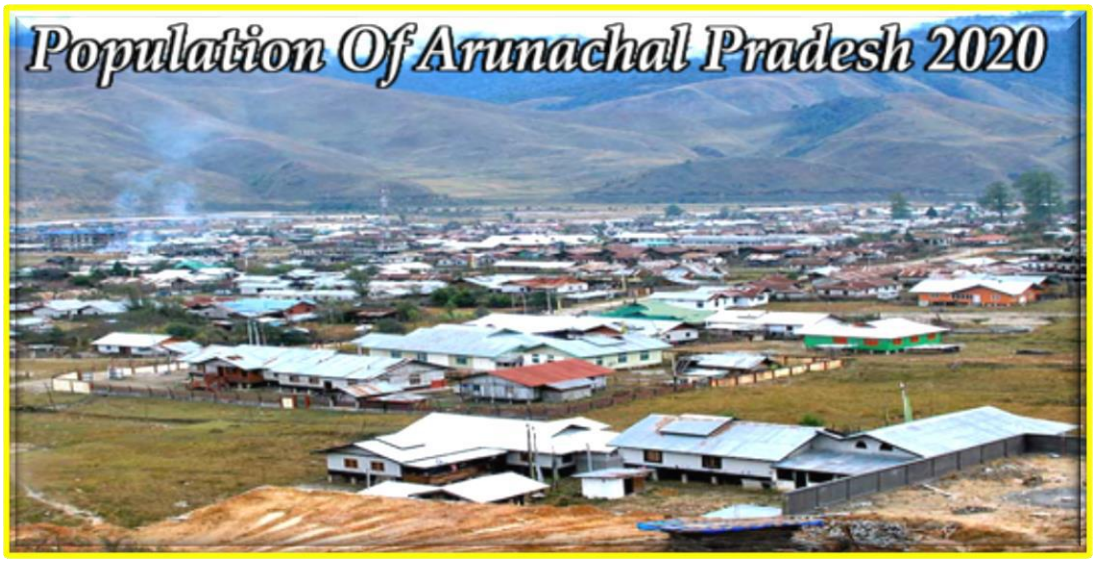
Pavement Condition

The existing road has CL – 9 specification an intermediate lane configuration from ***Km 142+020 to 167+100 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 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.	144+900	*145+100*	200	*Scattered Built Up*	Janbo

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.

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 13**.

Table 13: Rapid Environmental Assessment Checklist.

Country/ Project Title	India: Arunachal Pradesh Sub – Project: Initial Environmental Examination Report for: Ditte – Dimme – 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 14** presents clearances required under the proposed project for roads network area.

Table 14: 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). Pollutants as per the prescribed standards.*	*Yes*	**GO UP; SPCB; TCEPA**
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 167.100 Km"** length concentric widening is **"Proposed"** for about **"25.080 Km"** mainly in built – up locations shown in **Tables 15, 16, 17 (a) and (b)**.

Table 15: 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 16: Chainage References of Village Community/ Town (Ditte – Dimme – 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.	Ditte Chainage: *142+020 Km* E – 82.5646° N – 21.3199° Z – 3,139 M OR 10,298.56 Feet	Dimme – Migging Chainage: *167+100 Km* E – 79.8412° N – 30.7776° Z – 5,070 M OR 16,633.86 Feet	Ditte – Dimme – Migging Road

Table 17 (a): Chainage of Reference Minor Junction Details (Ditte – Dimme – 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.	132+180	*L/ S – Janbo Basti*	LHS	*Y – Junction*	Minor
2.	132+230	*R/ S – Janbo Basti*	RHS	*Y – Junction*	Minor
3.	132+240	*Jano Dett.*	RHS	*T – Junction*	Minor
4.	150+410	*Mosing*	LHS	*Y – Junction*	Minor

Table 17 (b): Chainage of Reference Details of Minor Bridge (Ditte – Dimme – 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.	146+460	133+650	MNB	1 × 24.5	3.40	MNB	1 × 35.0	Reconstruction
2.	154+960	141+635	SLAB	1 × 6.0	7.00	MNB	1 × 10.0	New Construction
3.	156+510	142+770	SLAB	1 × 6.0	7.00	MNB	1 ×15.0	New Construction
4.	158+390	144+585	SLAB	1 × 6.0	7.00	MNB	1 × 15.0	New Construction
5.	160+130	146+195	MNB	1 × 24.5	3.40	MNB	1 × 35.0	Reconstruction
6.	160+270	146+300	MNB	1 × 40.0	3.40	MNB	1 × 55.0	Reconstruction
7.	160+590	146+620	SLAB	1 × 6.0	6.80	MNB	1 × 10.0	New Construction

Table 17 (c): Chainage of Reference Details of HPC Reconstructed to Slab Culverts (Ditte – Dimme – 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+300	141+975	HPC	1 ROW 450	7.2	SLAB	1 × 2.0	Reconstruction

Table 17 (d): Chainage of Reference Details of FCW Reconstructed to Slab Culverts (Ditte – Dimme – 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), 02 Nos. of **"Flush Cause Ways" (FCW)**, 01 Nos. of **"Hume Pipe Culvert" (HPC)**, and 63 Nos. Culverts, 00 Nos. of (Arch) Minor Bridges, and 03 Nos. of Minor Bridges along the Existing Road. During inventory and condition survey, the details of Bridge and 16 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 18** 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 18: 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 **Ditte – Dimme – 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 **167.100 Km.** and the details of which are given in the **Table 19** below:

Table 19: 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.	*142+020*	**167+100**	*142+020*	**167+100**	*25.080*	**Rolling Or Mountainous Terrain**

RESERVED FOREST

There is forest land area exists in about **167.100 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 **Ditte – Dimme – Migging Road** has found forest land exists on the project corridor **(Table 23)**. 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 **Ditte – Dimme – Migging Road** were the only towns of commercial importance in the erstwhile/ former/ previous State as shown in the **Table 23**.

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 20**. 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 **Ditte – Dimme – Migging Road** and the Traffic Survey Locations and Schedules are given below: