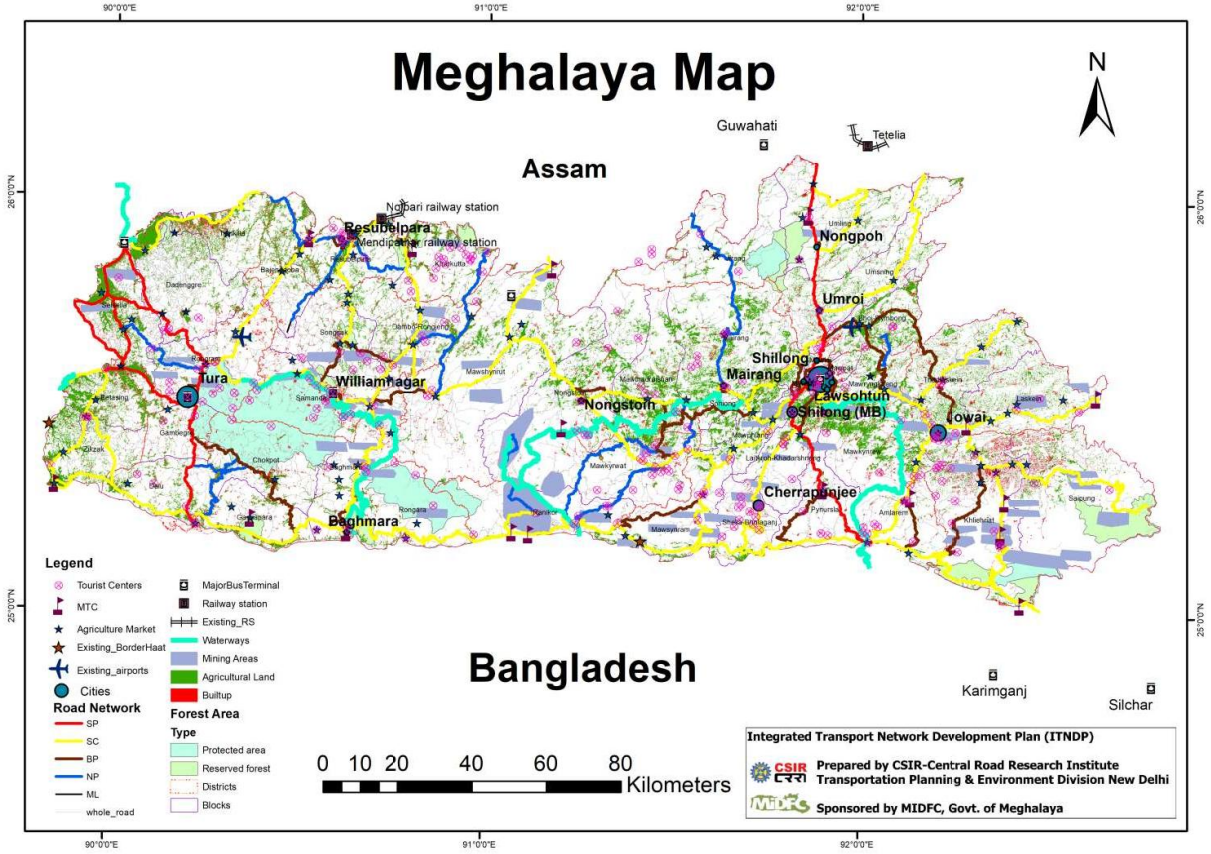
Integrated Transport Network DevelopmentPlan (ITNDP)

Sponsored
By
Meghalaya Infrastructure Development &Finance Corporation (MIDFC), Shillong



Phase1Report
Submitted

By
CSIR-Central Road Research Institute NewDelhi

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Team

Professor Ranjana Aggarwal
Director CRRI

Dr. Ravindra Kumar	**Transportation Planning Specialist cum Team Leader**	**Dr. Satish Chandra**	Highway /Transport Expert
Dr. E Madhu	Highway/Transportation Expert	**Shri Sakshi Gupta**	Database Expert
Dr K .Ravinder (HOD, TPE)	Transportation Expert	***Shri Sanjay Kumar***	Field Work staff
Shri S. S Geharwal	Structural/Bridge Expert	**Shri Dayaram**	Field Work Staff
Dr. Ch. Ravisekhar	Transportation and GIS Specialist	***Shri Abhi Mandal***	Database and Drawing
Dr. Nasim Akhtar	Transport Economist	**Smt. Sarita Sethi**	Admin Staff
Miss Preeti Sinha	Database Work Manager	**Smt. Shakuntala Devi**	Support Staff
Shri D Ravinder	Database Expert	***Shri Lalit Kad***	Project Associate level -1
Shri Neeraj Prajapati	Database Expert	***Shri Sanjay Mallya***	Project Associate level -1
Shri Keshav Kaushik	Database Expert	***Shri Manmeet Singh***	Project Associate level -1
Smt. Neha Choudhary	Database and Editorial		

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Contents

1 INTRODUCTION

1.1 Meghalaya Vision and Challenges of Integrated Transport network development Plan

Meghalaya state vision-2030 is to transform it into a high-income State and improve the well-being of every citizen of the State. Infrastructure expansion is one of the core pillars of the state Government's vision to achieve the well-being of every citizen. The infrastructure development is deficient due to heavy rainfall, severe climatic conditions, earthquakes, forest, floods on the western side of Meghalaya, State climatic vulnerable apart from the terrain. Road density in State is only 47.8km/ 100 square km against a national average of 170km/100 square km.

Maintenance and up-gradation cost is very high. There is a 27% gap in the roads' maintenance cost, causing roads in bad condition. Also, the construction cost of the state roads is 47% higher than the eastern State due to high carriageway charges of material. Many single-lane semi timber bridges are in poor condition, requiring up-gradation to double lane and permanent RCC Bridge. The State promotes the economy through human development, primary sector rejuvenation, infrastructure expansion, entrepreneurship promotion, environmental protection, and government reforms. Tourists, agriculture, horticulture, mining, industry, border hats, land customs stations, and international check posts need infrastructure and transport connectivity and efficiency support. Their integration of different modes of transport and roads plays an essential role for Meghalaya, combining to maximize ease and efficiency for the user in terms of time, cost, comfort, safety, accessibility, and convenience.

1.2 Objective and Scope of the Study

In this regard, MIDFC assigned the work to CSIR-CRRI on Integrated Transport network development Plan intending to develop an Integrated Transport Network Development Plan (ITNDP) for the entire State by identifying the transport network required to achieve the State's vision and the demands for sectors, including tourism, agriculture, industries, and mining as transport connectivity of all the habitations. The objectives are given below in Figure 1.1. The interrelation between activities of a task to achieve this activity is shown in Figure 1.2 as the flow diagram. Scope of the work covers Base Map Preparation, assessing transport demand, road inventory and condition survey, OD survey, checking the network's adequacy, preparing the network plan, and estimates and financial plan.

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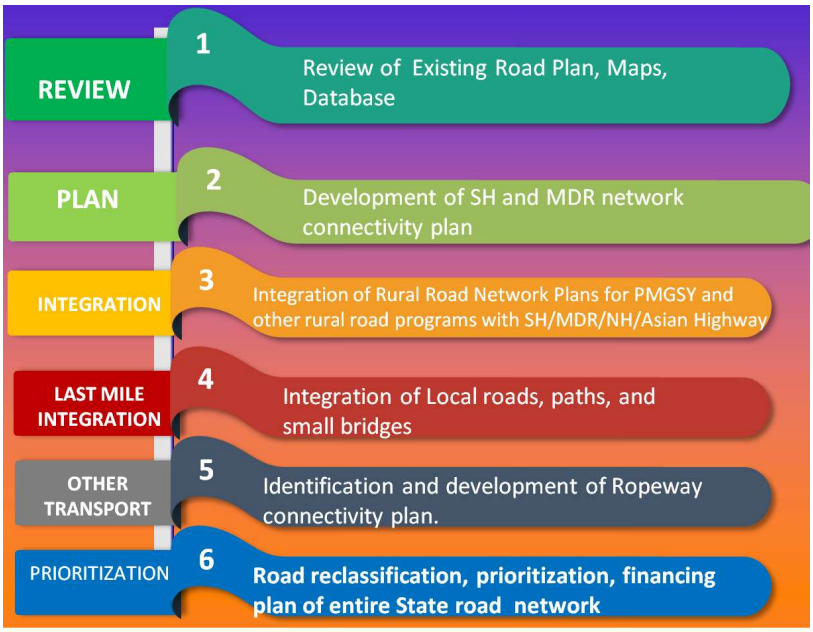

Figure 1-1Objective of the study

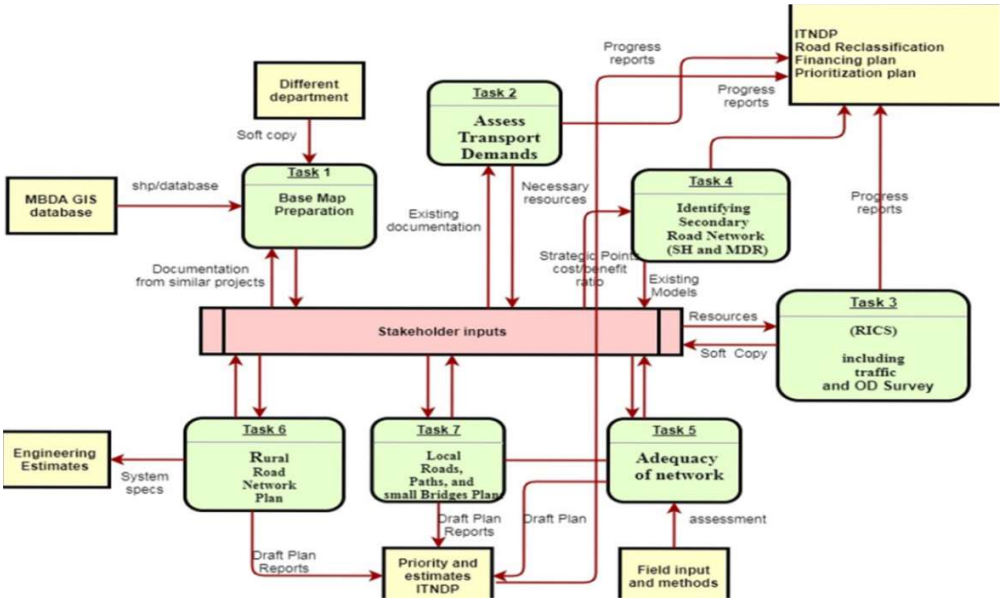

Figure 1-2Scope of the work and flow diagram of a methodology

1.3 Activity Chart and Deliverable

Work agreed under ITNDP, and their deliverable is shown below.

(a) Inception Report: to be submitted within thirty days after the date of commencing the services. The Inception Report shall specify the detailed methodology, staffing schedule and the inputs required from MIDFC to deliver the services. –D1 Submitted. The comment received from World Bank is dealt in Annexure 10.

(b) Quarterly project progress reports to be submitted by the seventh day of the month after quarter - D1 Submitted

(c) Primary report Master Plan for SH/MDR and their necessary GIS data in different layers and their map in A0 size to be submitted within six (6) months from the commencement of services.-Being Submitted D2

(d) Draft Report on Integrated Master Plan for Road and Transport System for SH/MDR/Rural roads /PMGSY including GIS data and map A0 size to be submitted within ten (14) months from the date of commencement of services –to be submitted-D3

(e) Final report on Integrated Master Plan for Road and Transport System SH/MDR/Rural roads /PMGSY/Village Roads/Other roads and necessary data GIS data and their map A0 size district wise map after two months from the receipt of comments on the draft report from the Client / Employer. – D4 and D5 to be submitted

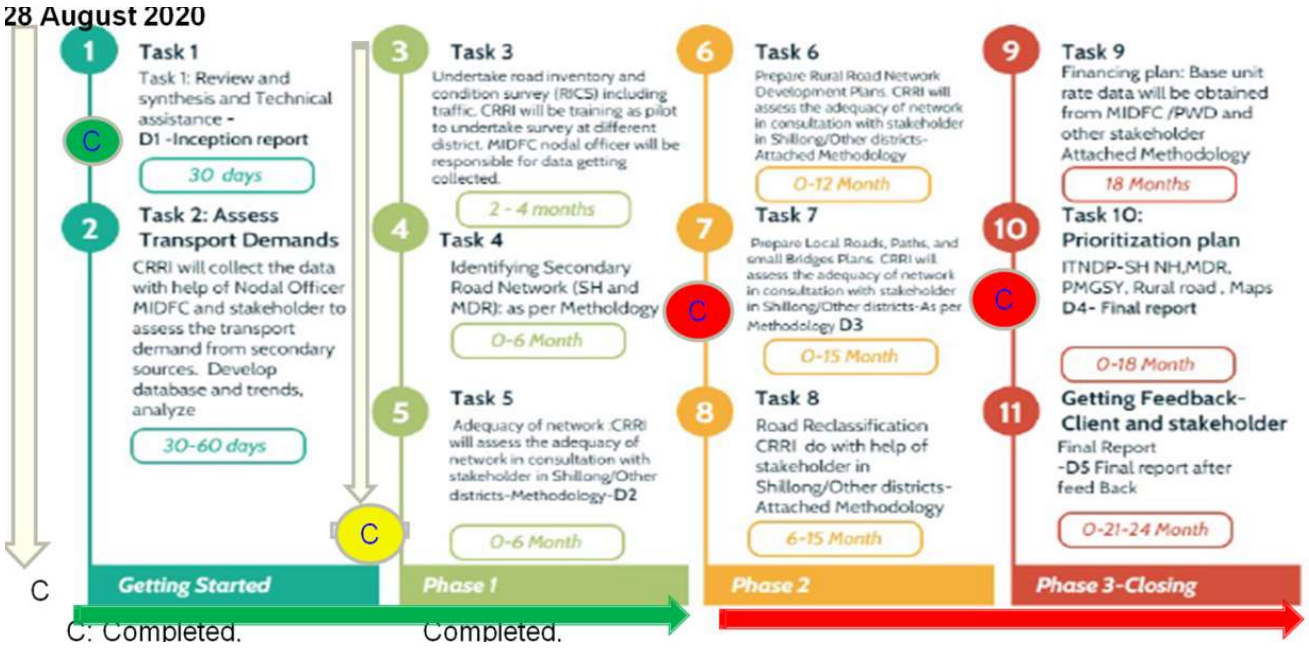

Figure 1-3**Task flow map**

2 DATA COLLECTION

2.1 Data Collection

2.1.1 Primary Source Data Collection

a) Stakeholder Workshop:

The stakeholder workshop was organized at Tura, Resubelpara, Williamnagar, Nongstion, and Shillong during the second week of January 2021. The stakeholder from Public Works Department, Tourist Department, Agriculture Department, Commerce & Industry, Community& Rural Development, Block development Officer attended the stakeholder meeting and submitted their view. Their problems related to road connectivity were discussed, and different solutions of a new link, up-gradation, and maintenance issues were proposed in the ITNDP network.

Figure 2. 1 Stakeholder workshop

b) Road Inventory and condition Survey(RICS):

ITNDP Workshop on RICS held on Mon Jun 14, 2021, 10:45 am - 5:45 pm was attended by 119 Engineers of different blocks of Meghalaya, which were imparted by six teams of CRRI. The meeting aims to discuss the issue raised in road inventory and the survey condition of 77 roads under phase-1.

The purpose of that meeting was to provide the RICS format and collect the data of the road inventory condition, general information about roads, and a discussion regarding the procedures from ITNDP Development, specifications, and estimates. All the information which the engineers provided is summarized in excel format.

The primary purpose of the RICS meeting is to identify the challenges faced by PWD to conduct RICS,, making them aware of new road nomenclature assigned by CSIR-CRRI, review the RICS format, note substandard design features of existing roads, and estimates of new roads in phase-1. The field engineer proposed the different work categories based on existing conditions and characteristics for mapping and estimates purposes. The summary of the road inventory and condition survey is shown below. (Refer Annexure 13 for Summary of all roads)

c) An Issue faced in Bridges

There are approximately 725 numbers of bridges. Their compositions of sizes are 2.76 % long, 18.48 % major, 78.35 % Minor, and 0.41 % Culvert(Please see Figure 2.2).

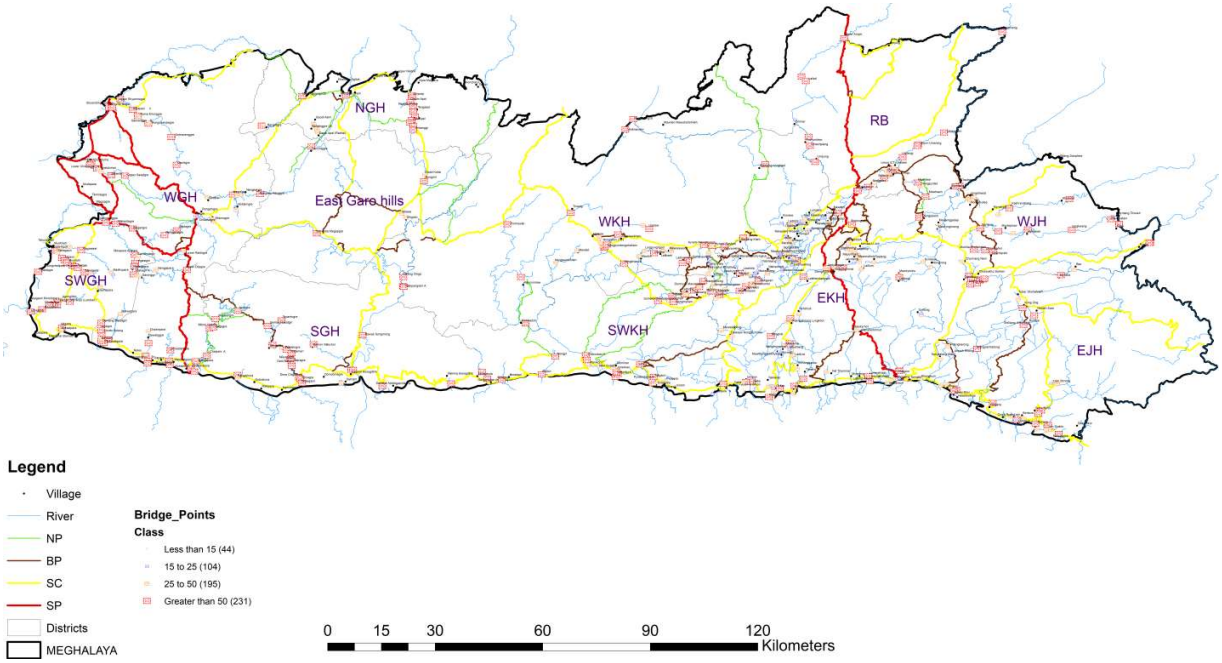

Figure 2. 2 **Existing Bridge map of Meghalaya**

There are several maintenance issues as follows.

- Corrosion of various structural elements
- Overloading of vehicles due to sand mining
- Damaged expansion joint at the junction
- Jam in expansion joints
- **Safety issue** and Signage
- **Replacement of timber** components of the bridge deck surface due to its higher maintenance cost.)
- **Missing linkage**

Source: Stakeholder discussion

d) Origin destination Survey

OD survey was carried out at 16 locations for commodity and passenger survey with 1941 sample, 12 places at Agriculture Market with 146 samples and 17 spots at Tourist site with 212 samples. Their location map is shown in Figure 2.3. A glimpse of the OD survey is shown in Figure 2.4, where there was full support of PWD, Meghalaya Police, and a team of CRRI coordinated this survey for above mention location in Meghalaya.

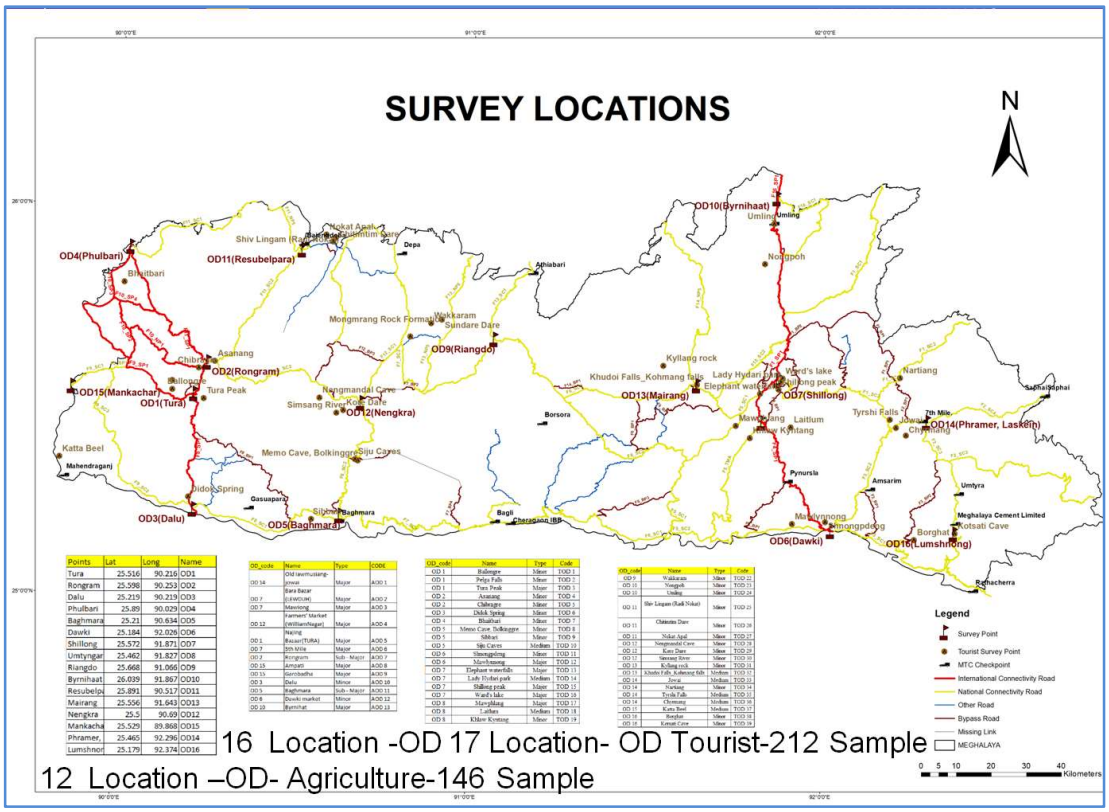

Figure 2. 3 **Location Maps of OD Survey**

Figure 2. 4 **Glimpses of OD survey**

Total O-D traffic Form-1 samples are 1941, out of which 1311 is considered, and the remaining 630 is discarded due to local trips (trip within the same zone) See Table 2.1. OD Matrix was created for 117 Zones, with 1311 trips. The study found that 17-20% of trips are external trips (incoming and outgoing Meghalaya).

Table 2. 1 Number of samples collected at different survey locations

OD Number	Location	No. Of sample
OD1	Dobasipara	99
OD2	Rongram	100
OD3	Dalu	50
OD4	Phulbari	102
OD5	Baghmara	99
OD6	Dawki	108
OD7	Umsning	167
OD8	Umtyngar	279
OD9	Riangdo	115
OD10	Byrnihaat	251
OD11	Resubelpara	107
OD12	Nengkra	100
OD13	Mairang	80
OD14	Laskein	110

OD15	Mankachar	72
OD16	Lumshnong	102
Total Sample		1941

After creating the matrix, we sorted out the most important roads based on a percentage of total samples. We have considered 12 origin points and 17 destination points, covering almost 65% of the whole samples (Please see Appendix). There are 41 roads identified from the OD survey in phase-1 out of a total of 77 roads that are considered in phase-1. The lists of roads shown in table 2.2 below are identified most important roads from trips points of view considered in Phase-1:

Table 2. 2 **List of Roads in Phase 1 identified through OD Survey contributing**

SP-1/F-1	SP-1/F-4	SP-1/F-8	SP-1/F-9	SP-1/F-10	SP-1/F-11	SP-1/F-16	SP-2/F-10	SP-3/F-10
SP-1/F-10	SC-1/F-1	SC-1/F-3	SC-1/F-5	SC-1/F-6	SC-1/F-7	SC-1/F-8	SC-1/F-9	SC-1/F-11
SC-1/F-12	SC-2/F-1	SC-2/F-3	SC-2/F-5	SC-2/F-6	SC-2/F-7	SC-2/F-8	SC-2/F-9	SC-2/F-11
SC-2/F-12	SC-2/F-15	SC-3/F-3	SC-3/F-6	SC-4/F-2	BP-1/F-1	BP-1/F-2	BP-1/F-4	BP-1/F-8
BP-1/F-14	BP-2/F-7	BP-2/F-8	BP-3/F-12	TMA/F-5				

2.1.2 TOPSIS Approach for Ranking of Roads

Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a Compensatory aggregation technique based (i) on the idea that an Ideal alternative must the smallest geometric distance to a positive ideal solution and (ii) the geometric farthest distance to a negative ideal solution. It means the benefit is maximized, and the cost is minimized (Hajduk, Sławomira. 2022).

(Hajduk, Sławomira. 2022. "Multi-Criteria Analysis in the Decision-Making Approach for the Linear Ordering of Urban Transport Based on TOPSIS Technique" Energies 15, no. 1: 274. https://doi.org/10.3390/en15010274)

Prioritization of IC, NC, Bypass, NP in Integrated Transport network Development Plan-ITNDP phase 1 has been carried out using TOPSIS Approach. In this method out by Expert Opinion Survey, the weightage of parameters was obtained from stakeholder meetings carried out in Meghalaya. Total 87 samples were collected in different districts and divisions. Weightage was assigned for the construction cost (Total Cost Connectivity, Economic Importance, Coverage, Missing Links (Missing links connectivity), Capacity Constraints, Time Saving, Condition of roads, Local Demand, Pre-Feasibility of width/Curve visual. (See Annexure 5)

In step 1, a normalized matrix is calculated using equation 1.

$$\overline{X}_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{n} X_{ij}^2}}$$ ----------Equation 2.1

Step2 Weighted normalized matrix is calculated using equation 2

$$V\_ij = \bar{X}\_ij \times W\_j$$ ----------Equation 2.2

Step-3 Calculate the ideal best and ideal worst value as Vj (Maximum) and Vj minimum for each parameter

Step-4 Calculate the Euclidean distance from the ideal best using Vj maximum

$$S_i^+ = \left[\sum_{j=1}^{m} \left(V_{ij} - V_j^+\right)^2\right]^{0.5}$$ ----------Equation 2.3

Step-5 Calculate the Euclidean distance from the ideal best using Vj minimum

$$S_i^- = \left[\sum_{j=1}^{m} \left(V_{ij} - V_j^-\right)^2\right]^{0.5}$$ ----------Equation 2.4

Step-6 Calculate Performance Score

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-}$$ ----------Equation 2.5

The performance score has been used as the ranking of Roads in ITNDP.

Cost, Capacity, Missing link data were available in the Road Inventory condition Survey. Time-saving, Coverage data were extracted using GIS Analysis. Perception of Stakeholders from PWD, tourist, agriculture and Industry, Community, and rural development in all 11 districts were obtained in a stakeholder workshop. The average weight obtained for different factors for the TOPSIS approach is shown in Figure 2.5.

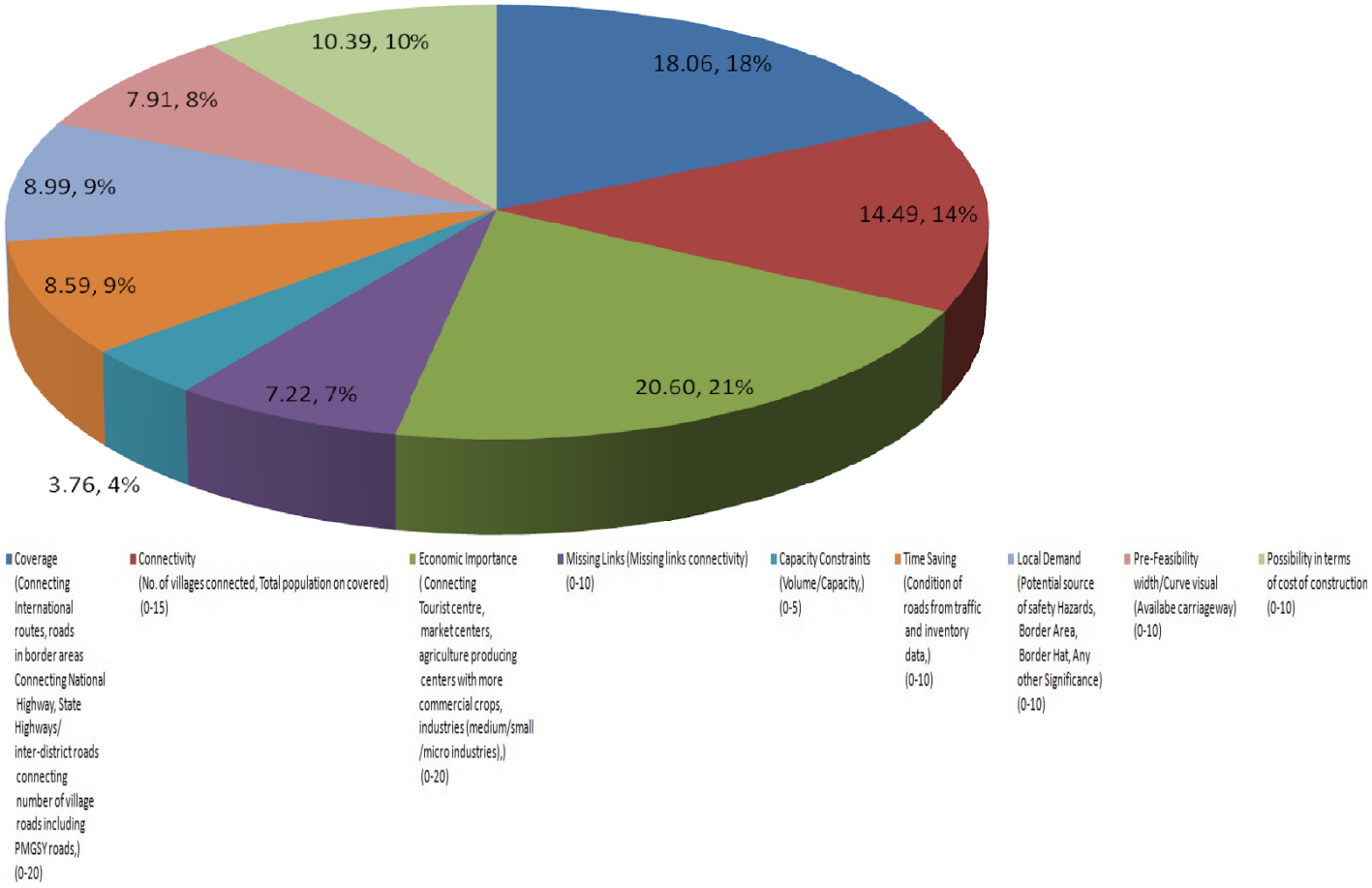

Figure 2. 5 **Overall Weightage for TOPSIS approach for ranking of roads.**

2.1.3 Classification of Road Network

IRC has classified roads in NH, SH, MDR, ODR, and VR. PMGSY is a centrally sponsored scheme. There are other criteria for Roads classification is as given below in Table 2.3

Table 2. 3 **other criteria for Roads classification**

Other criteria	Factors	Road Name	Road Name
Based on usage	Different seasons of Year	All-weather roads	Fair-weather roads
Based on the carriageway	type of the carriageway or the road pavement	Paved roads- Water bound macadam (WBM), Bituminous macadam (BM), concrete roads	Unpaved roads (Earthen)
Alignment	Gradients, Curves	Horizontal alignment	Vertical alignment

In this study, apart from the above criteria, the whole road network for phase 1 road has been classified based on functional and strategic, and traffic flow direction as given below.

- International Connectivity (IC)- Directly Connecting country (Bangladesh, Bhutan via Assam, Primary Strategic Importance (SP)
- National connectivity(NC): Connecting Assam and rest part of India, connecting to primary strategic importance, and acting as secondary support for strategic importance for National Connectivity
- Bypass Road (BP). Act as decongest city and increase the journey speed
- New Proposal (NP): Important MDR and important ODR are essential to improving network efficiency, saving journey time, and not falling in the above category.

2.1.4 Secondary Source Data Collection

A large number of GIS and attribute and their data has been collected from different State and central government departments to achieve the above objective. The following are the important data collected.

I. Transport infrastructure location, length, number
II. and their existing alignment including roads, bridges, tracks, and footpath and footbridges, Helipads airport, railways, waterways, including those providing international/regional
III. Cities/ towns, villages/ habitations,
IV. Markets including local markets and border haats,
V. Tourist centers,
VI. Industries including MSMEs (Warehouses with their functionality); LCS
VII. Mining areas, mineral transport checkpoints,
VIII. Agriculture areas, other centers of economic activities which require transport connectivity,
IX. Administrative boundaries International, State/District/Block and their Head Quarter
X. GDP, SGDP, Vehicles, population Agriculture yield, mining, and industry,
XI. Tourist circuits

Their map and summary of the existing features are shown in Figure below. The component in terms of length and number is detailed below.

The secondary data collection process for the following items is as follows

1) Road length and its type

Information on different types of roads like NH, SH, MDR, PMGSY, and other roads was obtained from the concerned department of Meghalaya. Data were in a tabular format having information of their name, start, via, endpoint, length, etc. The GIS database of the above roads was created from this ancillary data. This GIS database created was compared with the road map earlier prepared by MIDFC for their quality check.

2) Village-

Data on villages of Meghalaya was obtained from North Eastern Space Applications Centre (NESAC). Data was freely available in the Geospatial portal of NESAC – NeSDR. This data consists of 6169 villages with their population (According to the 2011 census).

3) Tourist –

About 250 tourist points were identified in the State of Meghalaya. They were classified into three classes based on their respective importance as Major, medium, and minor. This classification is based on primary sources (field visits) and secondary sources (tourist websites, officer's interviews, etc.). Among 250 sites, 15 sites are in the class of Major tourist spots, 33 in the medium category, and 202 areas are of minor importance. Further based on the kind, tourist places are classified as Adventure spots, cultural spots, Heritage bearing spots, ecological spots, Archaeological, Historical spots, viewpoints, etc.

4) Agriculture –

About 161 agricultural markets are identified in the State of Meghalaya. These markets are further classified based on the quantity (tonnage) of goods they handle into three categories as Major, Sub-major, and Minor. After the classification, it is found that about 11 markets fall under the primary category, seven under the sub-major category, and 143 under the minor category.

5) Mining and minerals-

Data on minerals were obtained from the department of mines and geology of the Meghalaya website in a map in pdf format. This map was georeferenced, and the locations of mining areas were extracted from the available ores/mines map.

6) Industry-

Data on the industrial area was extracted from the LULC map obtained from NESAC, which was freely available but required a certificate of safe custody. Data contained the location of 295 industrial sites in the form of polygons. These sites were further classified based on the area covered by them as Major (>100 hectares), moderate (>50 hectares and <100 hectares), and minor (<50 hectares). After this classification, only two sites belong to the primary category, six belong to the moderate category, and the rest belong to the minor category.

7) Bridge-

Bridges are digitized manually by observing high-resolution satellite images. About 574 bridges are identified in the State of Meghalaya. These bridges are further classified based on their length as culvert (less than 15m), Small Bridge (15-25m), medium bridge (25-50m), large bridge (greater than 50m). After classification, it is found that there are about 44 culverts, 104 minor bridges, 195 medium bridges, and about 231 large bridges.

3 TRANSPORT DEMAND ASSESSMENT

3.1 Method used for Travel Demand Assessment

3.1.1 Base Data Integration

Assessment of Travel demand relies heavily on travel survey data, land use and socioeconomic data, and transportation network data. These data are inventoried as part of the travel demand assessment. Travel Origin-Destination surveys provide the basis for relating individual travel behavior to zonal aggregations of socioeconomic and land use information to understand the generating trip activity at the zonal level. Surveys also provide observations of real travel choices made by individuals and individual drivers. Survey data and geo-coding methods show travel behavior information is spatially referenced. A GIS is beneficial in this check as trip patterns can be visualized by plotting lines between trip end locations, and inconsistent trip sequences can be readily identified. A combined map of different land use, agriculture, mining, tourist, transport network, and the facility is shown in Figure 3.1.

Figure 3.1 shows Shillong, Tura, Cherapunji, Baghmara, Wlliamnagar, Jowai, Khleriahat, Resubelpara, Nongstion, Mawsynram, Mawkyrwat, Mahendraganj, Kharkutta are the major Centre showing the various trip generation attraction opportunities like a tourist, agriculture, mining, border hats, transportation network, and infrastructure facilities. The essential details are given in the Table: trip attraction and distribution destination. The total area of Meghalaya is 22720 square km. Meghalaya has 21 critical towns, and ten cities are within the vicinity of Shillong city. This Centre creates a lot of trip attractions and production for different purposes. Apart from these cities, 6169 habitations require connection as last-mile connectivity.

3.1.2 Income Sources in Meghalaya:

Meghalaya income is dependent on Agriculture (12%), Forestry & Logging (5%), Fishing (1%), Mining & Quarrying (3%), Manufacturing (10%),Construction(9%), Electricity Gas & Water Supply(3%), Transport Storage & Communication(6%), Trade Hotel & Restaurant(22%), Banking and Insurance (3%), Real Estate Ownership of dwelling and Business Services(5%), Public Administration(13%), other services (10%). The primary sector comes from 38%, secondary and tertiary sector comes from 21% of total GDP Rs 3446818 Lakh as shown in Figure 3.1. Agriculture,

tourist, mining, manufacturing, and construction sectors share more extensive coverage of income in the state. It is important to provide adequate infrastructure growth keeping their issue to increase their efficiency. Overall growth in GDP is 13.84% on average.

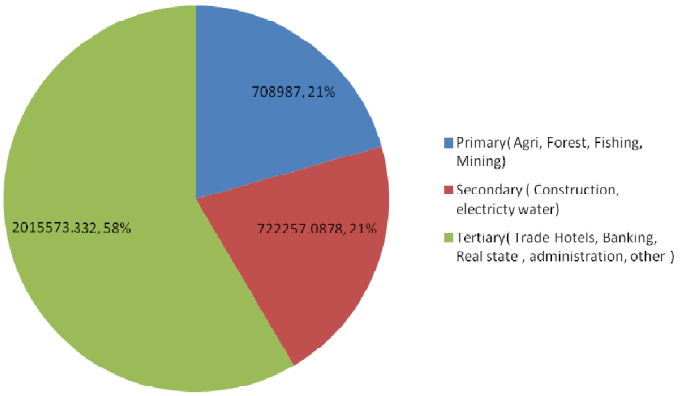

Figure 3. 1 Sectored share of GDP in the state.

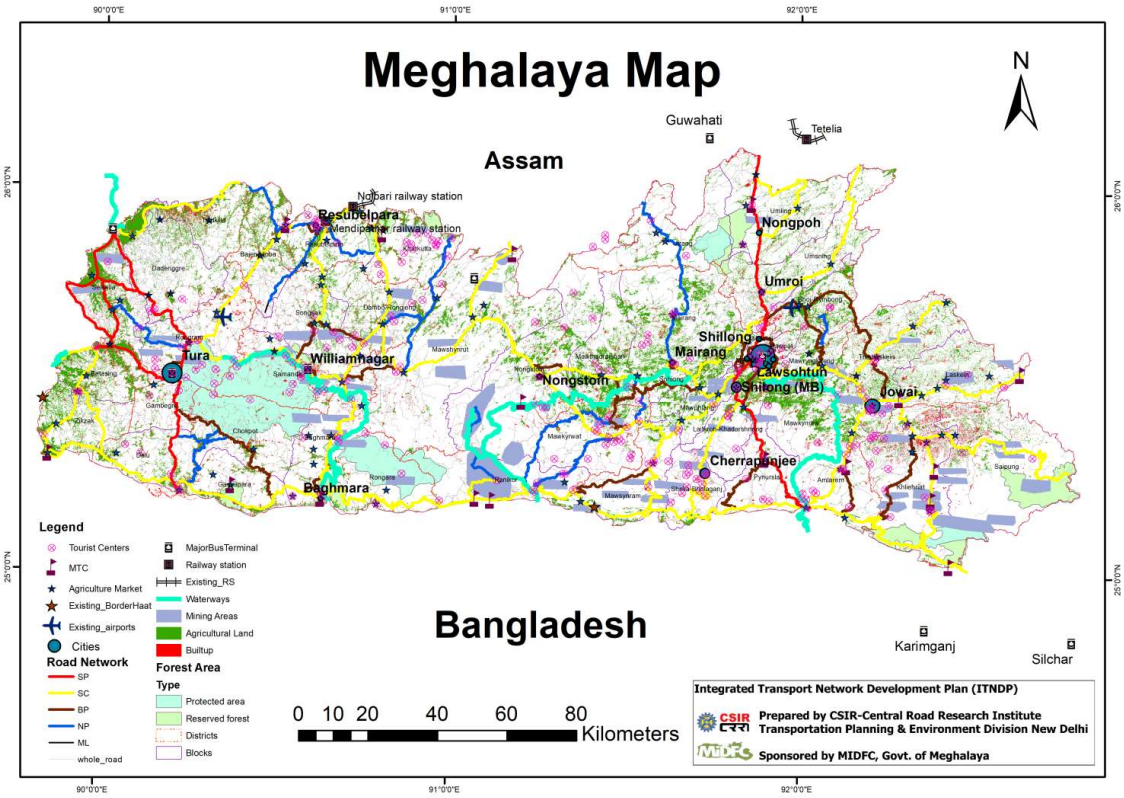

Figure 3. 2 **Combined Map of existing facilities**

The following are the existing features of Meghalaya obtained from GIS analysis.

Table 3. 1 Secondary Data Collection for ITNDP

<table>
<tr><td>Features</td><td>Value</td></tr>
<tr><td>The total length of roads</td><td>28391.7km</td></tr>
<tr><td>Length of Railway</td><td>600m</td></tr>
<tr><td>Number of existing bridges identified by CRRI</td><td>574</td></tr>
<tr><td>Helipad</td><td>2</td></tr>
<tr><td>Waterway</td><td>5 Rivers (Umngot, Simsang, Kynshi, Ganol Jinjiram)
7 Water terminals by IWAI,</td></tr>
<tr><td>Cities/ Towns</td><td>21</td></tr>
<tr><td>Villages/Habitation</td><td>6169</td></tr>
<tr><td>Tourist Centers</td><td>250</td></tr>
<tr><td>Industrial area</td><td>295 (4 Major, 6 Moderate, 285 Minor)</td></tr>
<tr><td>Land Custom Station</td><td>14</td></tr>
<tr><td>Mining Areas</td><td>65</td></tr>
<tr><td>MTC</td><td>17 existing</td></tr>
<tr><td>Agricultural Area</td><td>19091 (number), total area = 2097.225 km2</td></tr>
<tr><td>Agriculture Market</td><td>107</td></tr>
<tr><td>Horticulture market</td><td>36</td></tr>
<tr><td>Administrative boundaries</td><td>International – 1 (Bangladesh) State – 1(Assam) District – 11 Number of Blocks – Total 46 blocks (boundaries of 44 identified in GIS)</td></tr>
<tr><td>Forest area</td><td>Total forest area - 13137.12km^2
a)Dense -3943.5km^2
b) Open - 7310.2km^2
c) Scrub forest - 1871km^2
d) Forest plantation - 12.4km^2
Protected forest – 6 no, 1310.67km^2</td></tr>
<tr><td>Reserved forest</td><td>28 no, 794.74km^2</td></tr>
<tr><td>Built-up area:</td><td>1. Urban- 78 no, 419.3km^2
2. Rural – 21861 no, 813.57km^2</td></tr>
<tr><td>Topography:</td><td><table><tr><td>Area (km^2)</td><td>Category (meters)</td></tr><tr><td>6873.68</td><td>Below 300</td></tr><tr><td>4758.00</td><td>300-600</td></tr><tr><td>3694.26</td><td>600-900</td></tr><tr><td>3179.3</td><td>900-1200</td></tr><tr><td>2304.17</td><td>1200-1500</td></tr><tr><td>1581.73</td><td>1500-1800</td></tr><tr><td>138.892</td><td>Above 1800</td></tr></table></td></tr>
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3.1.3 Vehicle data projection

In the last ten years, the vehicle in the Meghalaya state has increased by 158000 to 365804, with an average rate of growth of 9.67% average rate of growth. The overall population of Meghalaya had grown at @6% per annum. As per provisional reports of Census India, the population of Meghalaya in 2011 was 29 66,889. As per the Census 2011, out of the total

population of Meghalaya, 20.07% of people lived in urban regions while 79.93% in rural areas. The urban population in the last ten years has increased by 20.07 percent. This means there is urban sprawl. There is an increase in state GDP @12.86% per annum on average Rapid growing population; GDP necessitates large investments in social infrastructure. A typical type of vehicle composition is shown in Figure 3.3 below.

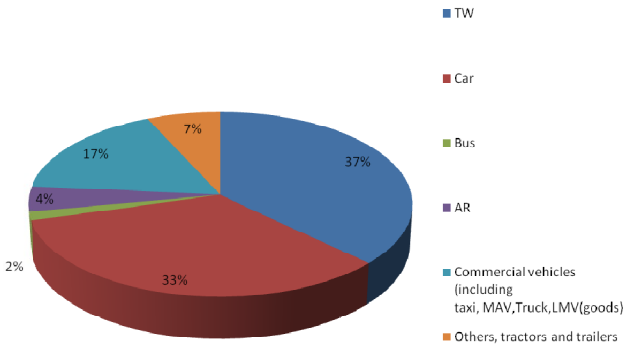


Figure 3. 3 **Traffic Composition in Meghalaya**

The growth of vehicles is projected for 2050 based on Econometric Approach. In the next 20 years, there will be 32.57 Lakh vehicles in Meghalaya. The elasticity factor is given below Table 3.2 Elasticity function table.

Table 3.2 **Elasticity function table**

Vehicle Type	Elasticity Function	R^2 Value	Constant
Car/jeep	ln Car = 1.1346 ln PCI - 1.2565	0.781	1.346
Bus	ln Bus = 0.5752 ln PCI +2.1299	0.7632	0.5752
Commercial	ln Truk = 0.6452 ln NSDP +1.379	0.859	0.6452
Trucks	ln Truk = 0.6452 ln GDP +1.379	0.859	0.6452
Two wheel	ln TW = 1.2997 ln PCI +3.1043	0.7871	1.2997
Others	ln others = 1.5526 ln PCI -7.6854	0.7158	1.5526

The rate of vehicle growth Two-Wheeled, Car, Bus, Auto Rickshaw (AR), Commercial vehicles (including taxi, MAV, Truck, LMV(goods), Others, tractors, and trailers found to be 5.7, 5.0, 2.9,4.5,3.8,6.6, 5.0 % per annum. The projected growth shown in Table 3.3 shows that vehicle growth will cross more than 1.21 Crore by 2026-2030. Such heavy change will require substantial support of road infrastructure that can facilitate the proper movement of traffic.

Table 3.3 **Projected Growth of vehicles registered in Meghalaya**

Veh. Type	**2021-2025**	**2026-2030**	**2031-2035**	**2036-2040**	**2041-2045**	**2045-2050**
TWO	266213	463966	781771	1276024	2021282	3112763
Car	244580	434307	744804	1236031	1988777	3108103
Bus	7994	10300	13063	16323	20113	24461
Comm. Veh	98090	144018	210672	307047	445888	632751

Others	54375	104867	194402	347189	598629	998516
Trucks	44008	53052	63311	74835	87659	101663
Total	7,15,259	1,21,0509	20,08024	32,57449	51,62349	79,78257
Vehicle /1000 population	193	242	287			

3.1.4 Growth rate of population:

The population projection has been made based on time series data. The projected population value shows that by the year 2021, the population of Meghalaya will be 37 Lakh, and in the next 2031, it will be 50 Lakh, and in 2041(26%), it would be 70 Lakh (28%). Overall, per year growth is 2.6%, and this will also require infrastructure support to sustain the growth further. Figure 3.4 shows the projected population in Meghalaya.

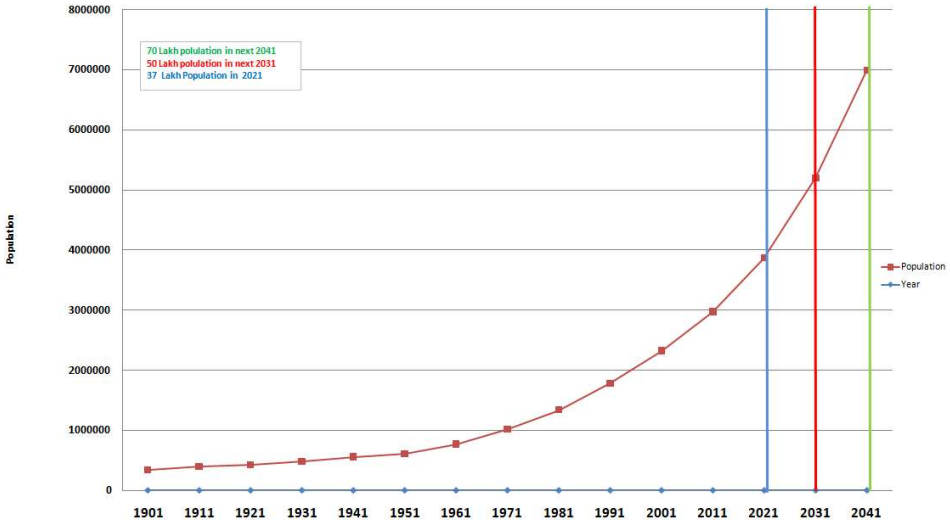


Figure 3. 4 **Growth rate of population in Meghalaya in next 10-20 years**
Source: https://censusofindia2021.com/meghalaya-population-2021-census-data/

3.1.5 Air Traffic Forecast

A relation between passenger and freight were developed with NSDP, as shown in Figure 3.5 and 3.6. The air traffic growth for passengers has been observed 6 to 6.48%, whereas the freight traffic rate ranges from 5.83 to 6%. Passenger traffic will increase by 1.6 times in 10 years. In 15 years, it would be 2.119 times, whereas in 20 years, 2.7 times of the current traffic (refer to Table 3.4 below). The current passenger air traffic load may require another 2 to three airports in 20 years.

Similarly, freight traffic (Ton) will increase by 1.72 times in 10 years. In 15 years, it would be 2.2 times, whereas in 20 years, 3.14 times the current traffic. The current passenger freight load will require 2-3 new freight terminals and a Cargo terminal Airport in 20 years. As there is none so requires keeping in the view. Currently, there is only two airport terminal, and only one is functional at Shillong.

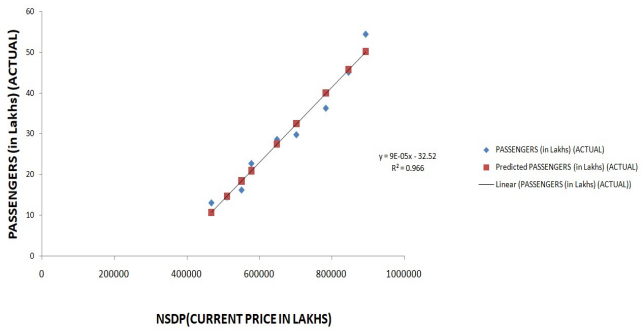


Figure 3. 5 **Relation of air passenger with NSDP (at Current Prices)**

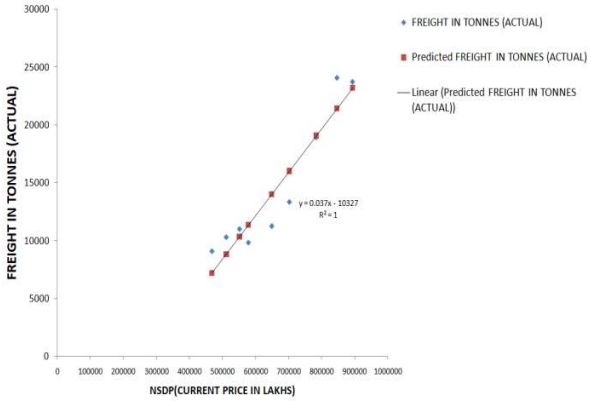


Figure 3. 6 **Relation of Air Freight with NSDP(at Current Prices)**

Table 3.4 Air Traffic Forecast using NSDP demand in Meghalaya & NER

Average growth Demand in future	% Growth No. Of AirCraft	% Growth Passenger (in Lakh)	% Growth Freight in Tons (for NE)
10 Years (2021-2030)	5.5% (1448 -2360)	6.48%(1.17- 2.02)	6.08%(39226.79-70391.03)
15 Years (2021-2035)	5.5%(1448-3069)	6.29%(1.17- 2.48)	5.95%(87786)
20 Years (2021-2040)	5.4%(1448-3973)	6.12%(1.17-3.21)	5.83%(114893)

3.1.6 Issue of Helipad/port in Meghalaya

India has fewer than 300 helicopters than Brazil's Sao Paulo, around 600, around 1,250 choppers, Australia (nearly 2,000), and the US (over 14,000). The Helicopter in India is underused in tourism, mining, corporate travel, and medical services. As per DGCA, Helicopters are being treated as fixed-wing planes. There is not enough flexibility in the rules. The government of India is not permitting too many places for helicopters to land outside airfields or airports. The government is adopting a futuristic approach to connecting important tourist destinations in the country through helicopter services in a planned manner. Helicopters are being operated from airports — which means there are

landing fees, navigation charges, and more. Due to this, the cost of operation hikes up. We need heliports that charge less than airports so more people can afford to use the services besides the 33 helicopter routes and five helipads that have been awarded under the flagship regional connectivity scheme — known as UDAN, which will expedite helicopter operations.

Moreover, 63 percent of India's helicopter fleet have a twin-engine and are primarily used for offshore operations, VVIP operations, election, and corporate flying. Around 37 percent are single-engine helicopters meant for religious tourism flights, hill flying, private flying, and sightseeing. However, Helicopters for medical purposes don't feature here.

Existing Policy Review

- Flexible mobility of transportation
- Allow for greater airspace access up to 500 ft incites
- Development of heliports all over major metropolitan cities.
- Set up unified rules for rooftop helipads and mandatory helicopter access with all hospitals.
- Ensure adequate infrastructure, amenities, and facilities at the heliports as well as plan accessibility through it.

There is the following issue in Meghalaya

- Issue of administrative control and irregularity in services at Shillong and Tura
- There is need of Helicopter as Emergency Medical -Result of roadblocks, narrow roads, hill roads
- Contribution to community and economic development.
- Realigning helicopter as an essential transportation service,

(https://theprint.in/economy/with-less-than-300-choppers-indias-helicopter-market-dwindles-industry-wants-better-rules/629474/)

Point considered for Helipad Selection:

The helicopter landing area or helipad ought to be adequately clear of any obstructions the helicopter may encounter while hovering or sitting over the helipad and along its approach and takeoff flight trajectory. Wrong selection of the location of the helipad that did not consider the likely proximity to power lines, trees, buildings, or towers has resulted in accidents due to collision with unseen or unaccounted obstruction.

As a rule of thumb, a helipad size of 35m x 35m is adequate for all small and medium-sized helicopters. Generally, a clear obstacle-free area is contained outside a slope of 4.6 deg from the helipad center to 800 ft distance would be a safe approach area. These criteria should be further executed in the field while detailed planning. A checklist for assessing the helipad clearances and obstacle clearance margins should be followed as per Heli Disha, Administrative Guidance Material For Civil Helicopter Operations, or another guideline per civil aviation.. https://www.civilaviation.gov.in/sites/default/files/GM-CIVIL-HELICOPTER-E-Book.pdf.

3.1.7 Review of Agriculture Production

The economy of Meghalaya is rural as it is rural-based, with Agriculture playing a predominant role in the state's economy. Since 81% of the state's population depends on Agriculture, employment and income generation also depend on Agricultural developmental activities to a great extent. Even after attaining full statehood more than twenty-five years ago, the state has yet to touch the National Level in economic and agricultural growth rate. Despite the numerous constraints and limiting factors, the condition is slowly and steadily progressing.

Though 81% of the population depends on agriculture, the net cropped area is only about 9.87% of the state's total geographical area. The state is a deficit in food grains by 1.22 lakh tonnes annually to feed a population of 2.3 million. This is due to many constraints, such as the undulating topography, transport, and communication problem, population dispersal pattern, inadequate credit support, poor marketing system, etc. To overcome these hurdles, future programs are proposed, like increasing agricultural/horticultural production and productivity, research system on the development of economically viable and location-specific technologies in rainfed, flood-prone irrigated areas, and increasing the utilization of irrigation potential, etc.

Data trends in the agriculture sector.
The average unit yield in kg /hectare /per crop increased from 4559.533 to 4687 kg/hectare /per crop. This increase is 2.8 percent per annum for Kharif, whereas Rabi has a 5.12 % increase in yield. Given the got support to the agriculture sector and increased fertilizer use, Meghalaya will increase its yield in the future. Commercial crops have a more significant potential to contribute increase their income level. GDP in the agriculture sector has grown @8.82% in the last ten years.

Data has been collected to make the projection of agriculture yield(AY) based on the last ten years' data. Table 3.5 below shows AY is increasing whereas percentage change is decreasing.

Table 3.5Agriculture Yield and their projection

Sr.No	Year	Area (Hectare)	Production (Metric Ton)	Hectare/Ton	AY(Kg/hectare)	% Change
1	2011-12	132518	255924	1.93124	1931.24	18.61
2	2012-13	138913	318202	2.290657	2290.66	4.82
3	2013-14	139322	334510	2.400985	2400.98	5.37
4	2014-15	139733	353502	2.529839	2529.84	0.99
5	2015-2016	139992	357670	2.554932	2554.93	7.16
6	2016-2017	185902	508993	2.737964	2737.96	-0.01
7	2017-2018	185975	509139	2.737674	2737.67	1.24
8	2019	188196	521614	2.771646	2771.65	2.00
9	2020	197304	557806	2.827139	2827.14	1.79
10	2021	**206412**	**593999**	2.877735	2877.73	1.61
11	2022	215520	630192	2.924054	2924.05	1.46
12	2023	224628	666384	2.966617	2966.62	1.32
13	2024	233735	702577	3.005864	3005.86	1.21
14	2025	242843	738769	3.042166	3042.17	1.11
15	2026	251951	774962	3.075844	3075.84	1.02
16	2027	261059	811154	3.107171	3107.17	0.94
17	2028	270167	847347	3.136387	3136.39	0.87
18	2029	279274	883540	3.163697	3163.70	0.81
19	2030	**288382**	**919732**	3.189282	3189.28	0.75
20	2031	297490	955925	3.2133	3213.30	
					Average	**2.79**

In 1991, with the assistance of the Centre for Agricultural Marketing, the Government of India prepared a master plan for the development of marketing infrastructures in Meghalaya. Accordingly, the Agriculture department proposed to set up secondary markets in each District in the state, called Wholesale Regulated Markets. Thus, the land was made available at Mawiong in the East Khasi-Hills District, Garobadha in the West Garo Hills District, and Williamnagar in the East Garo Hills District.

The Meghalaya State Agricultural Produce And Livestock Marketing (Promotion And Facilitation) Act, 2o2o was passed to provide for geographically restriction-free trade transaction of agricultural produce including livestock across the state and country to give freedom to the agriculturists to sell their produce across time and space; to enhance transparency in trade operations and price settlement mechanism through the adoption of electronic and another innovative form of technology; to promote the emergence of multiple channels for competitive marketing, agro-processing, and agricultural export; to encourage investments in the development of markets and marketing

infrastructure in the state of Meghalaya; and whereas it is expedient to put in place facilitative regulation, professional management, and conducive policy framework thereof and purposes connected in addition to that and to lay down procedures and systems to it. The establishment of Markets is one of the important steps towards this act. These markets need exceptional vision in the integration of transport network development plans.

The agriculture Mandi is a significant economic center where these crops are traded. The following is the list of agriculture Mandi identified as more prominent, smaller, and medium Mandi.

Table 3.6List of Agriculture Market Centers in Meghalaya

Sr. No	Name	Type	Name	Name	Name	Name	Name	Type
1	Jowai	Major	Sutnga	Jirang Block Office	Shallang	ThÄpa Darenchi	Damalgiri	Minor
2	Mylliem	Major	Sookilo Market	Mawhati	Rongjeng	Mendipathar	Rajabala	Minor
3	Lewduh	Major	Lad Rymbai	Umroi	Mangsang Bamil	Damas	Chibinang	Minor
4	Tura	Major	Rymbai	Smit	Rongmil Market	Bajengdoba	Raksamgre	Minor
5	Mawiong	Major	Wapung Skur	Laitlyngkot	Nogolpara	Dingok	Resubelpara	Minor
6	Williamnagar	Major	Shangpung	Pynursla	WÄgeÄsi	Dagal Apal	Dekachang	Minor
7	Garobadha	Major	Raliang	Mawngap	Gairong Apal	Gokolgre Playground	Jonglapara	Minor
8	Ampati	Major	Laskein	Sohiong	Dobu Rongmu	Jengjal	Phodkroh	Minor
9	Byrnihat	Major	Iooksi	Umden	Nengkhra	Rongsak Bazar	Balat	Minor
10	samanda	Major	Jarain	20th Mile	Jadigittim	Chokpot		Minor
11	Nongpoh	Major	Amlarem	Mairang	Siju	Gasuapara		Minor
12	Nongstoin Horti Hub	Major	Lumsnang	Tyrsad	Nengkong Mandagiri	Dimapara		Minor
				Kynshi	Balkalasim	Dalu		Minor
19	Khliehriat	Medium	Dawki Market	Markasa	Mahadeo	Emangiri		Minor
20	Baghmara	Medium	MuktÄpur	Nongkhlaw	Rongra	Purakhasia		Minor

21	Dadenggiri	Medium	Nartiang	Jirang	Sibbari	Mahendraganj		Minor
22	Rongram	Medium	Namdong	Patharkhmah	Rongap Songgital	Kalaipara		Minor
23	Tikrikilla	Medium	Khainduli	Mawshynrut	Rongsak	Betasing		Minor
24	Wahiajer	Medium	Mawryngkneg	Raingdo	Nangapa	Mandagre		Minor
25	Rom Bazar	Medium	Bhoirymbong	Mawsynram	Dagal	Selsella		Minor

Department of Agriculture has identified 12 Major, 7 Sub Major, and 69 minor Mandi.

3.1.8 Demand Assessment for Minerals and Mining

India is the fourth-largest coal producer in the world, and India will invest around Rs 20,000 crore in four major projects for conversion of 100 million tons (MT) of coal into a gas by the end of this decade. Demand for coal in India is projected to increase dramatically in short to medium term, resulting in increased coal mining in different parts of India, including the northeast region. In 2021, the Government of Meghalaya announced that the Supreme Court of India passed an order to lift the ban following the finalization of standard operating protocols that permitted only scientific and legal coal mining activities.

Overall demand for coal reduced during 2014-2015 to 2020. After lifting the ban again, there is likely to increase the demand for coal and its production. The projected value is shown in Figure 3.7. Another Lime Stone has a continuous increase in demand of 8.98% per annum. These minerals require a proper infrastructure for supply and connectivity to significant import centers (Bangladesh, Assam). Due to the mining and quarry sector, GDP has increased 19% per annum.

Time series data on coal and limestone has been collected. Their projection has been made till 2030. Figure 3.7 shows that the demand for limestone will grow from 7.6 Million Ton to 14.5 Million Ton by 2030.

Similarly, coal demand will also grow from 0.06 Million Ton to 5 Million Ton. The demand will be almost more than five times in next 2030. Overall load of only these minerals will be three times more in next ten years ahead such demand warrant requisite transport such freight carrier, mineral transportation checkpoint (MTC) and road infrastructure to deal with.

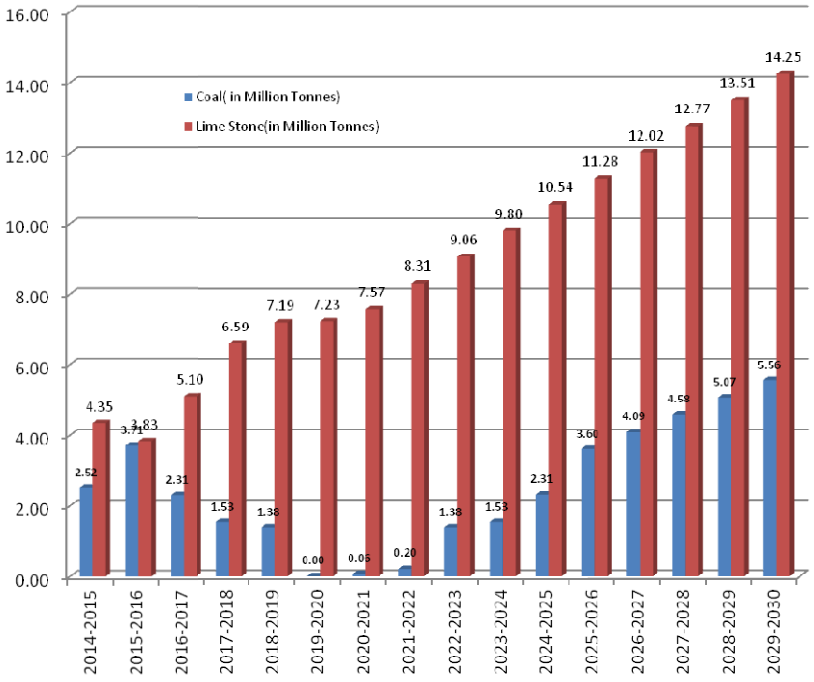


Figure 3. 7 **Demand for coal and limestone in next 2030**

3.1.9 Demand assessment of manufacturing, Industry, and Border Haats

Though it is one of the young and small states in the country, Meghalaya has a long international boundary of 443 km with Bangladesh, which sets a unique advantage of setting up industries based on demand in the country. All units will have an edge on account of the low cost of product transportation.

To prevent the problem of prospective entrepreneurs in acquiring sites for Industrial estates and Areas, many more to come up soon have been created. The government of Meghalaya has identified Industrial states Shillong (10.22 Acres), Tura (19.83 Acres), Jowai (14.56Acres), Williamnagar(15.30 Acres), MendiPathar (7.00 Acres) and growth center (36.00 Acres), Nongstoin(10.00 Acres), Byrnihat (259.00 Acres, 51.00 Acres Extended Area (Export Promotion Industrial Park-EPIP), Umiam 109.67 Acres. Different types of industrial units are located. However, road freight connectivity remains the challenge. Apart from these, several micros and small-scale industries are available that also need infrastructure support. Manufacturing transport storage communications share 16.5% GDP, so it needs proper transport infrastructure support to further sustain in the future. Figure 3.8 shows that there will be continued growth based on time series data analysis in this sector.

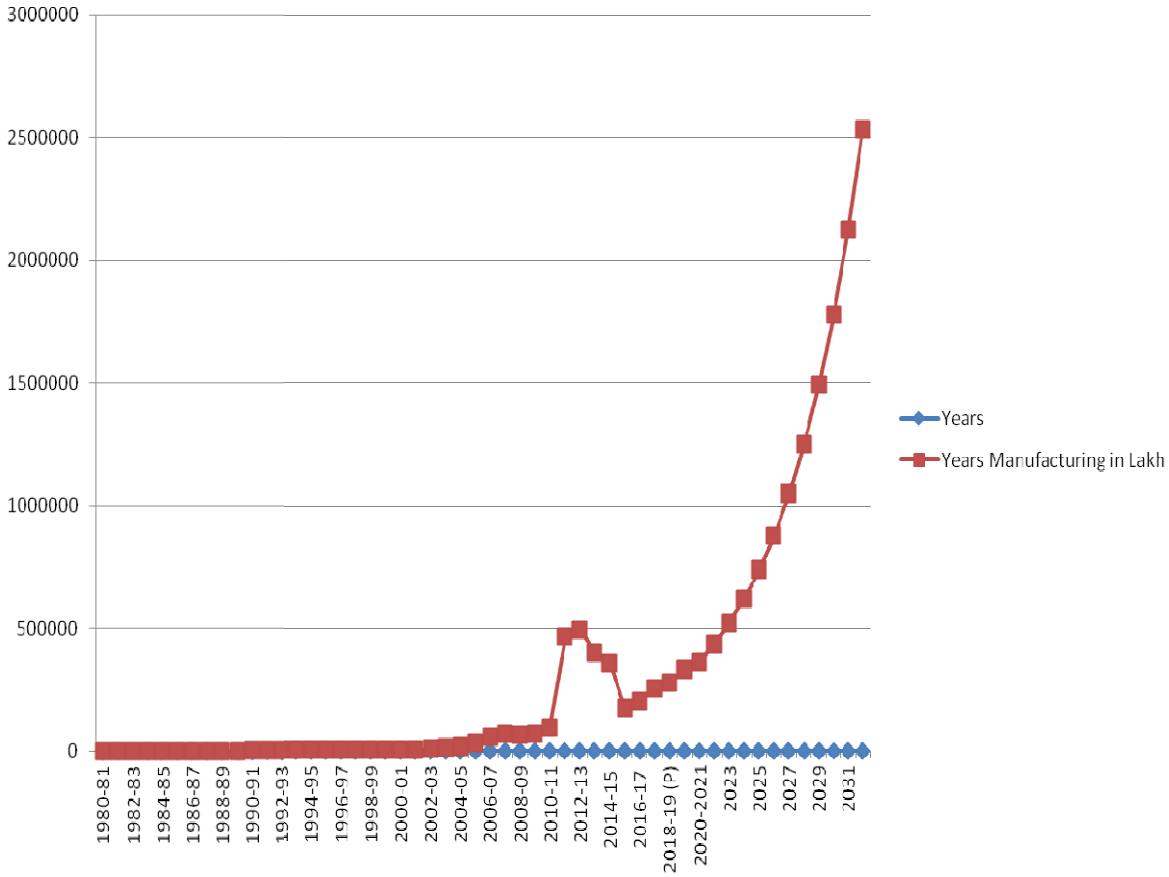


Figure 3. 8**Growth of GDP due to Manufacturing Sector**

Besides the Land Customs Station and improving the livelihood of the people living in the areas bordering Bangladesh, the Government of India and the People's Republic of Bangladesh has signed the Memorandum of Understanding (MOU) to set up the operationalization of Border Haats in Meghalaya.

There are two functional Border Haats

- Kalaichar, West Garo Hills District, Meghalaya, India-Baliamari, Kurigram District, Bangladesh
- Balat, East Khasi Hills District, Meghalaya, India-Lauwaghar,Dalora,Sunamgang District, Bangladesh

These border haats are functional, and a few more border haat has been proposed for the future by the Department of Commerce and Industry. The maps show the existing, under construction, and proposed border huts.(See Annexure 4)

3.1.10 Demand Assessment in terms of International connectivity (IC):

The Dhubri - Phulbari Bridge is an under-construction bridge over the Brahmaputra River between Assam and Meghalaya in North-East India. The Dhubri - Phulbari Bridge, to be completed by 2026–27, would be India's longest bridge over water and would span more than 19 km. Close to the Bangladesh border, this proposed bridge will connect Assam's Dhubri with Meghalaya's Phulbari, a missing link of National Highway 127B. Civil works started in 2019–2020. Japan International Cooperation Agency is funding this, and NHIDCL is executing it. This is one of 6 proposed bridges on the Brahmaputra.

The proposed bridge will be located on NH-127B, originating from Srirampur on NH-27 (East-West Corridor), and terminating at Nongstoin on NH-106 in the State of Meghalaya. It will connect Dhubri in Assam to South Salmara, Mankachar, Phulbari, Tura, Rongram and Rongjeng in Meghalaya. Larsen and Toubro (L&T) have bagged the contract to construct this India's longest river bridge across the river Brahmaputra. It will feature a navigation bridge of 12.625 km approach viaducts of 3.5 km on the Dubri side and 2.2 km on the Phulbari side, connected with approach roads and interchanges on both sides. The bridge, to be built with a total cost of approx Rs 4,997 crore, will meet the long-standing demand of the people from Assam and Meghalaya who were depending on ferry services to travel between the two banks of the river. It will reduce the distance of 205 Km to be crossed by the road to 19 Km, which is the bridge's total length. Connectivity in the country's Northeastern region is set to boost with more bridges connecting one state to another, primarily Assam and Meghalaya. In probably the next 5years, Dhola-Sadiya Bridge will lose its 'title' to Dhubri-Phulbari Bridge. The investment made by Govt of India on the longest bridge from Phulbari and Dhubari should be appropriately utilized for opening the Meghalaya from west to east using its central corridor via Williamnagar and developing roads at the Bangladesh border as part of National connectivity. The following are the significant demand for international connection and strategic connection.

- Dhaka to Bhutan: The constructed bridge will save journey time from Bangladesh to Bhutan. Dhaka to Bhutan Via Tura Phulbari: 717 Km keeping 84 km (via Rangpur) and journey time saving is 3 Hours

- Shillong to Dhaka: 378 Km (10 Hours) is currently an Asian highway that can further be strengthened via Dawki

- Possibility to Connect Shillong to Chattogram Port via Sabroom Maitree Bridge 667 Km (Via Sylhet 515 km).

Alternate Chicken neck: The Siliguri corridor, known as India's 'chicken neck,' became a crucial passageway after the India-China Doklam crisis in 2017. Located in West Bengal, the gallery is 60 km long and 20 km wide and connects the North-East with the rest of India. It is an important trade route and an essential gateway to Southeast Asia. In case of emergency, the following are the option for connection to India by road.

- Phulbari (Meghalaya) to Hili(West Bengal): Currently, it takes 14 hours for 516 km using Chicken neck. Time-saving will be 7 hours via Phulbari if the strategic corridor is used via Bangladesh. The total length will be 245 km, only travel 6.65 hours.

- Mahendraganj (Meghalaya) to Hili(West Bengal): Currently, it takes 16.5 hours for 609 km using Chicken neck. Time-saving will be 14 hours via Mahendraganj if the strategic corridor is used via Bangladesh by constructing a bridge on Brahmputra. The total length will be 98 km, only travel 2.65 hours.

3.1.11 Demand Assessment in terms of National connectivity (NC):

Assam and Bangladesh surround Meghalaya. Guwahati, Silchar, Boko, Dudhnoi, Golpara, Lakipur, Mankachar, Dhubari, Kokrajhar, Badarpur, Imphal, Aizwal, Jalpaiguri are the central surrounding that uses Meghalaya connection. As per the OD survey, it is identified that 17-20% of trips are from outside the Meghalaya. These are important for strengthening the national connectivity of Meghalaya with the rest part of India. Tura, William Nagar, Nongstion, Mairang, Shillong, Guhawati –Shillong-Dwaki, Lumsnang, Ratachera are the important external trip trips. Also, the corridor from north to the south connects entry from Assam to Meghalaya at Phulbari, Paikan, Dudhnoi, Dainadubbi Market, Hashim, entry from entry Belguri-Nongrim Jiang, Byrnihat, Umsiang, exit from Khanduli, Kupili, Ratachera are important for national connectivity. Since the road density is still less in Meghalaya than the National average, so existing road length for national connectivity should be further identified along the different alternative corridors.

The alternate national passage is extending the connection of west to east via Mahendrgunj, Dalu, Kapsipara, Baghmara, Rongra Bazar, Nekora, Bagli, Ranikor, Rajapar Dangar, Santolina, Ryngku, Shella Post office, Bholagunj Bazar, missing connection between Umniuh hat to Thymmai Hat Bisnakandi ranei Waterfall, Nongeitniang Tripoint, Dawki, Muktapur, Amtra, Hungaria, Huroi, Lejari, Sonapur-Umkiang, and Ratacherla. This corridor is also important from a strategic point of view and alternate connection from the western part of India to Silchar Assam Badarpur side once the bridge at Phulbari is constructed.

3.1.12 Demand in terms of Bypass of the city

As the cities register more significant growth for population and vehicle ownership, their sprawl and congestion increase day by day. Most of the towns in Meghalaya has narrow lane due to hill. It is essential to identify the critical alternative routes to avoid the journey via towns. It was determined that this Bypass could reduce the travel time and increase the efficiency of the national connectivity of Meghalaya.

3.1.13 Demand assessment in terms of its conditioof n of roads

About 21% of roads were in a good category, 43% were in an appropriate category, and 36% were poor. It was assessed that IC category roads require only widening (83%) and periodic maintenance (17%). While NC road requires Earth to BT (2.9%), widening (68.1%), WBM to BT (3.8%), BT Renewal (9.0%), Periodic maintenance (16.2%),whereas Bypass road requires Earth to BT (17.5%), widening (26.86%), WBM to BT (13.0), BT Renewal (17.7%), Periodic maintenance (24.91%). Few new proposal requires Earth to BT (25.5%), widening (39.0%), WBM to BT (5.5%), BT Renewal (6.81%), Periodic maintenance (8.8%) and New construction (14.4%) please see Figure 3.9 below. Their condition is detailed in Table 3.7 below.

Table 3.7Road Type(Surface Type) and their road conditions

Road Type	Good	Fair	Poor	Earthen-Kutcha(Km)	Gravel(Km)	BT(km)
IC	2	8	2	5	0	385.63
NC	10	21	15	70.5	56.5	1890.925
BP	8	7	12	62.88	28.57	540.56

NP	1	7	9	104.76	14	184.66
Total	21	43	38	243.14	99.07	3001.775

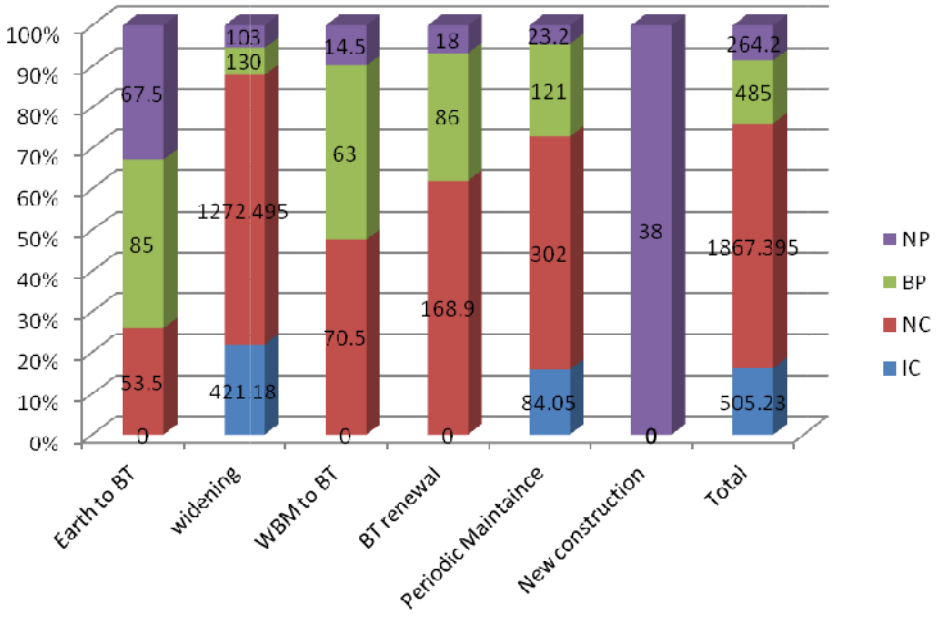


Figure 3. 9**Category of Work in ITNDP**

3.1.14 Tourist Demand Estimation

Moreover, compared to Assam, the leading recipient of tourists in North-East India, Meghalaya has been an add-on destination to Assam for the last one or two decades and till today. A statistical report on tourist arrival in North East showed that in 1996, Assam received 3,27,260 domestic tourists and 5885 foreign tourists while Meghalaya received a mere 1,36,183 domestic tourists and 1573 foreign tourists. In 2000, 10 01,577 domestic and 5,959 foreign tourists visited Assam, while Meghalaya received only 1 69,929 domestic and 2,327 foreign tourists. In 2007, there were 34, 79,870 domestic and 13,657 foreign visitors in Assam, while only 3, 75,911 domestic and 5,099 foreign visitors in Meghalaya. However, Meghalaya still stands second to Assam in tourist arrival compared to other North-East states. The state also witnessed a steady increase in domestic and foreign tourist arrival from 2011 onwards. Meghalaya has typically classified tourism into adventured tourism, cultural tourism, agri-tourism, and educational tourism (Peinlang BL, 2019)). The development needs infrastructure, heritage safety, passenger management, site maintenance, management, and

community participation plan before developing a place for tourist attraction is a prime necessity to achieve the objective of sustainability.

The tourist demand has been estimated based on the Time-series data analysis technique, and the model is shown below by equation 3.1

No of Tourist = $13.114x^3 - 356.9x^2 + 2916.5x - 2091.9$ ----------**Equation 3.1**
$R^2 = 0.9452$

The current demand of 11 46,461 tourist inflows will increase by 70% by 2030 and will require massive infrastructure connectivity and support infrastructure like hotels, motels, restaurants to manage the growth rate.

Table 3.8Tourist Demand Forecast of Meghalaya

Serial Number	Year	Domestic	Foreign	Total	% Growth
1	1999	159730	1971	161701	
2	2000	169929	2327	172256	6.53
3	2001	178697	2390	181087	5.13
4	2002	268529	3191	271720	50.05
5	2003	371953	6304	378257	39.21
6	2004	433495	12707	446206	17.96
7	2005	375911	5099	381010	-14.61
8	2006	400287	4259	404546	6.18
9	2007	457685	5267	462952	14.44
10	2008	549954	4919	554873	19.86
11	2009	591398	4522	595920	7.40
12	2010	652756	4177	656933	10.24
13	2011	667504	4803	672307	2.34
14	2012	680254	5313	685567	1.97
15	2013	691269	6773	698042	1.82
16	2014	717789	8664	726453	4.07
17	2015	751165	8027	759192	4.51
18	2016	830887	8476	839363	10.56
19	2017	990856	12051	1002907	19.48
20	2018	1198340	18114	1216454	21.29
21	2019	1245633	25813	1271446	4.52
22	2020	1070150	29907	1100057	-13.48
23	2021	1146461	36721	1183182	7.56
24	2022	1225244	44631	1269875	7.33
25	2023	1306499	53715	1360214	7.11
26	2024	1390226	64052	1454278	6.92
27	2025	1476425	75720	1552145	6.73

28	2026	1565096	88798	1653894	6.56
29	2027	1656239	103365	1759604	6.39
30	2028	1749854	119499	1869353	6.24
31	2029	1845941	137279	1983220	6.09
32	2030	1944500	156784	2101284	5.95

Meghalaya has the potential resources for sustainable tourism development. Some hindrances must be addressed and incorporated in development planning to achieve sustainability in the process.

3.2 Promotion of Eco-friendly Transport -Electric Vehicle Infrastructure in Meghalaya

The Indian government has issued a policy for Charging Infrastructure for Electric Vehicles (EV) – the revised consolidated Guidelines & Standards (15th Jan 2022), which promotes energy security and reduction of emission intensity of the county. The implementation must be done by an aggregator mutually decided between central and state nodal agencies.

Sustained economic development and expanding road networks have led to a rapid increase in motorized vehicles in Meghalaya. As of October 2020, Meghalaya accounts for only 0.002% of the electric vehicles sold in India. The total EVs in the State account for only 0.001% of the total vehicles registered in the State. Therefore, it is imperative to accelerate the early adoption of EVs in the State of Meghalaya by providing adequate impetus and support for adopting Battery EVs and setting up related charging infrastructures. (Source: Meghalaya Electric Vehicle Policy – 2021)

Meghalaya will soon join the list of India's EV charging networks. The northeastern State will quickly get it’s first-ever EV charging station. Power Grid Corporation of India Limited has laid the foundation stone for the first-ever Electric Vehicle Charging Station (EVCS) in the State at its office complex at Lapalang, Shillong. Powergrid will develop a total of 11 EVCS in Shillong city. These will include five public EVCS and six at government establishments. Each EV charging station will have four 15 kW DC-001 chargers and one 100 kW CCS-2/CHAdeMO charger with a dual gun. This will eventually result in 66 EV charging points in Shillong. The tentative EV map based on satellite imagerises data of parked vehicle for Shillong and Tura is given in Annexure 3.

https://auto.hindustantimes.com/auto/news/meghalaya-to-soon-get-its-first-ever-ev-charging-station-41630816784164.html

3.3 Transportation Network Challenges in Climate Hazardous

The historical hazard information shows that the city and State are vulnerable to earthquakes, floods, landslides, thunderstorms (associated with strong wind, lightning, hailstorms, and cloudbursts), cold waves, fire, and climate change impact on hydro-meteorological hazards. Being located in seismic Zone-V, the Meghalaya is highly vulnerable to earthquakes (see the frequency Table 3.9). Dadengri and Kharkutta block, Songsak block, and Laskin show higher earthquakes. The roads in these areas are susceptible to earthquake **needs** aseismic reinforcement techniques of road embankments (Oda etel., 2008).

Other Historical hazard information, including frequency of occurrence and location, were considered while carrying GIS mapping see Table 3.9. The impact of projected climate change on hydro-metrological hazards, particularly on floods and thunderstorms (including strong wind), has also been factored in for the assessment of Meghalaya. The natural hazard map is shown in Figure 3.10 below. Figure 3.10 shows 133 point land slides in Meghalaya, which covers a total length of 548.2km alternative routes. There are 8 locations in the Raksamgre market, Tikrikilla, Tikrikilla-Holaidanga road, Rilbong, Mawlonghat, Wahingdoh, and Lachumiere Meghalaya, where heavy flood has been observed. This location gain needs alternate routes and mitigation. 64km length needs special attention from a flood point of view (See Annexure 7).

Table 3.9Frequency and Magnitude of Earthquake

Sr. No	Magnitude		Year	Frequency	Sr. No	Magnitude	Year	Frequency
1	6.5		1842	1	15	6	1956	3
2	6.5		1845	1	16	5	1958	1
3	6.5		1858	1	17	6.2	1963	1
4	5.5		1868	1	18	6.2	1963	2
5	8.7		1897	1	19	5.4	1968	1
6	5		1915	2	20	5	1982	1
7	7.1		1923	1	21	5	1982	1

8	5.5		1930	4	22	5.5	1986	1
9	7.1		1930	4	23	5.2	1986	1
10	5.5		1932	2	24	5	1991	1
11	5.3		1933	2	25	5	1992	1
12	5.2		1939	1	26	5	1994	1
13	6.1		1945	1	27	5.6	1997	1
14	6.6		1951	1	28	5.3	1999	1
					29	5.3	2004	1

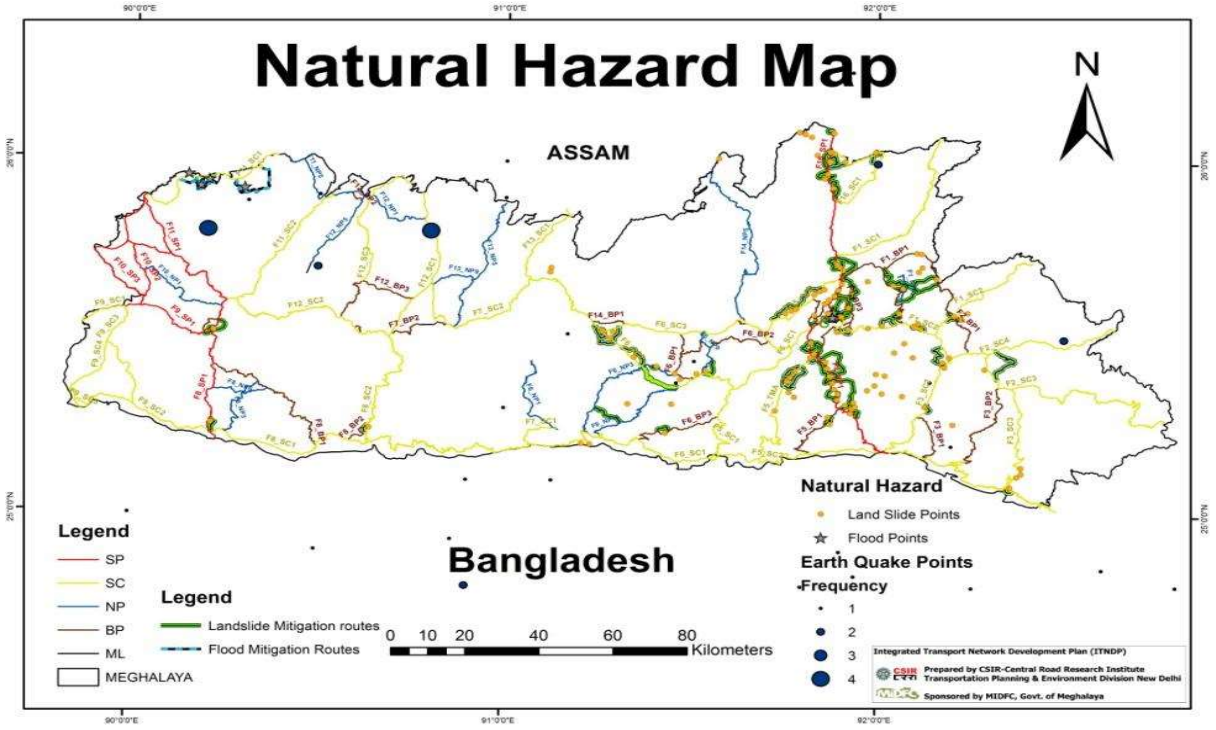


Figure 3. 10**Hazard Map in Meghalaya**

Roads are often blocked due to natural hazards, causing a delay in transporting passengers and goods. There is a need to find alternative routes in case of such risks.

There are challenges associated with construction during the rainy season. Meghalaya gets maximum rainfall in July (31% of SW monsoon rainfall) followed by June (30 % of SW monsoon rainfall). The rainfall analysis was carried out for five classes of rainfall intensity for different blocks in Meghalaya. (i) Very high - 7 blocks - 3769.1km2 (ii) High - 11 blocks - 5722.5 km2 (iii) Medium - 9 blocks - 5864.4km2 (iv) Low - 12 blocks - 5730km2 (v) Very low- 5 blocks - 1375.5km2. These identified blocks need eco-friendly construction techniques such as Cold Mix technology, and

construction should be completed before the rain starts. Figure 3.11 shows the rainfall maps of different intensities.

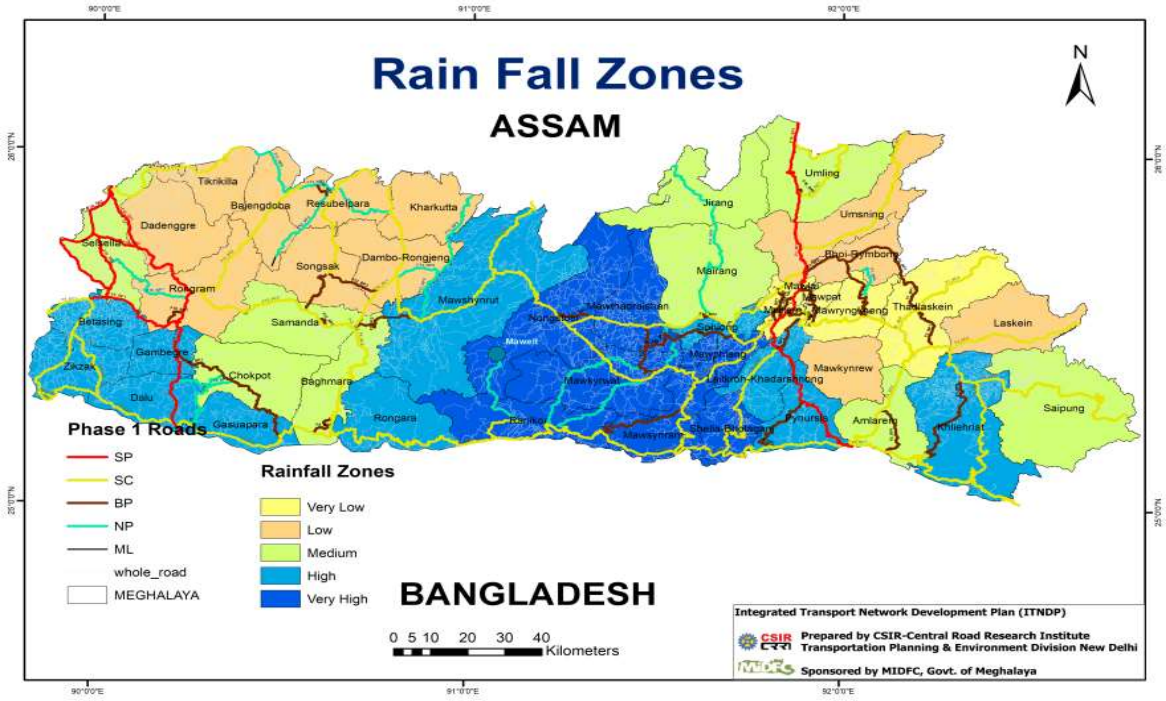


Figure 3. 11**Rainfall map showing different intensity in different blocks of Meghalaya**

Table 3.10 below shows a conditional matrix for the construction of roads in different districts of Meghalaya and its construction feasibility. It is created by analyzing rainfall data and taking months where the average daily rainfall is less than 1 cm.

Table 3.10 Conditional matrix for the construction of roads

Cold mix technology	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Garo Hills	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
East Jaintia Hills	Y	Y	Y,Nr	N	N	N	N	N	N	Y,Nr	Y	Y
South West Khasi Hills	Y	Y	Y, Nr	N	N	N	N	N	N	N	Y	Y
South West Garo Hills	Y	Y	Y	Y, Nr	N	N	N	N	N	Y	Y	Y
South Garo Hills	Y	Y	N	N	N	N	N	N	N	Y	Y	Y

Ri Bhoi	Y	Y	Y	N	N	Y, Nr	Y, Nr	Y	Y	Y	Y	Y
East Garo Hills	Y	Y	Y	N	N	N	N	N	N	Y, Nr	Y	Y
West Khasi Hills	Y	Y	Y, Nr	N	N	N	N	N	N	N	Y	Y
West Jaintia Hills	Y	Y	Y,Nr	N	N	N	N	N	N	N	Y	Y
West Garo Hills	Y	Y	Y	N	N	N	N	N	N	Y, Nr	Y	Y
East Khasi Hills	Y, Nr	Y, Nr	N	N	N	N	N	N	N	N	Y	Y

Y - Yes, construction can be done Y, Nr- - Construction can be done, but there is a chance of high rainfall, so it is not recommended N - Construction cannot be done

4 GAP ANALYSIS FOR ITNDP

4.1 Gap Analysis

Catering for the needs of the transport disadvantaged remains a vital objective and justification for the provision of transport infrastructure in regional settings of Meghalaya. This will provide explanations for improvement of the road network and transportation supply service provision, to increase connectivity coverage with Bangladesh, Assam, the larger population in Meghalaya, the connectivity's among the economic center, the driving speed by connecting missing link, safety, congestion relief, accessibility, and the environmental impact reduction.

Despite the apparent importance of the above issue, very little work has been undertaken to ensure these needs. In particular, the allocation of money on transport infrastructure often can be based more on historical and political precedents than on a rational assessment of the distribution of potential uses. This section deals

- To measure the geographical distribution of transport infrastructure needs in Meghalaya
- To assess the distribution and quality of transport infrastructure service provided geographically, and
- To identify any needs gap between needs and service provision.

4.2 District wise Transport Needs Measurement

As part of the stakeholder workshop, 87 samples were collected from all 11 districts of Meghalaya to understand the need of stakeholders. The methodology for measuring conditions involves assembling transport needs indicators for a series of areas and defining a single needs score for each district based on the relative indicator values. Transport needs indicators used in the analysis are identified in Table 4.1

Table 4. 1. **Transport Needs Indicators and Weights Applied**

Need Indicators	Weight
Coverage (Connecting International routes, roads, in border areas, Connecting National, Highway, State Highways/ inter-district roads connecting several village roads including PMGSY roads)	(0-20)
Connectivity (No. of villages connected, Total population on covered)	(0-15)
Economic Importance (Connecting Tourist center, market centers, agriculture producing, centers with more commercial crops, industries (medium/small /micro industries),)	(0-20)
Missing Links (Missing links connectivity)	(0-10)
Capacity Constraints (Volume/Capacity)	(0-5)
Time-Saving (Condition of roads from traffic and inventory data)	(0-10)
Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other, Significance)	(0-10)
Pre-Feasibility width/Curve visual (Available carriageway)	(0-10)
Possibility in terms of cost of construction	(0-10)

Single needs score is derived from the indicators by first standardizing each value. This involves resetting the scores to a value between 0 and 100 based on their relationship to the highest value in its series. Each standardized value is then weighted and added together, and a finalized needs index is generated. This is then standardized to obtain needs scores between 0 and 100 for all districts in the analysis.

4.3 Needs Gap Analysis

The need gap analysis compares the needs scores with the network supply costs and trip purpose. To assist in understanding the considerable quantities of data this analysis produced. All values were classified: very low, low, average, high, and very high. Hence, a district with very high needs could be identified and its supply quality measured. Supply measures included categorizing a trip not possible where the transport service did not enable travel.

4.4 KEY FINDINGS

4.4.1 Coverage

- Meghalaya's 443-km international border with Bangladesh serves 546199 population, 1692 no of the village with the overall area covered 8860 square km. Road corridor along the border is vital for strategic development.
- Two existing and four under implementation, Border Haats and eight functional and two non-functional Land Custom Station are there to facilitate the trade between Bangladesh and

India. Department of Commerce and Industry is planning for more number of Border Haats in future.

- There is a considerable amount of mineral transported from India to Bangladesh. Road and water transport are not connected to facilitate these movements.
- The strategic corridor from the west part of Meghalaya Mahendragunj to Ratachera via Dawki will be opening the whole Meghalaya into typical development from mines, tourists, and crossing the Meghalaya from West to east movement perspective along border haats. Road corridor along this is vital for strategic development and an alternate corridor for the movement of transportation and goods from west to east.
- In Chicken Neck closure, Meghalaya can be connected to India via Hili, West Bengal, using a strategic corridor from Bangladesh from either Mahendragunj or Phulbari.
- Existing Shillong , Guwahati Roads and Shillong Dawki Roads need up-gradation.

4.4.2 Connectivity

- Whole villages are 6169 habitations, and the entire population is 34.4 Lakh. They need a connection from the last mile connectivity perspective.

4.4.3 Economic Importance

- There are Tourist centers (237), town (21 Cities), agriculture producing centers with more commercial crops (12 Major, 7 Minor and 69 minor Mandi), 48 large scale industries, four no of Lime Stone Mining/Crushing Plant, 12 No of Foods, 3 No of beverage, 2 No of Coke, 2 No of Information Technology, 4 No of HDPE Bags, 31 No of other industries. These centers need a proper connection of roads.

4.4.4 Missing Links

- The Road network in Shillong has been found fragmented. Several missing links need to be developed for further opening the area.
- Transport terminal and their connectivity with main roads need further integration to increase efficiency.
- Several places require bridge construction to develop the whole corridor.

4.4.5 Capacity Constraints (Volume/Capacity)

- Many cities in Meghalaya require an additional route to avoid entering the towns to improve the efficiency of intercity travel.
- The Bypass or through route is a way to mitigate the issue.
- Many roads with international connections and strategic links need widening due to their traffic cause.

4.4.6 Time-Saving

- Shillong is the capital of Meghalaya. From the Western part of Meghalaya District HQ Ampati to the capital, the journey time is 9 hours (353km) with an average speed of 39 km per hour by private vehicles. The major hospital, administrative HQ, and other schools and colleges are located in Shillong.
- From the southeastern part of Ratachera to Shillong, it takes 5.30 hours (161km) with a speed of 29km per hour by private vehicles.
- Shillong to Jorabat (Assam Border) connection to Guwahati takes 2hour 15 minutes (86.4km) with 38.5km per hour by private vehicles.
- The cost and time of travel by public transportation system vary considerably by trip purpose.

4.4.7 Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other, Significance)

- There is an accident spot identified in different districts of EGH(9), EJH(2), EKH(16), NGH(1), RB(6), WJH(8), WKH(1).

Figure 4.1 presents the distribution of transport needs in Meghalaya. This includes a blowup of the areas in a different district in Meghalaya. Conditions are indicated in Figure 4.1 by shading; darker shades are areas with higher needs, and lighter shades indicate lower states.

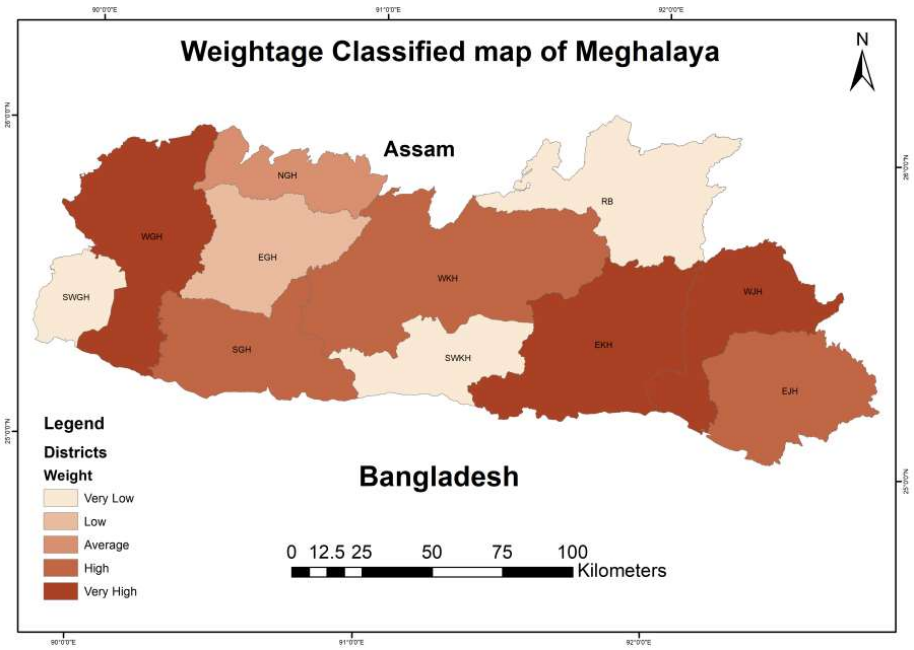


Figure 4. 1 Transportation Need Map of Meghalaya

- In general, the needs distribution is patchy, suggesting a scatter distribution of high and low scores with no particular trend toward inner versus outer areas being either high or low scores. Some fringe areas with evident concentrations of very high or high scores, including EKH and developed parts of WGH.

- Fringe areas with high needs scores include South Garo; and parts of West Khasi Hill and East Jaintia Hill.

- In general, undeveloped districts have meager needs scores. This is to be expected given low total population levels. Figure 4.2 shows the size of component indicator scores for the highest-rated needs district.

- Figure 4.2 indicates that districts of EKH, WGH, WJH owe a large part of their total needs scores to the Coverage; Connectivity, Economic importance is visible in all communities. The cost has been the primary concern in South West Garo Hill districts, and the missing link is prevalent in EKH, WGH, WKH, and EJH.

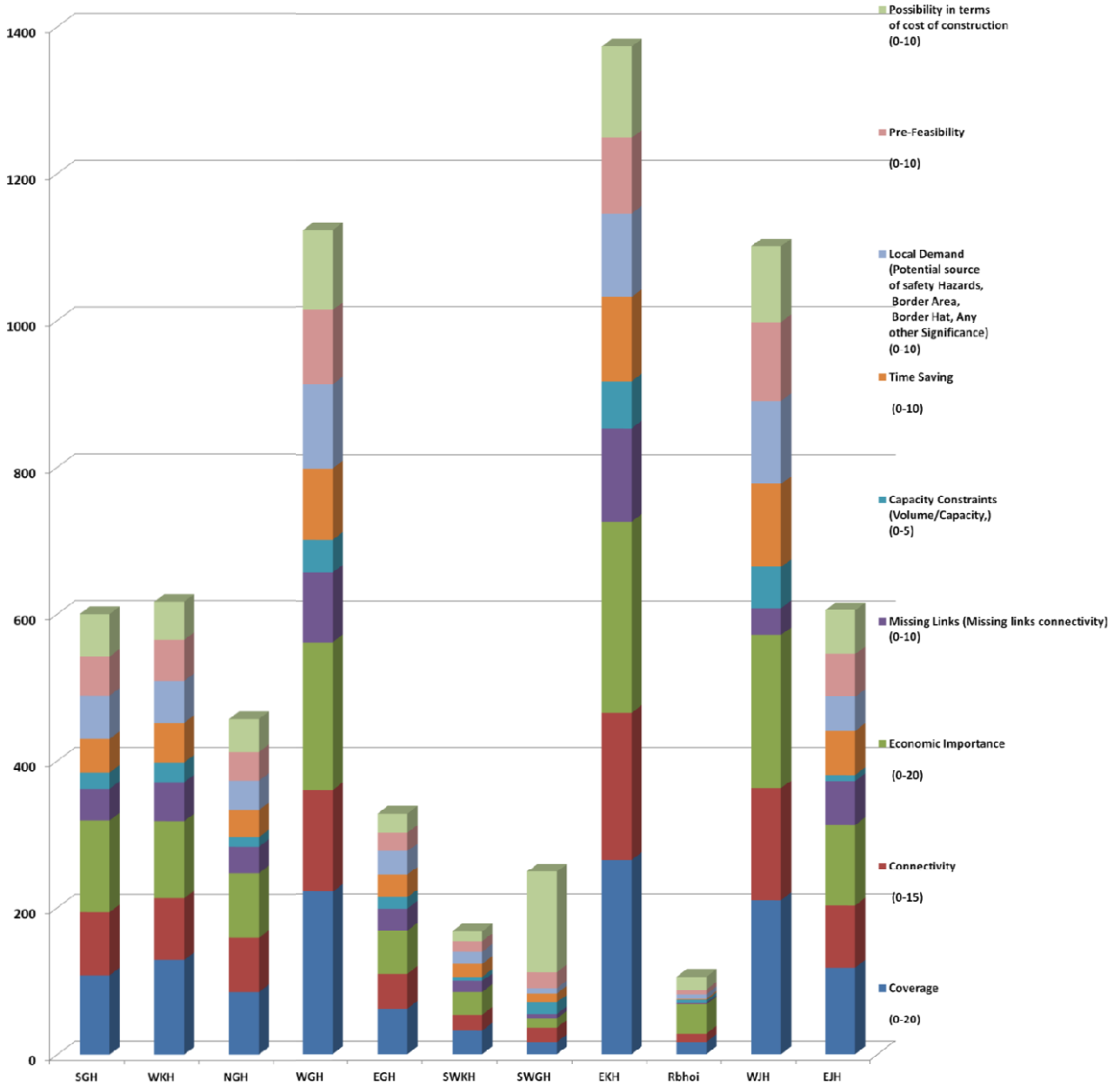


Figure 4. 2 **Component indicator share of total needs score for all districts.**

4.4.8 Land Use Gap

Meghalaya has 57.8% area covers a forest of 13137.12 km2. Again they are a) Dense -3943.5 km2, b) Open - 7310.2 km2, c) Scrub forest – 1871 km2, d) Forest plantation - 12.4 km2. No construction is permitted in a Protected forest – 6 no, 1310.67 km2 and Reserved forest 28 no, 794.74 km2. Built-up urban areas are very less Urban- 78 no, 419.3 km2(1.8% of total area) whereas Rural – 21861 no, 813.57 km2(3.5%). Figure 4.3 shows the forest cover Map of Meghalaya. All the development has to keep view the environmental aspect of Meghalaya. Figure 4.3 shows protected, reserved forest and dense forest. As per EIA, all the roads construction activity has to meet their EIA clearance as per their norms.

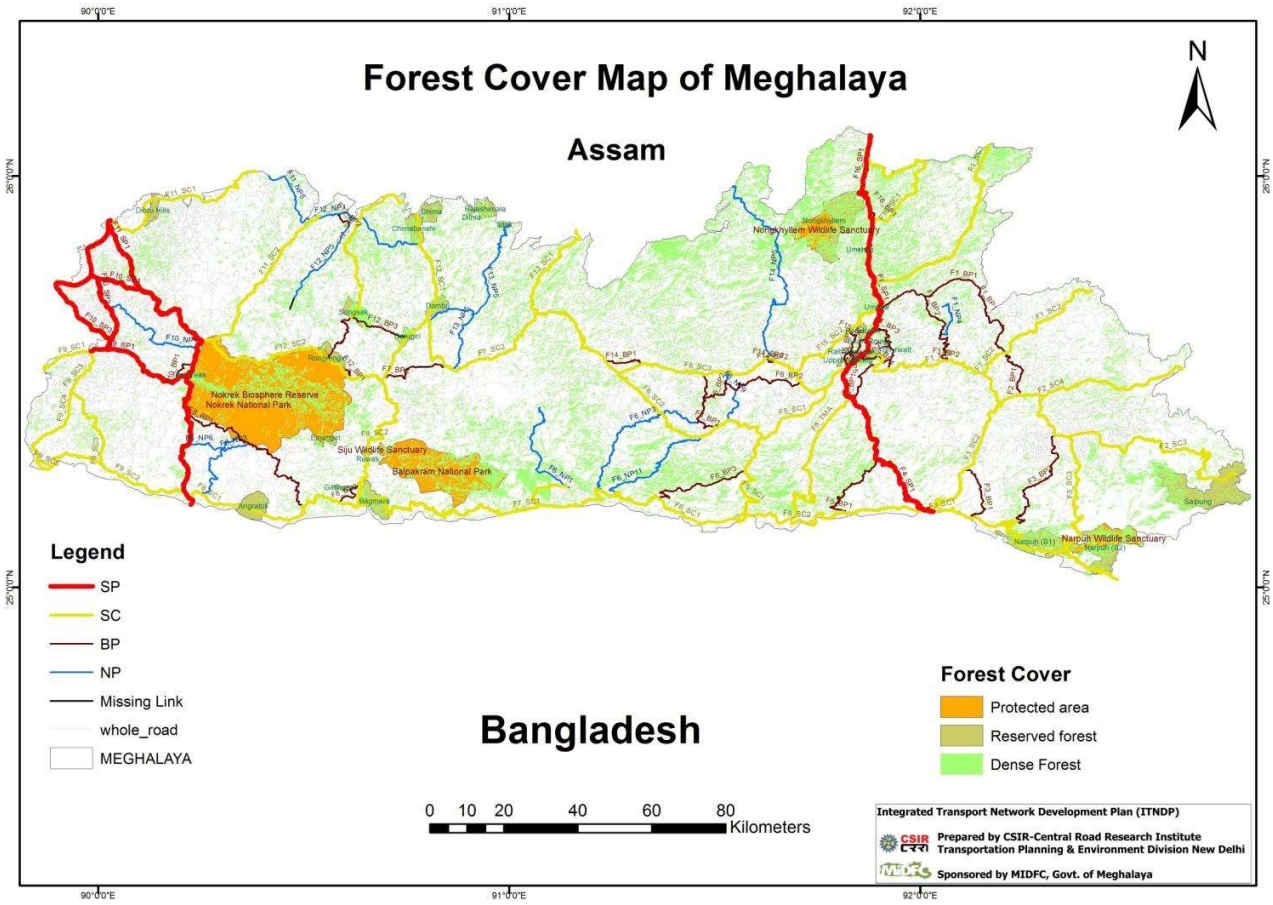


Figure 4. 3 **Forest Cover Map of Meghalaya**

4.5 Gap Analysis of Freight Sector in Agriculture

Considering Agriculture's business as usual scenario, yield in Meghalaya will increase by 10%. There is an anticipated increase in Area (Hectare) by 28%, Production (Metric Tons) by 35%, and Agriculture Yield (Kg/hectare) by 10%. India's current transportation planning process doesn't focus on the freight sector for agriculture and cannot cope with the demand.

Table 4. 2Agriculture Demand gap in next ten years

Year	Area (Hectare)	Production (Metric Ton)	Hectare/Ton	Agriculture Yield(Kg/hectare)	% Change
2021	206412	593999.	2.85	2877.74	
2030	288382.2	919732	3.19	3189.29	10.83
Gap	81970.2	325733	0.32	311.55	

4.5.1 Cause of Gaps:

- The agriculture economy is growing in Meghalaya.
- There is no coverage or facilitation of local agriculture, mainly commercial crops, to the cluster market.
- More congestion at Mandi if not appropriately facilitated.
- Lack of suitable clusters of operations to support market-to-consumer links, losses during transit,
- There is much wastage during storage, lead times are high, and security issues if not reached the market center.
- Unorganized and inefficient agriculture supply chain is not very effective either.
- Lack of awareness, understanding, and overall vision of goods movement.
- Fragmentation in nature of stakeholders and gaps in skills and knowledge.
- Lack of information about the flow of goods movement along NH, SH, MDR
- Several issues of parking for deliveries and reverse logistics (e.g., recycling and garbage collection)
- The aspects of supply chain linkages, storage, handling, and distribution, including the modes used, are unnecessary.

(Source : Garima Pratap, ,Yash Singh, 2021)

4.5.2 Agriculture Supply Chain Connectivity

Development of Wholesale Logistics Hubs: The absence of wholesale logistics hubs necessitated the goods trucks to load and unload goods at Bara Bazaar (Mawlonghat & Garikhana) near the city's heart. The situation warrants the construction of by-passes and wholesale hubs near the proposed ISBTs and ISTTs to prevent heavy goods vehicles from entering the city's commercial areas. This decongestion measure/strategy is recommended.

Figure 4.4 shows Agriculture Supply Chain Connectivity with NH, SH, MDR Map, and Figure 4.5 shows connectivity between collector points to Wholesale Market Point and regional transport hub. These links have been identified using GIS analysis and identifying the different collector Wholesale Market Point and regional transport hub using arrival load of commercial crops at that center. Jowai, Mylliem, Lewduh, Tura, Mawiong, Williamnagar, Garobadha, Ampati, Byrnihat, Samanda and Nongpoh are major market centers. There are 5 sub major centers Khliehriat, Baghmara, Dadenggiri, Rongram, Tikrikilla, Wahiajer and Rom Bazar and remaining 88 are minor centers. All these centers need interconnection and act as an aggregator for national transfer or Bangladesh transfer.

There were 17 cross-border connections shown in Figure 4.5. The supply chain linkages are necessary storage, handling, distribution, and digital connectivity at major hubs. Thirty-nine roads from Phase 1 serve this supply chain of a total length of 2259 km. Agriculture serving centers can only be successful if the entire agriculture market is connected to the last mile. Agriculture supply chain connection with last-mile connectivity map is prepared for all the districts, and these maps and their list are given in Annexure 1. These 16 roads in Phase 1 serve Sixty-five agriculture points.

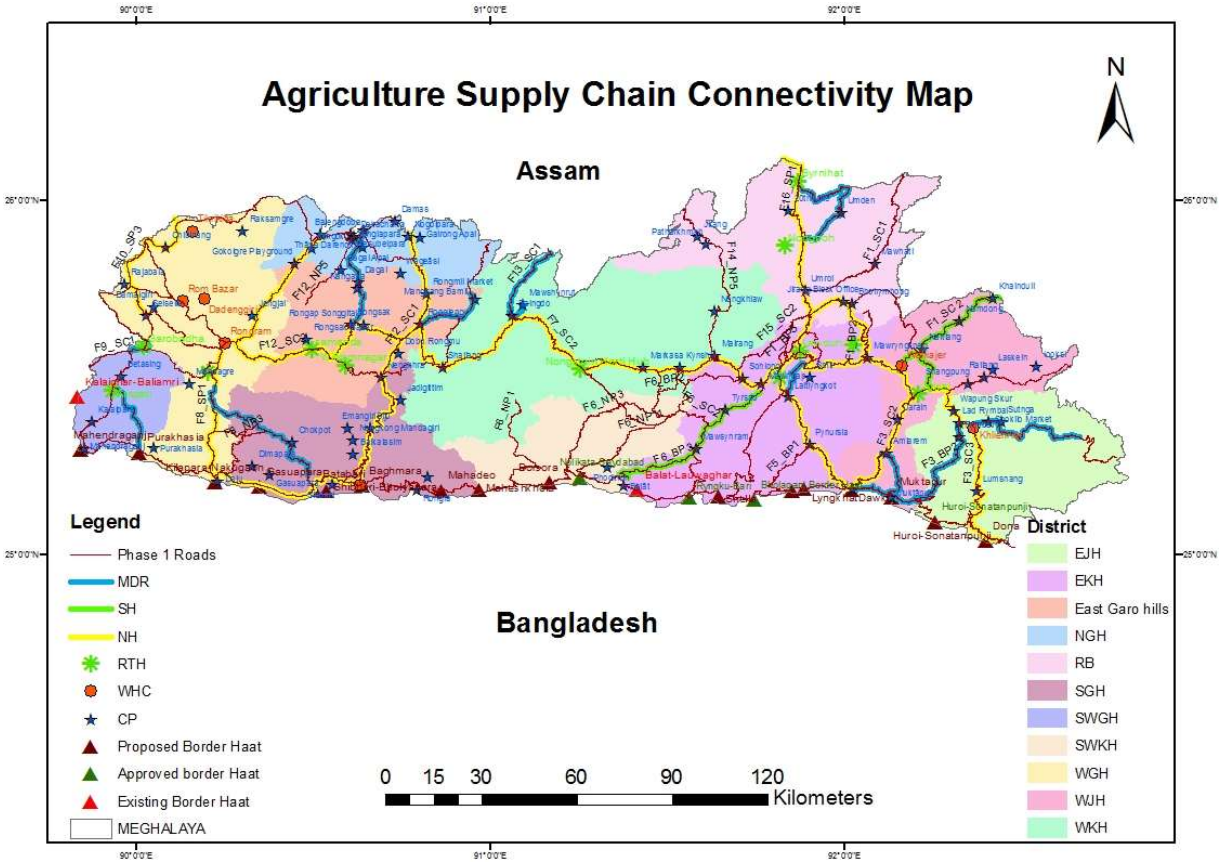


Figure 4. 4 **Agriculture Supply Chain- Connectivity with NH, SH, MDR Map**

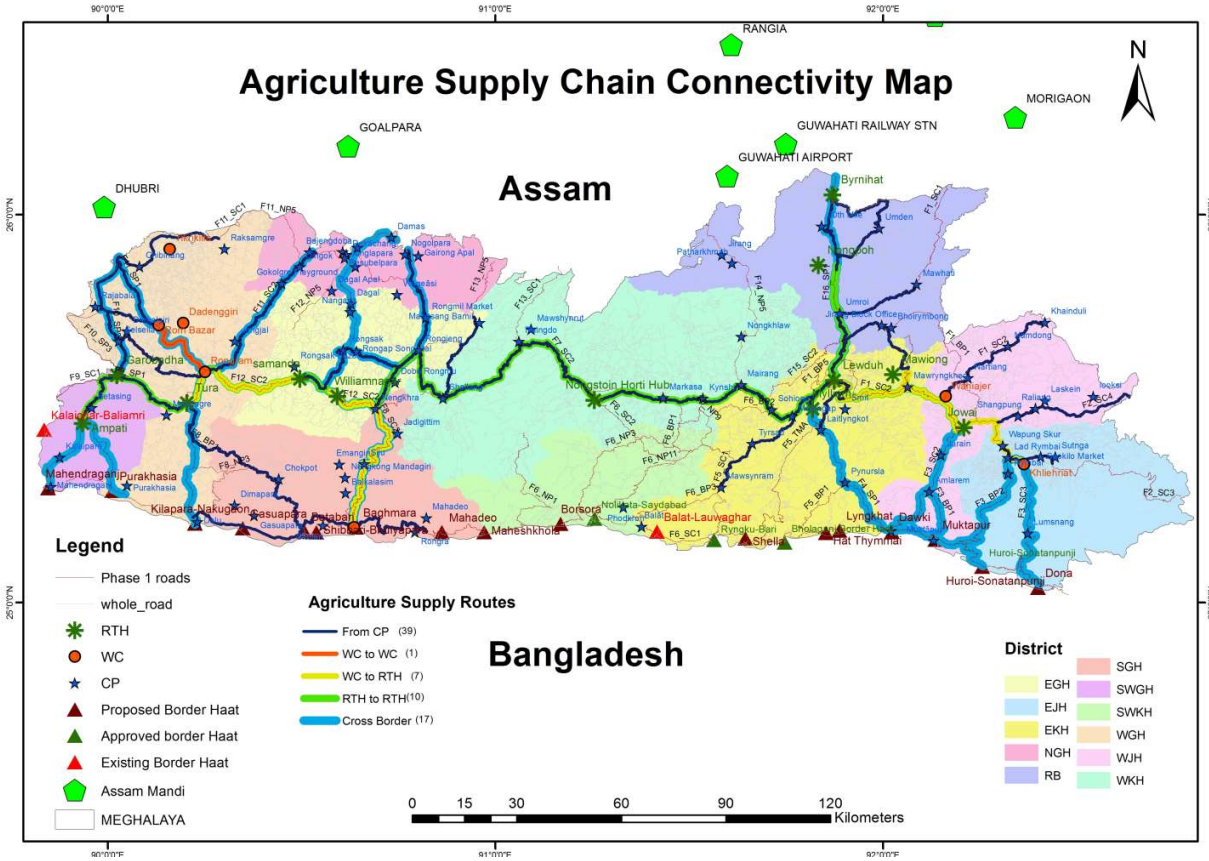


Figure 4. 5 Agriculture Supply chain connectivity map showing the connection between CP, WC, and RTH

4.6 Gap Analysis of Tourist Sector

Considering the business as usual scenario of Tourist inflow in Meghalaya will increase by 91% by 2030. There is an anticipated increase in domestic tourists by 81%, foreign tourists by 424%, and overall total tourists by 91%. Tourist flow needs comprehensive transportation support, and the current transportation facility cannot cope with the demand cost-effectively.

Table 4. 3 Growth in Tourist flow

Year	Domestic	Foreign	Total
2020	1070150	29906.68	1100057
2030	1944500	156783.9	2101284
Gap	874350	126877.2	1001227
% Growth	81.7035	424.2437	91.01596

4.6.1 Cause of Gaps:

There is a large number of tourists point approximately 250 in number.

- The NEC and Swadesh circuits have a missing link. These circuits need further updation
- Meghalaya's highest elevations occur in the Khasi Hills, and the southern edge is home to the planet's rainiest stretches.
- People have been visiting destinations like Sohra and Mawsynram for generations to witness the madness of the monsoons. At the same time, cosmopolitan Shillong offers a distinct blend of small-town charm mixed with a modern urban vibe.
- The Khasi Hills offer extremes scenic road trips, sleep under the stars, or lounge in a café with a book – there are options for all.
- 'Wild and verdant' is apt to sum up, the Garo Hills. This western chunk of Meghalaya is home to most wild species found in the State – from wild pachyderm herds and the enigmatic Hoolock gibbon to an elusive predator. The Nokrek Biosphere Reserve is one of the most precious ecosystems in the country, while Balpakram is not only an adventurer's delight; it is also home to many myths and legends. Angling enthusiasts will love exploring the riverine patches, and the Garo Hills is also known for its unique traditions and cuisine.
- A garden of monoliths, boats floating on crystal-clear waters, curtains of waterfalls over weathered rocks tucked in a secret forest – these are images that the Jaintia Hills conjure. Meghalaya's eastern section has been thick of North-eastern history, being mentioned in the chronicles of the Ahoms and other neighboring cultures.
- The Jaintia Hills also provide the mesmeric scenery that one expects from Meghalaya as routes dart between highland meadows and steep tropical landscapes.

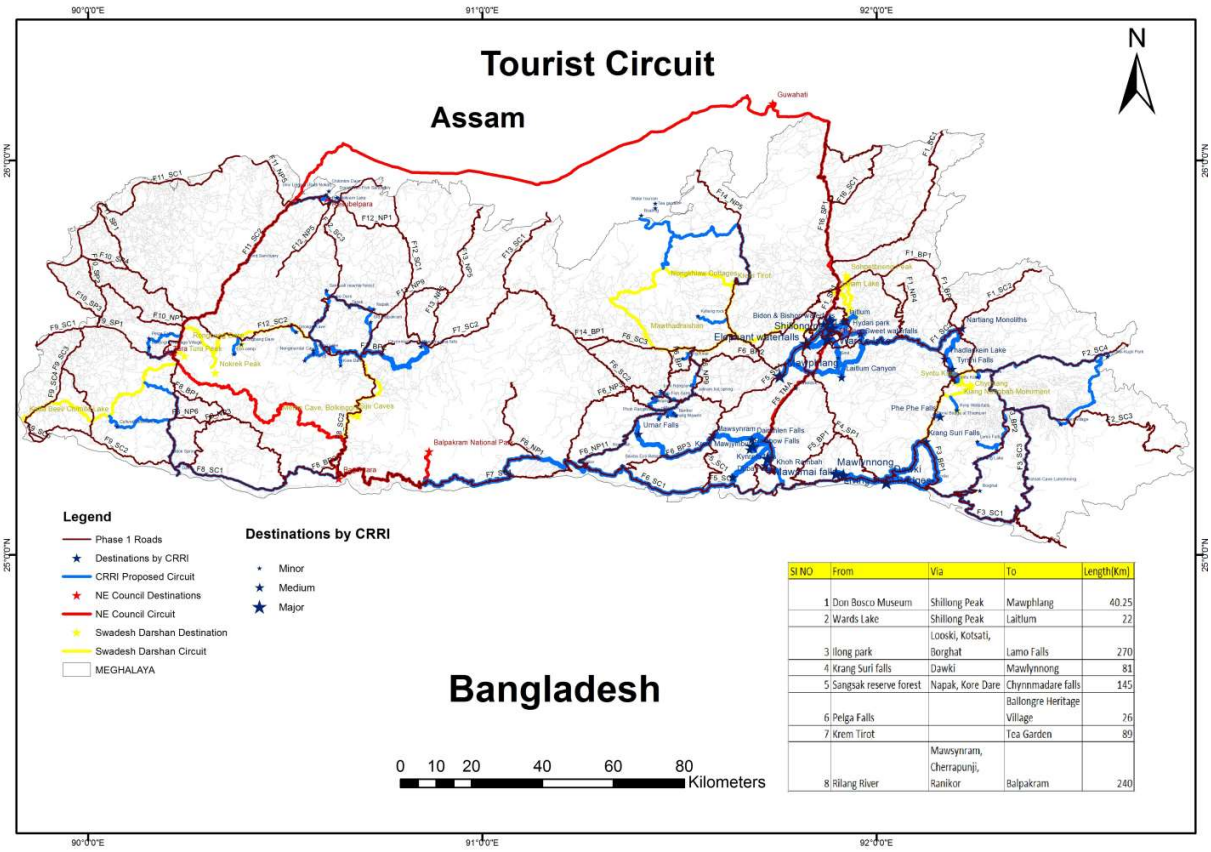
However, there is a minimal scope of shared transport facilities at tourist places without public transport facilities.

Currently, only one airport is operational with limited supply. Many times there are operation disturbances.

Guwahati is the nearest airport that serves Shillong by road. At any tourist place, roads are not maintained, and approach tracks are not built.

CRRI has identified the gaps in the Swadesh darshan circuit (553.7 km) and NE Council tourist circuit (548.2kms) as many major tourist points were not part of this circuit. CRRI has identified

938kms of additional circuits named CRRI tourist circuit as shown below in Figure 4.6 that has further potential to be developed in the future and provide an extra boost in tourism-related infrastructure. Twenty-eight roads from Phase 1 roads are serving this circuit. Figure 4.7 shows the detail of the circuit in the Shillong area.



Sl NO	From	Via	To	Length(Km)
1	Don Bosco Museum	Shillong Peak	Mawphlang	40.25
2	Wards Lake	Shillong Peak	Laitlum	22
3	Ilong park	Looski, Kotsati, Borghat	Lamo Falls	270
4	Krang Suri falls	Dawki	Mawlynnong	81
5	Sangsak reserve forest	Napak, Kore Dare	Chynnmadare falls	145
6	Pelga Falls		Ballongre Heritage Village	26
7	Krem Tirot		Tea Garden	89
8	Rilang River	Mawsynram, Cherrapunji, Ranikor	Balpakram	240

Figure 4. 6 **Tourist Circuit in Meghalaya in Phase -1**

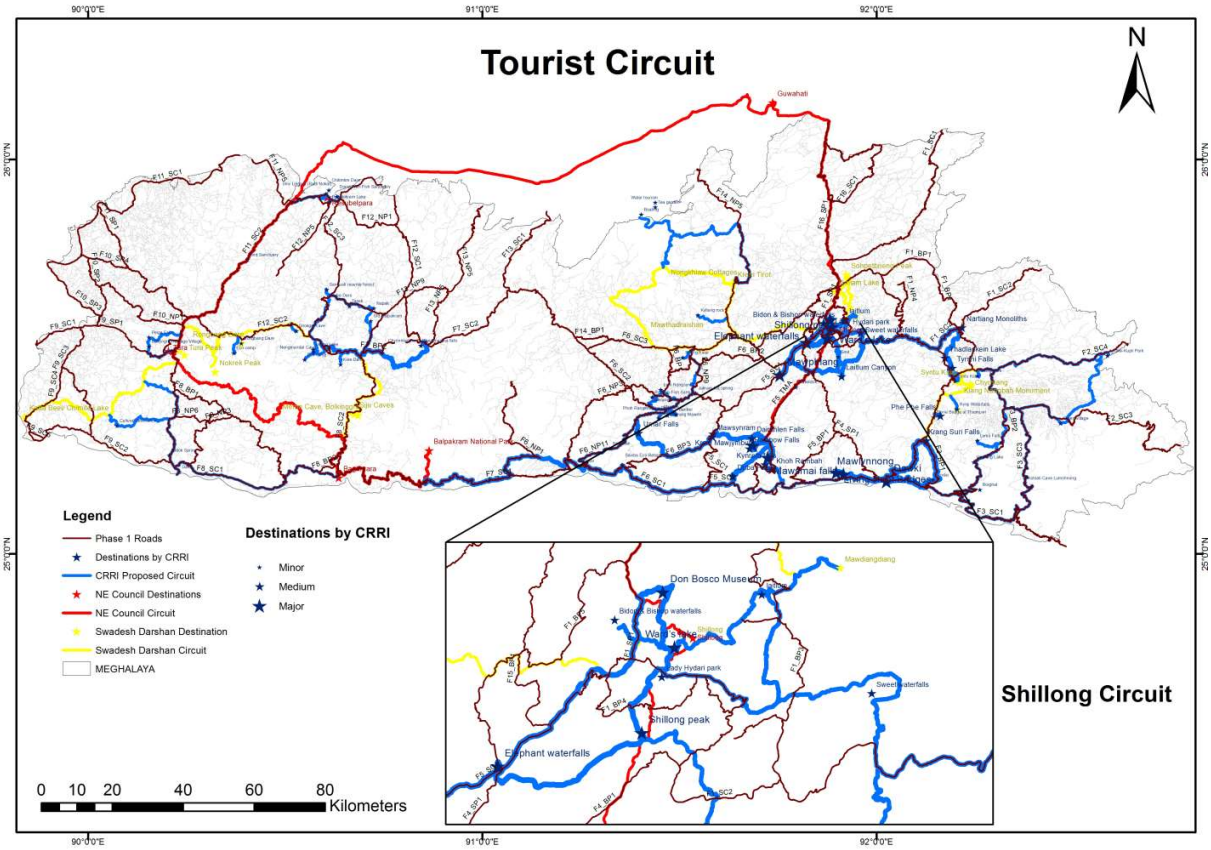


Figure 4. 7 **Tourist Circuit in Meghalaya in Phase -1-Shillong Area**

Figure 4.7 Tourist Circuit in Meghalaya in Phase -1-Shillong Area. Tourists can only be prosperous if the entire tourist destination is connected to last-mile travel. Tourist connection with a last-mile map is prepared for all the districts, and these maps are given in Annexure 2. The 15 roads of Phase -1 serve about 133 tourist points within a buffer distance of 1km. A typical tourist map of East Khasi district is shown in Figure 4.8.

Figure 4. 8 **Last mile tourist destination map of East Khasi Hill district of Meghalaya**

4.7 Gap Analysis of Mining and Industry

Considering the business as usual scenario of mineral (Coal) production in Meghalaya will increase by 5.36 Million Ton by 2030. There is an anticipated increase in Limestone from 8.3 Tonne to 14.25 tonnes, increasing 71 Mton. The heavy production of minerals will require overall support of road and transportation, and the current transportation facility cannot cope with the demand cost-effectively.

Table 4. 4 Growth rate of the Mining sector

Year	Coal(in Million Tonnes)	Lime Stone(in Million Tonnes)
2021	0.2	8.3133
2030	5.5599	14.2501
Gap	5.3599	5.9368
% Growth	2679.95	71.41328

4.7.1 Cause of Gaps:

Meghalaya Mines and Minerals Policy 2012 also dwells on ensuring optimal utilization of available mineral resources, realizing vast mineral potential, generating revenue for socio-economic development, uplifting the economy of the State, and enhancing employment opportunities.

- Limestone, Coal, Clay, Granite, Kaolin, Iron, Glass, Quartz, Feldspar, Sillimanite, Bauxite, Rock, Phosphatic, Gypsum, and Uranium in different parts of Meghalaya.
- There are ample resources of 15100 million ton limestone and 576 million Ton coal long with lithomarge clay of 97 million tons, 50 million meter3, granite, glass sand 3 million Ton, kaoline 5.24 million tones, bauxite 1.45 ton and iron ore 3.6 million ton.
- Mining contributes significantly to state revenues; there is a need for an efficient regulatory mechanism with high penetration of e-governance systems to prevent illegal mining and value leakages.
- Mining contributes significantly to employment generation,
- There is continuous demand in industries for all these materials.
- There is continuous growth and tremendous potential of geo-site tourism plateau, valley caves.

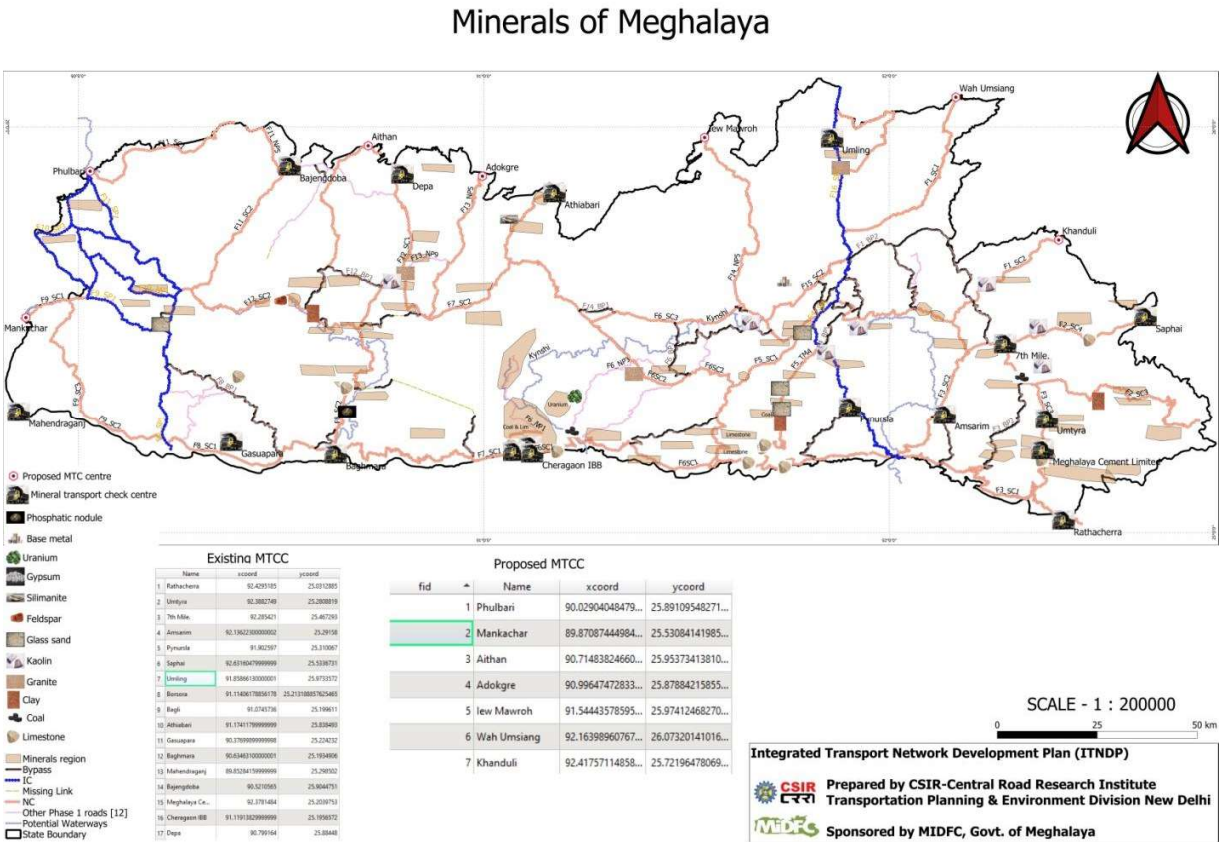


Figure 4. 9 **Mineral transportation map of Meghalaya**

4.7.2 Supply side for Mining

- Base Current transport infrastructure finds it difficult to supply sufficient coal stocks to power plants due to fewer railway lines.
- It is developing various new rail links, rapid loading systems, and significant road infrastructure like Dedicated Freight Corridor from Shillong to Ratachera.
- Rail link that is being established finds a way forward for introducing goods train from Tetelia to Byrnihat in the Khasi Hills region of the State.
- The economy of Mendipathar has gone up after the goods train has arrived there.
- Today, people send their vegetables to Guwahati from North Garo Hill. People who were selling vegetables at Rs 100 – Rs 200 or Rs 300 a day are today getting Rs 2000 or Rs 3000, the different products that are coming in which used to be costing much higher in Mendipathar earlier, today are getting products that are cheaper in Mendipathar compared to Dudnoi and Krisnai which means there is a substantial economic advantage to them.

4.7.3 Industry

- Meghalaya's vision is to emerge as a preferred destination for start-ups by 2024 through strategic partnerships, a conducive ecosystem, and investment and policy interventions.
- Meghalaya set up Procurement Preference Policy for Micro and Small Enterprises, 2020 to promote and develop Industry.
- The Government of Meghalaya proposes to develop quality infrastructure across the State with all necessary) facilities made available for entrepreneurs. It is equally vital to activate the usage of existing infrastructure.
- Meghalaya Industrial and Investment Promotion Policy (MIIPP) - 2012 aimed to create a conducive environment for industrial development by creating the basic Infrastructural facilities and setting up industrial areas, growth centers, and export promotion industrial Park.
- Set of Industrial areas, Park can create much potential for future development.

4.8 Gap Analysis of Safety

- SDG 3.6 targets may be achieved by 2030 with great effort in India; the presently available safety interventions may not be adequate to bring death rates below 2.0 per hundred thousand people. Since the situation differs significantly between cities, it will be essential to evolve city-specific policies for safety intervention priorities and changes in travel behavior. The desired reductions in road traffic injuries in India will not be possible without much more significant investment in road safety research and road design for safer travel.
- Black spot data were collected from Meghalaya Police Department. Their GIS location was identified, and mapping was done to see the black spot map. The black spot location is shown in Figure 4.1. These locations are critical for engineering improvement in the road sector. A maximum number of accidents has higher sensitivity from an accident's point of view. Guwahati Shillong –Dawki, Shillong Ratachera Roads, and Shillong Bypass have been identified as roads that need to improve Geometry. Songsak, Darugree T junction, Shillong City, Laitryngew Mawkdok of EKH, Carbalu, Umrandairy has many occurrences of an accident. Mawryngkneng Police Station has recorded the 144 highest number of an accident along the NH44 Bypass (Refer Table 4.5). The safety aspect is substantial from an infrastructure and planning perspective.

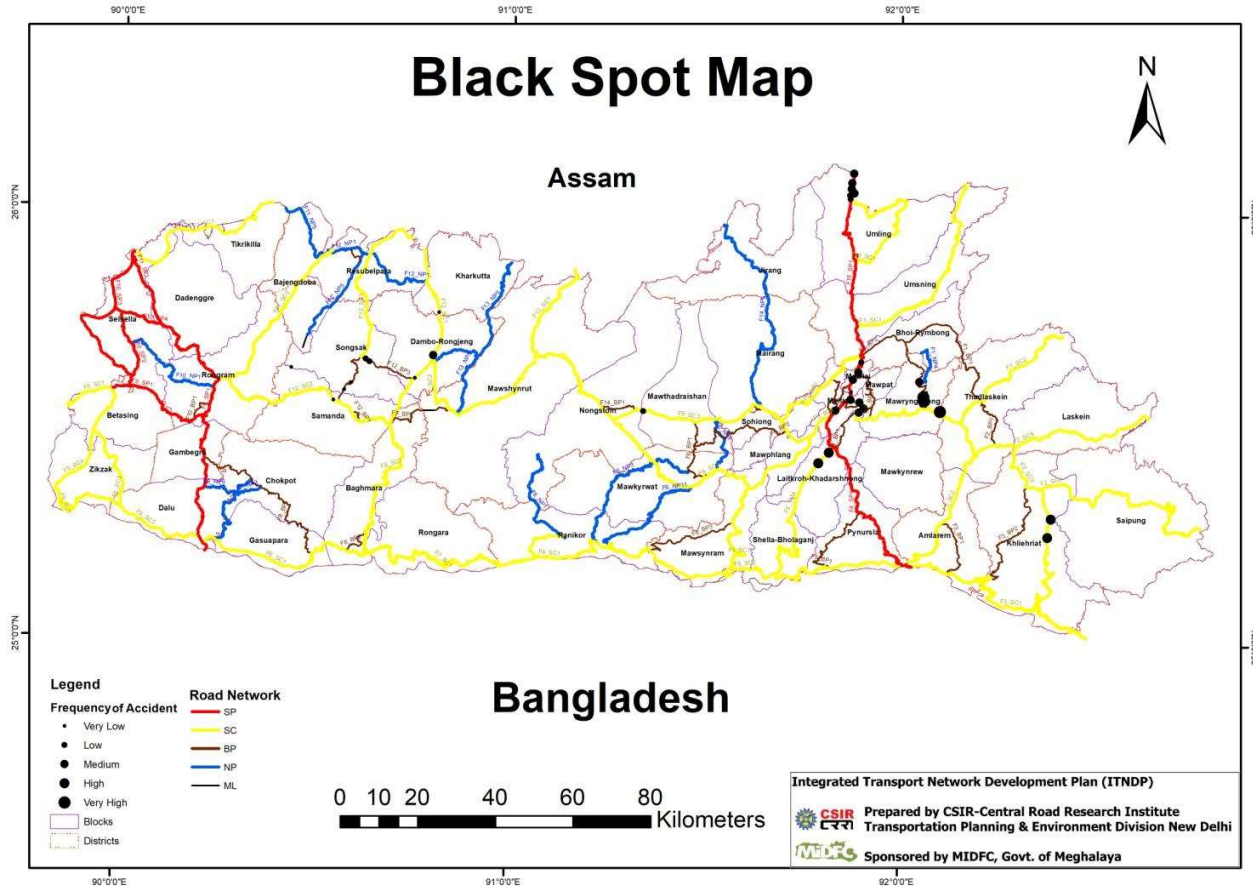


Figure 4. 10 **Black spot location Maps**

Table 4. 5T Black Spot Location Details

BLACK SPOT LOCATION DETAILS FOR THE YEAR										
Sl. No.	Name of District	Name of Jurisdictional Police Station	NH/SH/MDR/ OR No.	Name of the Location/Place	GIS Location	Number of Accident				
						2015	2016	2017	2018	2019
1	West Jaintia Hills	Jowai Traffic Branch	NH 06,NH44 Town etc.	N/A	N/A	Nil	Nil	Nil	Nil	Nil
2		Amlarem PS	NH 40E	Nil	Nil	Nil	Nil	Nil	Nil	Nil
3		Phramer Traffic cell under Jowai PS	NH 06	Ialong & Phramer	NH 06 Ialong	_	1	_	2	_
4			NH 06	7th Mile	NH 06 7th Mile	_	1	_	_	_
5			Rural	Kyndong Tuber village	Kyndong Tuber	_	_	1	_	_
6		Dawki P.S	Tamabil Dawki	Between LCS office & Indo Bangla Border Gate	1km from Dawki PS	1	_	_	_	_
7			NH 40 E	Sokha village	Ten km approx. from Dawki P.S	1	_	_	_	1
8			Bakur village	Bakur village near the bridge	0.5 Km approx. fromDawki P.S	_	1	_	_	_
9			Rjang Syndai village	Curve road at Lad Darrang village	15 Km approx. from Dawki P.S	_	_	1	_	_
10			Lad Darrang	Curve road at Lad Darrang village	5 Km approx. from Dawki P.S	_	_	1	_	_
11			Shnongpdeng village	Between Shnongpdeng & Darrang village	7 Km approx. From Dawki P.S.	_	_	_	_	1
1	EAST KHASI HILLS DISTRICT	Laitumkhrah Police Station	NH 44	Jowai Road	Lat 25.565375 Long 91.89584	1	1	3	3	1
2		Mawlai Police Station	NH 40	Ryndang Briew	Lat N 25°39' 29.808" Long E 91° 53' 58.8732."	2	1	0	2	0
3				Mawiong Umjapung	Lat N 25° 37' 5.178" Long E 91° 52' 42.654"	2	3	2	0	4
4				Mawiongrim	Lat N 25° 38' 5.0028" Long E 91° 53' 33.0072"	2	3	2	2	0
5				Mawkynroh By-Pass	Lat N 25° 35' 16.4616" Long E 91° 52' 23.9988"	0	0	0	0	1
6		Diengpasoh Police Station	Shillong by-Pass Road	Ummir	Lat 25.613692 Long 92.049075	0	0	4	3	2

7		Lumdiengjri Police Station	NH 44(E)	6th Mile	Lat N 25° 32' 44.5092" Long E 91° 50' 2.814"	0	0	2	3	4
8		Sohra Police Station	MDR	Laitryngew	Lat N 25° 25' 24.8088" Long E 91° 47 30.588."	4	7	5	9	0
9				Mawkdok	Lat N 25° 25' 24.7764" Long E 91° 47 30.6672"	6	5	4	6	0
10				Kyrdemkhla	Lat N 25° 26' 53.466" Long E 91° 49' 5.9088"	5	3	6	3	0
11		Sadar Police Station	NH 40	Near Military Hospital	Lat 25.5714086° Long 91.8726803°	3	2	1	1	1
12		Madanrting Police Station	NH 44	Laitkor	Lat N 25° 32' 29.7852" Long E 91° 53' 41.334"	4	1	3	4	1
13				Mawblei	Lat N 25° 33' 5.2524" Long E 91°54' 23.3856."	2	2	1	3	0
14		Mawryngkneng Police Station	NH 44 & Shillong By-Pass Road	Puriang	Lat 25.54517 Long 92.10248	187	214	180	141	4 (only Fatal Accidents)
15				Mawryngkneng/Dewsaw	Lat 25.5693083 Long 92.0612033					
16				Thangshalai	Lat 25.5790686 Long 92.059599					
1	EAST GARO HILLS	Williamnagar PS	NH44E	Khera	25.5565055,90.546625				1	
				chisobibra	25.5803268, 90.573877				1	
		Chiading PS	NH44E	Chinamgija	25.630006, 90.437267					1
		Songsak PS	NH44E	Songsak Agalgre	25.646487,90.638029 and 25.653016, 90.628113	1		1		2
			NH44E	Rongapgre	25.597182, 90.590691			1		
		Rongjeng PS	NH62	Gabildaningkha	25.7631450, 90.8142640	1				
				Darugre Tri- Junction	25.6101101, 90.7548890	1				
				Dambo Reserve	25.6626640, 90.8009820	1		3	2	2
1	WEST KHASI HILLS	Nongstoin P.S	NH-44E	Nongspung	25*32'25.1"N 91*20'29.0"E	2		1		1

1		Umiam P.S	NH-06 GS Road	Lad umroi	61+400 to 62+000	3		1		
2			NH-06 GS Road	Umtrew	54+000 to 55+300	3				4
3			NH-06 GS Road	Lad Sharai	56+500 to 57+600	2				
4			NH-06 GS Road	Sumer	57+600 to 59+000	1	4			
5			NH-06 GS Road	Umbang	59+000 to 60+000	2	2	1		
6			NH-06 GS Road	Umlaren	55+300 to 56+500	2				
7			NH-06 GS Road	Lad Umsaw	60+000 to 61+400	2				
8			Shillong By-Pass	Pyllun	01+400		2	2		
9			Shillong By-Pass	Mawpun Kshaid	04+500	1		2	1	
10			Shillong By-Pass	ICAR	62+000 to 62+400			1		1
11	RI-BHOI	NONGPOH TRAFFIC BRANCH	NH-06	Downgate Nongpoh NH-06	Chainage 500 mtrs	2	2	2	3	1
12			NH-06	Pahamrioh, NH-06	2 km	3	1	3	3	2
13			NH-06	Jyntru, NH-06	6 km	2	3	1	3	3
14			NH-06	Shangbangla NH-06	5km	3	1		3	3
15			NH-06	Pahamsyiem, NH-06	300 mtrs	4	2	4	4	1
16			NH-06	Nongpoh Proper	100 mtrs	4	2	4	1	3
17		UMSNING OP	NH-06	Carbalu	Chainage 39,900 km				7	
18			NH-06	Umrandairy	Chainage 43,400 km				20	4
19			NH-06	Sohbala	Chainage 46,800 kms				1	1
20			NH-06	Nongthymmai	Chainage 47,140 km				4	2
21			NH-06	Nongthymmai Junction	Chainage 48,140 km				4	2
22			NH-06	Umtrew Junction	Chainage 53,000 km				5	
23		UMROI PIC	NH-44	Umdohbyrthih Bypass	Chainage 19+000	3	2		1	1

24			NH-44	Dwarksuid By-pass	Chainage 13+000	2	1			
25			NH-44	Nongtraw By-pass	Chainage 19+000	1				2
26			NH-44	Bhoirymbong	PWD	1			1	
27		BYRNIHAT OP	NH-06 GS Road	12th mile	1+1000 mtrs	2	2	4	3	2
28			NH-06 GS Road	13th mile	2+400 mtrs		1	4	5	3
29			NH-06 GS Road	14th mile	4+6 mtrs	1	1	2		3
30			NH-06 GS Road	15th mile	5+600 mtrs	1	1	3	1	2
31			NH-06 GS Road	16th mile	6+700 mtrs	1	1		1	1
32			NH-06 GS Road	17th mile	10+500 mtrs	3	1		1	1
33			NH-06 GS Road	18th mile	11+200 mtrs		1	2	1	4

In Phase 1 of ITNDP, about 21 roads have notified black spot points.

4.9 Gap Analysis of Transport Intervention

Meghalaya has six modes of transport at the regional level, viz. Roadways, Railways, Waterways, Airways, Ropeways, and Beltways. Vehicles such as buses, trucks, taxis, cabs, cars, jeeps, and tractors of varied carriage capacities are the most widely used modes for transport in the State. These trucks constitute the major freight carriers.

4.9.1 Bus

Currently, The Transport Department is contemplating setting up an Inter-State Truck Terminus and two Inter-State Bus Terminus in the two District of the State, namely at Mawlein Ri-Bhoi District

and Mawiong East Khasi Hills District, and Tura, respectively. There is an existing Bus Stand at Phulbari, Tura, William Nagar, Sonapahar, and Shillong (see Figure 4.11).

However, keeping, population, and economic growth increase the mobility needs for goods and passengers, rising at an annual rate of 9%. The passenger transport sector is becoming highly energy-intensive because of a shift in consumer preference from public transport to private transport, which has severe implications for climate change and air quality. There is an urgent need to arrest this shift and undertake necessary measures to increase public transport use for urban mobility and inter-city travel. The new terminal's location depends on Access and approach, Existing capacity and future demand estimation, Enhanced level of service, integrating multi-modal accessibility and feeder infrastructure, Crime prevention through environmental design (CPTED), Integrating universal design.

Keeping the factors Population density (Population/Km^2), Tourist places, Agriculture points, Colleges, Railway station, Hospital, Universities, Industries, the following location of bus terminal is identified for future requirement as the population keeps on growing in many cities. The overall minimum distance between two airports is assumed to be 30km, and the population and other facilities mentioned above are the primary criteria for selecting a terminal. Table 4.6 shows the requirements for choosing Bus terminals in Meghalaya.

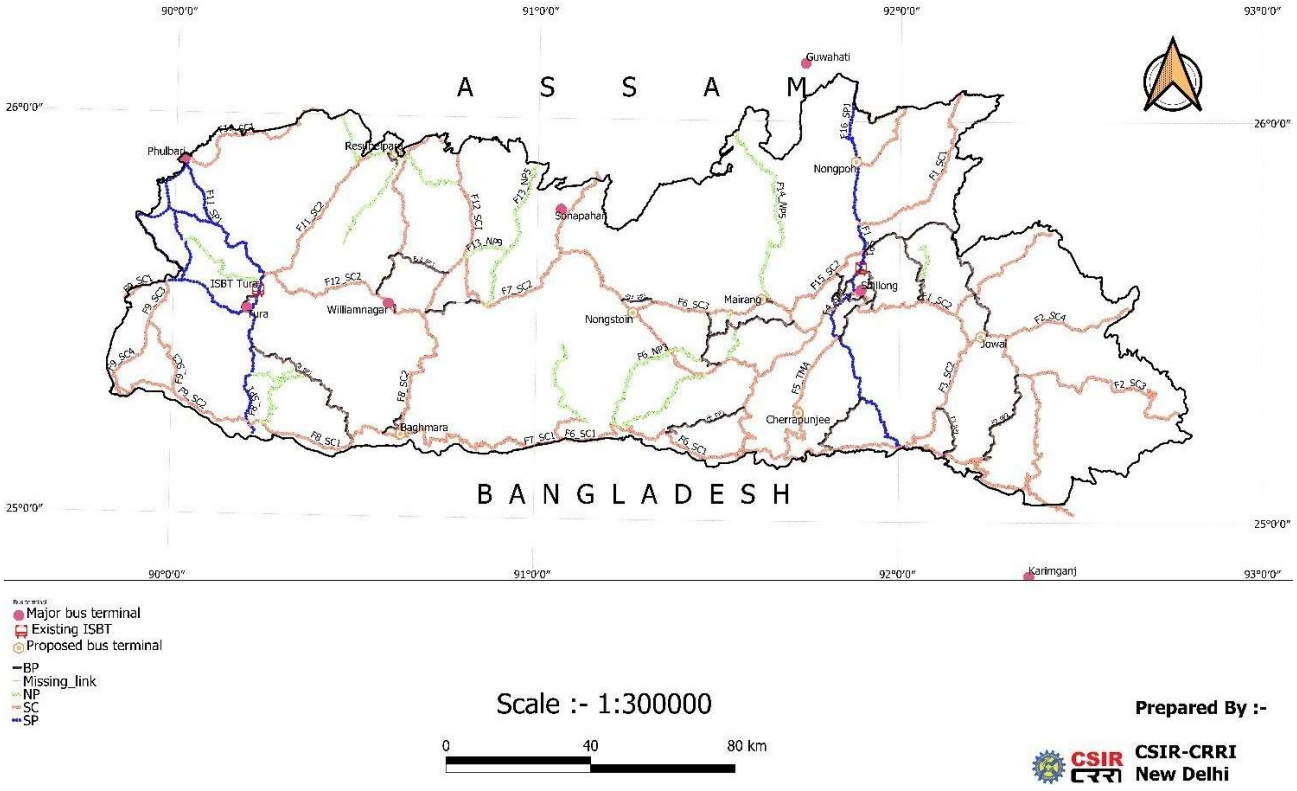


Figure 4. 11 **Bus Terminal Location Map**

Table 4. 6 Criteria used in the selection of new bus terminal

Sr. No	City(21 Cities)	Population	Population density(Population/Km2)	Tourist places	Agriculture points	Colleges	Railway station	Hospital	Universities	Industries	Distance from nearby existing Bus terminal
1	Baghmara	9201	29.28	3	2	1	0	1	0		110
2	Nongstoin	46795	148.89	4	0	1	0	2	0		63
3	Resubelpara	23057	73.36	8	2	1	1	0	0		60
4	Cherrapunji	32477	103.34	12	1	1	0	0	0		58
5	Jowai	52867	168.21	13	1	3	0	2	0		42.5
6	Mairang	125102	398.05	4	1	2	0	1	0		38
7	Nongpoh	44487	141.55	2	1	1	0	1	0		30
8	Shilong(MB)	225881	718.71	11	5	5	0	2	0		15
9	Mawlai	139776	444.74	11	1	34	0	8	6		9
10	Umroi	40705	129.52	3	2	0	0	0	1		7

11	Umlyngka	265573	845.01	12	2	33	0	8	5		6.5
12	Nongkesh	236879	753.71	12	2	33	0	8	5		5
13	Madanriting	196577	625.47	12	2	33	0	8	5		4.5
14	Pynthormukhrah	163705	520.88	12	1	34	0	8	6		4
15	Umpling	182336	580.16	11	2	33	0	8	5		4
16	Lawsohtun	258609	822.85	13	3	32	0	8	5		4
17	Nongmynsong	178306	567.34	13	2	34	0	8	5		3
18	Nongthymmai	193320	615.11	13	2	33	0	8	5		3
19	Shillong	185977	591.75	15	2	34	0	8	5		0
20	Williamnagar	60220	191.61	12	1	2	0	1	0		0
21	Tura	37635	119.75	9	1	8	0	2	1		0

4.9.2 Ropeway

Economical mode of transportation: Given that ropeway projects are built straight over hilly terrain, it also lowers land acquisition costs. Hence, despite having a higher cost of construction per km than roadways, ropeway projects' construction cost may happen to be more economical than roadways.

The ropeway is a Faster mode of transportation: Owing to the aerial mode of transportation, ropeways have an advantage over roadway projects where ropeways can be built in a straight line, over hilly terrain.

The ropeway is Environmentally friendly: Low dust emissions. Material containers can be designed to rule out any soiling of the environment.

Ropeway help to reach Last mile connectivity: Ropeway projects adopting 3S (a kind of cable car system) or equivalent technologies can transport 6000-8000 passengers per hour. Apart from road connectivity to the villages, there is also the need to connect to the agri-horticulture fields to transport the produces up to motorable points. While road connectivity is a difficult proposition, a ropeway system could solve the problem to a large extent. The Border Area Development Department of the Government of Meghalaya had introduced the ropeway system in a few villages. However, the scheme has not been very successful. The possibility could be freshly explored.

Ropeways cope with the demand for transport of goods/commodities by the people living in the southern parts where the terrains are steep, and construction of roads is challenging and expensive. The state has constructed 78 numbers ropeways at the total cost of Rs 1195.001akhs. Ropeway support farmers to move their agricultural produce, livestock, and other materials over the steep hills of the village. Development of the state as a 'high-value tourism destination,' building cable propelled transportation system (cable-cars/ropeways) as a long-term solution to 'decongest' Shillong city and decrease the carbon footprint.

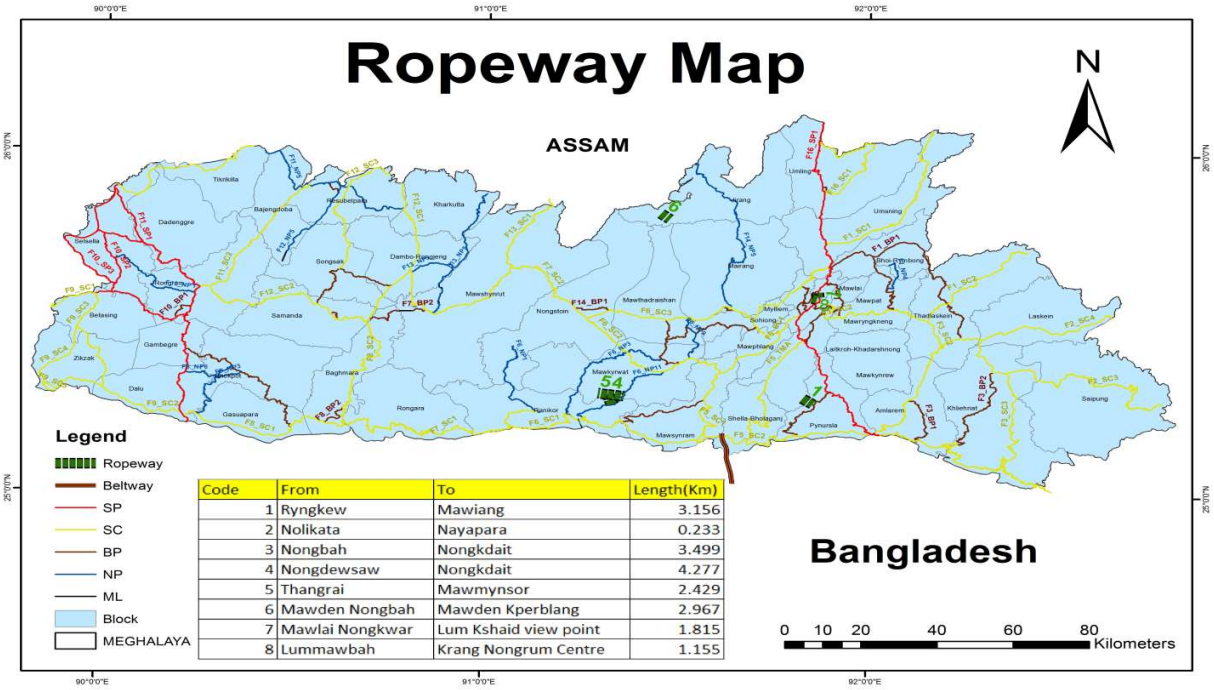
The Ministry of Road Transport and Highways (MoRTH) has decided to build ropeways across the difficult hilly areas of Northeast India to overcome transportation challenges, thereby developing robust infrastructure and multimodal connectivity.

Developing an efficient transport network is a big challenge in hilly areas. The rail and air transport networks are limited in these areas, while the development of road networks has technical challenges. In this backdrop, Ropeways have emerged as a convenient and safe alternate transport mode https://www.yumpu.com/en/document/read/4014058/pre-feasibility-study-report-of-gravity-ropeway-in-practical-action.

Development of Value Chain of Lakadong Turmeric in Meghalaya is possible by developing the roadways, ropeways, etc., to improve the accessibility between producer and market.

Based on the discussion with: Challenges of a construction Stakeholder workshop held at Meghalaya, January 2021, Meghalaya State Strategies for Transforming Urban and Regional Mobility, 14 September 2020.

The following are the eight ropeways identified in Meghalaya that needs attention in Phase 1 of ITNDP (See Annexure 8).



Code	From	To	Length(Km)
1	Ryngkew	Mawiang	3.156
2	Nolikata	Nayapara	0.233
3	Nongbah	Nongkdait	3.499
4	Nongdewsaw	Nongkdait	4.277
5	Thangrai	Mawmynsor	2.429
6	Mawden Nongbah	Mawden Kperblang	2.967
7	Mawlai Nongkwar	Lum Kshaid view point	1.815
8	Lummawbah	Krang Nongrum Centre	1.155

Figure 4. 12 **Ropeway and Beltway map of Meghalaya**

4.9.3 Beltways

Presently, the State has only one 17.00 km long conveyor belt which provides an uninterrupted supply of raw limestone from Nongtrai village, East Khasi Hills District, to the cement plant at Chhatak, Bangladesh, and is owned and managed by the Lafarge Company, a world-leading firm in cement and other building materials as shown in figure 4.12 above.

4.9.4 Waterways

Inland Water Transport (IWT) is operationally cheaper, high fuel-efficient, and environmentally friendly. It has a vast potential to act as an alternate and supplementary mode of transportation in certain conditions. India has many inland waterways consisting of rivers, canals, backwaters, creeks, lakes, etc., which have the potential for developing an efficient waterways transport network. However, the development of inland water transport has remained dormant for a long time.

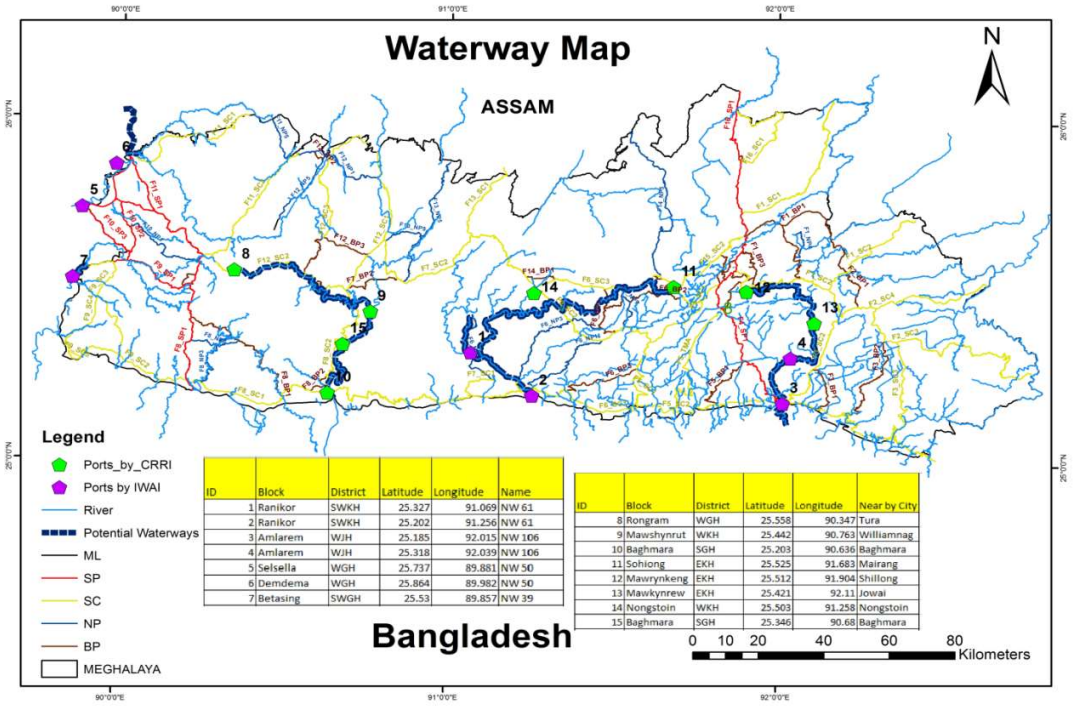
The Government approves feasibility studies of building up infrastructures for starting the small vessels, barges, pontoons, motorboats, and ferries in Jinjiram, Kynshi, Simsang. Umngot and Ganol Rivers for transporting persons and goods locally to Assam and Bangladesh and for boosting tourism

Data are collected from Source: Identification Of Potential Waterways in North East India prepared by RITES Report, Inland Waterways Authority of India, IWDA FINAL REPORT JULY 2011.

There are limitations of**:**

- Market Analysis
- Stakeholder involvement(Shipping, Line, Terminal Operator, Terminal User)
- EIA
- Costing

The waterway map (as shown in Figure 4.13) is identified with literature. There is a need for further study to explore all these tentative locations of the waterway terminal and waterway map.



ID	Block	District	Latitude	Longitude	Name
1	Ranikor	SWKH	25.327	91.069	NW 61
2	Ranikor	SWKH	25.202	91.256	NW 61
3	Amlarem	WJH	25.185	92.015	NW 106
4	Amlarem	WJH	25.318	92.039	NW 106
5	Selsella	WGH	25.737	89.881	NW 50
6	Demdema	WGH	25.864	89.982	NW 50
7	Betasing	SWGH	25.53	89.857	NW 39

ID	Block	District	Latitude	Longitude	Near by City
8	Rongram	WGH	25.558	90.347	Tura
9	Mawshynrut	WKH	25.442	90.763	Williamnag
10	Baghmara	SGH	25.203	90.636	Baghmara
11	Sohiong	EKH	25.525	91.683	Mairang
12	Mawrynkeng	EKH	25.512	91.904	Shillong
13	Mawkynrew	EKH	25.421	92.11	Jowai
14	Nongstoin	WKH	25.503	91.258	Nongstoin
15	Baghmara	SGH	25.346	90.68	Baghmara

Figure 4. 13 **Waterway Map in Meghalaya**

4.9.5 Air, Railway, and Heliports

- Airline passenger movement in North East India grows with each passing month.
- All the state capitals of the region's eight states would be connected by air and railway network by 2023-24. Most of the places in the Northeastern states are inaccessible and

located in far-flung areas. Road and Rail facilities are inadequate. Viable means of transportation in the Northeastern states is by air.

- In the next ten years, the number of aircraft will increase from 1448 to 2360, 1.6 times of current demand, whereas passengers will grow 1.7 times and air freight traffic 1.8 times in Meghalaya. To export high-value fruits, flowers, spices, herbal plants, sericulture, handicrafts, etc., facilities for cargo handling have to increase in the major airports of the NE region. For any study or survey in this regard, funds from this plan can be made available subject to the suitability of proposals and the size of the plan fund.
- Considering the growth, there is a need to develop and make the airport available at Tura in the next ten years. This will further require a traffic survey for which states concerned may submit a proposal for providing some funds subject to the financial size of this plan.
- Also, considering the growth in freight, an air cargo terminal is required at Shillong and Tura airports. Suitable proposals in this regard, funding may be considered under this plan.

4.9.6 **Railway**

- Meghalaya may not want to remain the only State to miss out on the Railway Ministry's plan for linking all State capitals with railway tracks by 2023. But political parties have a condition — only goods service will be allowed since the NGOs in the hill State think passenger trains will lead to an influx of outsiders. Three of the eight capitals of the northeastern States are on the railway map. They are Guwahati (within which official capital Dispur is located), Agartala, and Naharlagun (twin capital along with Itanagar).

- The work to link the capitals or take the railway line to the nearest point is in progress in Manipur, Mizoram, Nagaland, and Sikkim. Meghalaya does have a railway station — Mendipathar in the North Garo Hills district, meters beyond the border with Assam — but linking Shillong has been an uphill challenge for the Northeast Frontier Railway (NFR). NFR had in May 2017 put on hold the work on a 22-km track from Tetelia in Assam to Byrnihat in Meghalaya's Ri-Bhoi district. This line was to have been extended to Shillong uphill. The NFR abandoned the project after a violent protest by the KSU through about 20 km of the stretch in Assam was completed due to no acquirement of land for the remaining 2.3 km in

Meghalaya. The railway station building at Kamalajari in Assam has already been commissioned.

- Concerning the Byrnihat-Shillong railway line, the documents show that the total length of the project is 108.40 km. There will be 100 bridges on the route, the longest of which will be 701 meters. As part of the project, seven significant bridges will be constructed, the longest of which will be 350.5 meters. Six tunnels will be built, measuring a cumulative length of 3.733 km. The longest tunnel will have a distance of 1.760 km, and there will be two railway stations on the route.

- There will be ten stations on the proposed route, covering Byrnihat- Sohkhwai- Lailad- Umsong- Umar- Nongsder- Kyrdemkulai- Umroi- Umpling and end at New Shillong. Figure 4.14 shows the location of the stations.

- The proposed project will have 31 tunnels, covering a total length of 39.06 km. As much as 36.03 percent of the entire route will be through tunnels. The longest tunnel is proposed to be 4.14 km in length.
- It is attracting tourists worldwide who don't want to miss the mesmerizing romance of the toy train ride through the hills crisscrossing the Hill.
- The proposed Shillong-Sohra railway link would provide new opportunities for the State and the people who would utilize the railway for high-end tourism destinations and as separate facilities for farmers.

- Sohra, known as one of the wettest places on the earth, is about 50 km from Shillong, the state capital.

- In 1895-96, the British provincial government of united Assam built the Cherra (Sohra) Companyganj State Railways, and it was one of the first railway projects of that era.

- It was a contemporary of the Darjeeling Himalayan Railways or the "Toy Train," now listed as World Heritage.

- It will be the most sought-after train ride for people who would like to visit Meghalaya again and again. This will also provide a train ride for couples enjoying their honeymoon or celebrating their anniversary amid beauty and nature.
- The Meghalaya government's proposal for the Shillong-Sohra railway line is significant in the wake of the violent protests in the Khasi-Jaintia Hills region opposing the ongoing railway project connecting Meghalaya's Byrnihat in Ri Bhoi district with Assam's Tetelia in Kamrup district.
- Railway lines are needed in Meghalaya to develop agriculture, floriculture, and infrastructure.
- The length was identified as 51km from Shillong to the Sohra toy train.
- A future need is identified to extend the Railway line from Mendipatahar to Agangre-104 km in the future development to connect the mining area, tourist, and border trades.
- The entire above proposal needs a detailed study or survey to develop a concrete proposal.

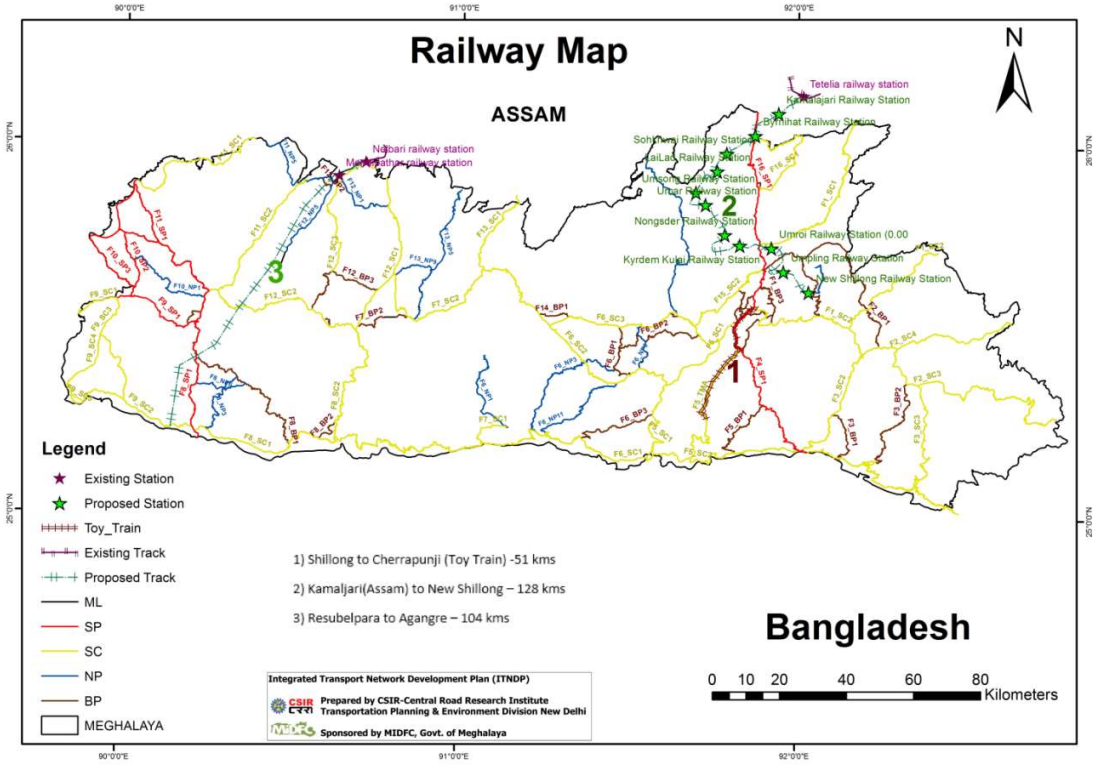


Figure 4. 14 **Railway proposal and existing track.**

4.9.7 Helipads

Helicopters have a tremendous future in India. Tourism and medical evacuation will be significant drivers of helicopter growth in India in the years to come. Given the ability of helicopters to fly in varied environments and because the infrastructure for fixed-wing aircraft can expand only incrementally, it is but natural for helicopters to grow at an unprecedented pace.

The need for frequently used helipads was felt during the Uttrakhand disaster, which has increased manifold for a seasonal religious pilgrimage like Amarnath, Kedarnath, MacPhail, Mani Mahesh, etc. The General and State elections have also seen extensive use of helicopters for electioneering and regularly operating from the temporary helipad. It is thus vital to lay down various facets of citing a helipad for safe helicopter operations in the form of a Checklist to ensure easy understanding and implementation of the applicable CARs on the subject by all concerned. It is also essential that State Govts, through District Administrations, ensure compliance with the Checklists while citing or approving a helipad for general flying, disaster management, tourism, seasonal pilgrimage, etc.

- Getting medical attention within the golden hour is saving the lives of many Indians from complex impact road accidents, house falls, trauma emergency response, and critical care also from natural or human-made disasters.
- Air ambulance in India is the most elevated standard medical emergency and non-emergency patient transit services provider for the people who need trauma or critical care, organ transplants, and other emergency services.
- These air ambulances will help move the patient from accident areas to healthcare facilities in India. The air ambulance in India will provide all the pre-medical emergency critical care.
- To help the air ambulance, the need for a helipad was felt in Meghalaya in different districts of Meghalaya.

- Also, Meghalaya has no civil helipad that has a disturbance in the transportation of people.

The type of helicopter operation governs planning criteria proposed such as Performance Class, visual flight rules (VFR), or Instrument Flight Rules (IFR) operations and the dimensions of the

helicopters intended to serve the heliport. The requirements for different procedures are provided by the Civil Aviation Requirements (CAR) of DGCA and ICAO.

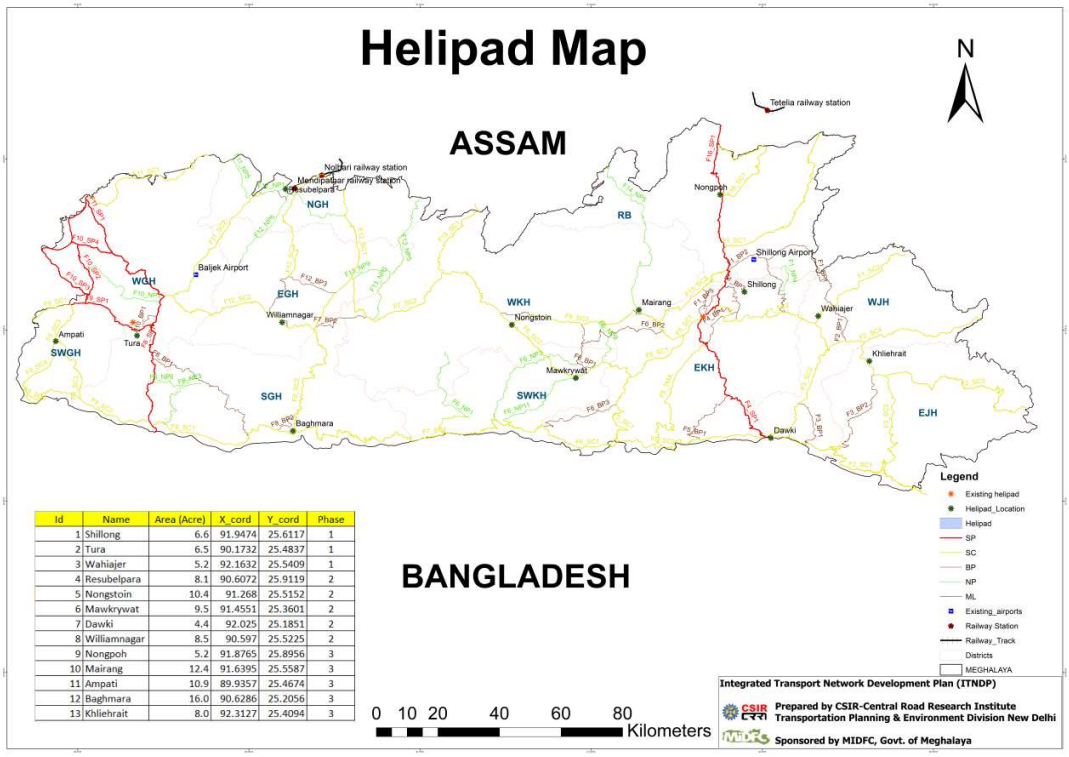
The following parameters have been finalized:

- The heliport will be planned to accommodate the largest of the fleet, presently in

Use for commercial operations in India.

- The heliport is intended to be operated by helicopters in Performance Class 1
- The heliport will be planned for.
- Detail identification will follow all the norms given by DGCA.

Currently, Tura and Shillong have only helipads. A tentative map location of the helipad for future development is shown in Figure 4.15. However, all the detailed investigations should be carried out per Civil Aviation Requirements and a thorough survey.



Id	Name	Area (Acre)	X_cord	Y_cord	Phase
1	Shillong	6.6	91.9474	25.6117	1
2	Tura	6.5	90.1732	25.4837	1
3	Wahiajer	5.2	92.1632	25.5409	1
4	Resubelpara	8.1	90.6072	25.9119	2
5	Nongstoin	10.4	91.268	25.5152	2
6	Mawkrywat	9.5	91.4551	25.3601	2
7	Dawki	4.4	92.025	25.1851	2
8	Williamnagar	8.5	90.597	25.5225	2
9	Nongpoh	5.2	91.8765	25.8956	3
10	Mairang	12.4	91.6395	25.5587	3
11	Ampati	10.9	89.9357	25.4674	3
12	Baghmara	16.0	90.6286	25.2056	3
13	Khliehrait	8.0	92.3127	25.4094	3

Figure 4. 15 **Tentative Map location of Helipad in Meghalaya**

4.10 Climatic Challenges

Transport networks underpin economic activity by enabling the movement of goods and people. During extreme weather events, transport infrastructure can be directly or indirectly damaged, posing a threat to human safety, and causing significant disruption and associated economic and social impacts. Due to intense precipitation, flooding is the predominant cause of weather-related disruption to the transport sector.

Flooding, especially flash flood events that start rapidly due to intense precipitation, is the predominant cause of weather-related disruption to the transport sector (DfT, 2014a). This is expected to continue (Dawson et al., 2016). This problem is particularly acute on the road network in urban areas due to the high proportion of impervious surfaces that prevent water infiltration into the soil. Heavy rain causes overland flow, resulting in drains exceeding their capacity and increasing the likelihood they become blocked by debris before flood warnings can be widely disseminated. The relationship between adverse weather, traffic flow, and congestion is acknowledged but poorly understood.

Reliable transport systems are valued for their safety, cost, travel time, and regularity of service. Maintaining the volume of traffic flow on the network, whether public transport or private travel, is fundamental for production, logistics, and business (Jenelius et al., 2006). Flooding impacts this in several ways through both direct impacts (e.g., physical damage to transport infrastructure) and indirect impacts (e.g., disruption to traffic flow, business interruption, increased emissions) (Brown and Dawson, 2016, Hammond et al., 2015, Walsh et al., 2012). Although direct damages could be consistent (USACE, 2009), the reduction in performance of transport systems due to flooding is the most detrimental factor for the society, and it has been estimated at around Rs 10000/- per hour for each main road affected (Arkell and Darch, 2006, Hooper et al., 2014). Meanwhile, studies have shown that roads are among the first cause of deaths in cities during flooding due to vehicles being driven through flooded roadways (Jonkman and Kelman, 2005, Fitzgerald et al., 2010, Drobot et al., 2007).

Flood risk analysis has been carried out based on frequent floods in the area, as shown in Figure 4.16 below. There is little location susceptible to flood. Alternate route identification is one of the approaches that can help users navigate further.

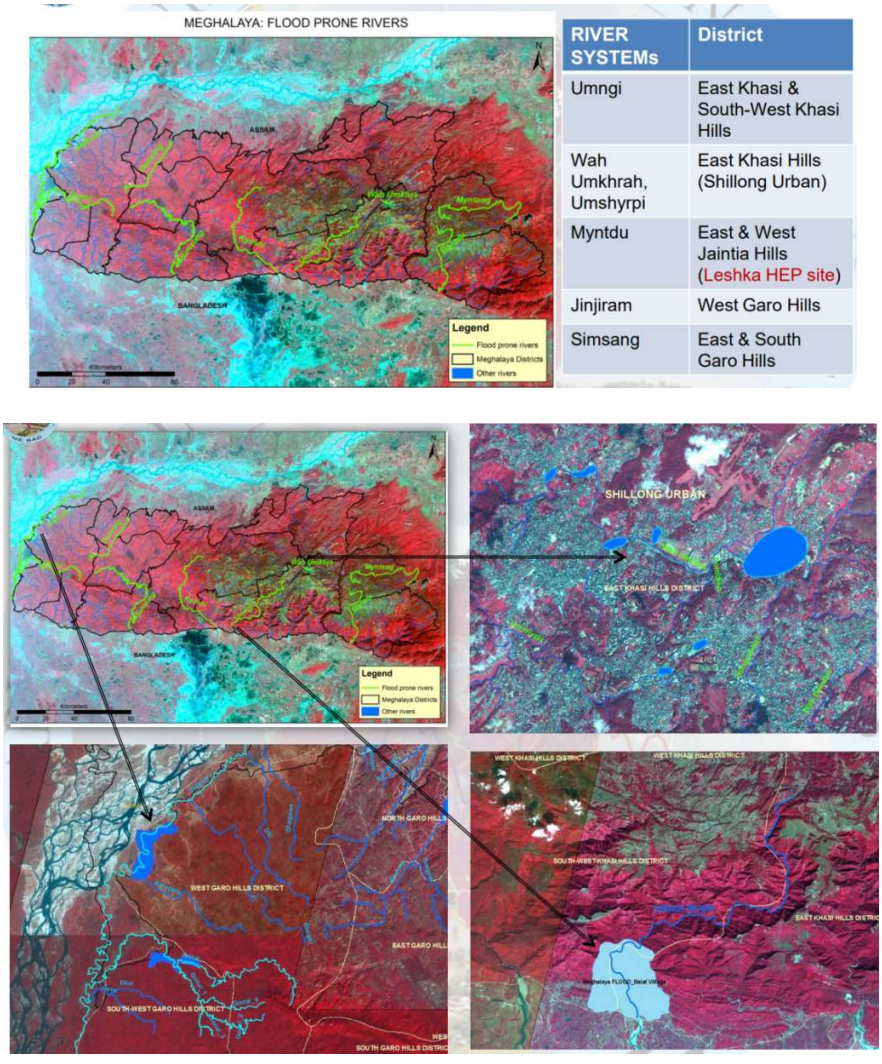
The Flood Prone Areas of Meghalaya

• Western part of Meghalaya like Tikrikilla, Phulbari, Rajabala, Garobadha, Hallidaygunj, Bhaitbari, Fersakandi, Magurmari, Silkata, Mahendraganj etc

• Plain areas near Bangladesh like Baghmara, Balat, Shella, Dawki, etc.

• Urban Flooding in localized areas of Shillong, Williamnagar, Tura, etc.

• Localized areas of West Khasi Hills, South West Khasi Hills, East Khasi Hills, Jaintia Hills, and Ri-Bhoi Districts.



RIVER SYSTEMs	District
Umngi	East Khasi & South-West Khasi Hills
Wah Umkhrah, Umshyrpi	East Khasi Hills (Shillong Urban)
Myntdu	East & West Jaintia Hills (Leshka HEP site)
Jinjiram	West Garo Hills
Simsang	East & South Garo Hills

Figure 4. 16 **Meghalaya Flood Prone Rivers and their zone (Source: NESAC)**

Rainfall resulted in impacting flows by reducing free-flow speed up to 9%. The commuting cost due to rain seemed to increase up to 15% and 7% for snowfall. Speed reduction is in the range of 25–30%. Heavy rainfall often leads to complete suspension of highway construction due to saturated and unworkable soil conditions. Therefore, quantifying the impact of rain on the productivity of highway construction is essential in preparing realistic schedules and cost estimates for the preconstruction stage and analyzing weather-related claims for the post-construction phase.

4.10.1 Conditional matrix for the construction of roads using cold mix technology

Table 4.7 below shows a conditional matrix for the construction of roads in different districts of Meghalaya and its construction feasibility. It is created by analyzing rainfall data and taking months where the average daily rainfall is less than 1 cm.

Table 4. 7 Conditional matrix for the construction of roads

Cold mix technology	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Garo Hills	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
East Jaintia Hills	Y	Y	Y,Nr	N	N	N	N	N	N	Y,Nr	Y	Y
South West Khasi Hills	Y	Y	Y, Nr	N	N	N	N	N	N	N	Y	Y
South West Garo Hills	Y	Y	Y	Y, Nr	N	N	N	N	N	Y	Y	Y
South Garo Hills	Y	Y	N	N	N	N	N	N	N	Y	Y	Y
Ri Bhoi	Y	Y	Y	N	N	Y, Nr	Y, Nr	Y	Y	Y	Y	Y
East Garo Hills	Y	Y	Y	N	N	N	N	N	N	Y, Nr	Y	Y
West Khasi Hills	Y	Y	Y, Nr	N	N	N	N	N	N	N	Y	Y
West Jaintia Hills	Y	Y	Y,Nr	N	N	N	N	N	N	N	Y	Y
West Garo Hills	Y	Y	Y	N	N	N	N	N	N	Y, Nr	Y	Y
East Khasi Hills	Y, Nr	Y, Nr	N	N	N	N	N	N	N	N	Y	Y

Y - Yes, construction can be done Y, Nr- - Construction can be done, but there is a chance of high rainfall, so it is not recommended N - Construction cannot be done

4.10.2 Construction Technique in a flood-prone area

The period of inundation by floodwater affects the strength of pavement layers significantly. In the case of inundation of road surface for 45 days, the CBR of sub-grade material may reduce by about 30 percent for medium compaction. Also, in the case of surface layers, the strength reduces substantially. Long-term inundation should be considered as a design parameter for designing roads. As flood is a perennial problem for a few parts of India and measures to prevent flood are not economically feasible, strategies to cope with floods may prove economically more justified. Considering the cost of rehabilitation of roads after the flood, even the increased initial cost to construct roads capable of withstanding inundation would prove to be much better in economic terms.

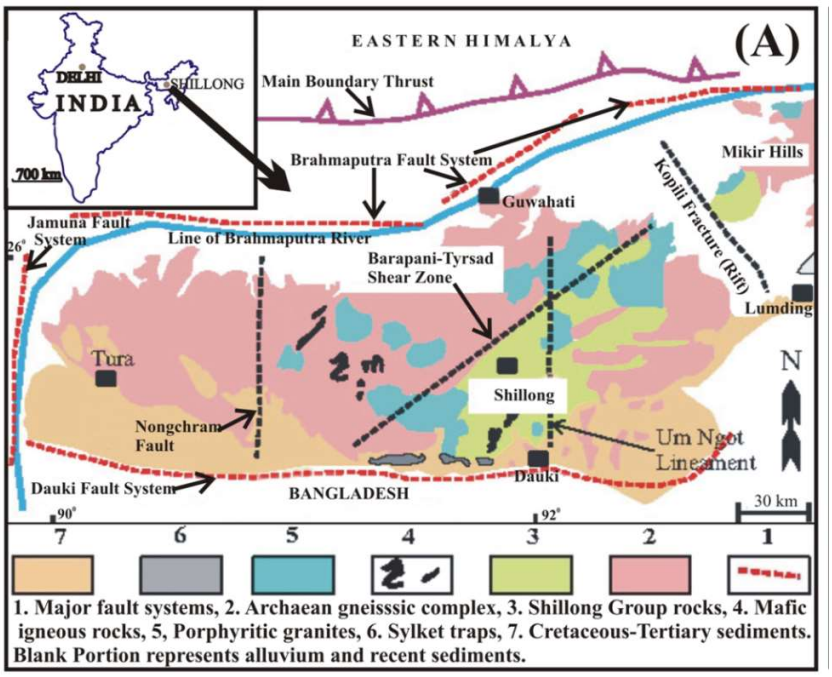
https://salekseraj.com/Page91-Jubair-4.pdf

https://www.sciencedirect.com/science/article/pii/S1361920916308367

https://nidm.gov.in/PDF/pubs/Landslide_Preparedness_Guide_.pdf

4.10.3 Construction and logistics in an earthquake zone

Nearly all of the state of Meghalaya lies on the "Shillong Massif." This block-like structure has not undergone much folding or faulting compared to the surrounding areas. The main threats to the state come from faults bounding the massif with the surrounding areas. The northern part of the massif has several faults, among the newly identified Oldham Fault believed responsible for the 1897 earthquake. The southern boundary is marked by the east-west trending Dauki Fault along the Bangladesh border. Moderate earthquakes have occurred in this state, but the most significant was the Great Assam earthquake of 1897. Centered across the state border in Assam, much of Meghalaya was severely jolted, especially Shillong.



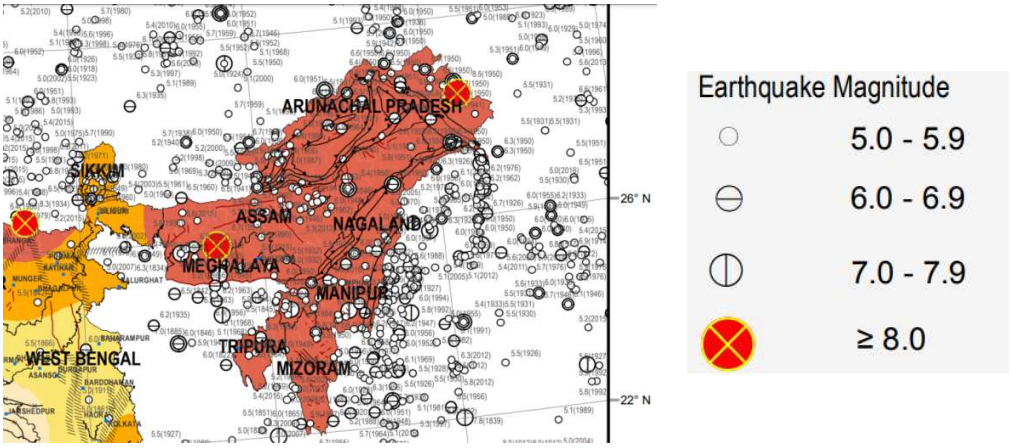


Figure 4. 17**Earthquake Hazard Map of Meghalaya**

- In 1958, Indian Roads Congress (IRC) published code provisions for seismic design of bridges, in which it provided a seismic zone map and seismic coefficients.
- The design of highway bridges in India is governed by the Indian Roads Congress (IRC) codes and railway bridges by the Bridge Rules of Indian Railways.
- Since both provide seismic provisions, the BIS code provisions on the seismic design of bridges are not commonly used.

- However, in some instances, the authority may require that the railway bridge must comply with the more conservative provisions of the BIS code and Bridge Rules.
- The IRC: 6 (Indian Roads Congress 1966) provides loads and stresses for the design of highway bridges.
- The code was first published in 1958 and revised from time to time. For the first three zones, the 1958 version provided three seismic zones with seismic design coefficients as zero, 5 %g, and 10 % g, respectively.
- Zone map also out several epicentral tracts based on past earthquakes; for such areas, the design coefficient was left at the discretion of the engineer 1376 Bull Earthquake Eng (2016) 14:1337–1436 123 responsible for the design.
- In 1979, the code adopted the seismic zone map of IS 1893 with the five seismic zones. It provided seismic design coefficients that depended not only on seismic zones but also on the importance of the bridge and the type of soil and foundation system.
- The guidelines prepared by the National Disaster Management Authority for managing earthquakes (NDMA 2007) provide for enforcement of codes in addition to many other elements, and it is now time to implement the same.
- SOP prepared by NDRF should be followed for logistic transport frame in providing support to local authorities when struck by the earthquake

4.10.4 Embankment Prevention in earthquake

- The resistance of embankment against earthquake is improved efficiently through reinforcement at the toe of walls.
- The position of the sliding surface in the dam can hardly be controlled through reinforcement at the toe of the walls.
- The resistance of embankment against an earthquake will be just a little improved with reinforcement at the upper surface of embankments.
- The reinforced area can prevent sliding failure to the upper surface of the embankment.

4.10.5 Thunderstorm in Meghalaya

Thunderstorm & Lightning/Squall/Dust Storm/Hailstorm and Strong Winds have a devastating impact on agriculture and aviation sectors in addition to surface transport, power, communication, and other socio-economic sectors. These may also lead to loss of human lives, assets/property/livelihoods, etc. Experts believe that due to rising global temperature and climate change (IPCC Special Report, 2018 - Global Warming of 1.5°C) 2, the severity and frequency of thunderstorms/dust storms will rise in the years ahead. Thunderstorms have essential characteristics such as storm formation, strong updraft and downdraft, towering cumulonimbus clouds associated with turbulence and icing, in-cloud electrification, associated lightning, localized heavy rain, and hailstorm. A dust storm associated with a thunderstorm generally carries very little rain, and the strong winds lift loose dust from dry land in arid and semi-arid regions. Sometimes, heavy rain and hail occur, which causes severe damage along with strong winds. Lightning is yet another weather-related disaster associated with thunderstorms.

North-East, East, and parts of peninsular India have registered a sharp lighting increase over the past two decades. The increase is minimal over Central India and moderates over the rest of the country. Cherpunji, Dhubari, Guwahati, Silchar, and Shillong have many thunderstorms. Figure 4.18 shows the thunderstorm map in Meghalaya.

Like any other natural hazard, lightning also exhibits inter annular variability. Compared to 2019, there is a 25% increase in lightning strikes in 2020. However, in 2021, data till June show a 10% decrease in lightning strikes compared to the corresponding period of 2020. Details of Cloud-to Ground strikes reported in 2019, 2020, and 2021 (till June) are given in Table 4.8 below.

Table 4. 8 Cloud-to Ground lightning strikes in Meghalaya

STATE	2019	2020	2021 (up to June)
Meghalaya	52949	9941	41906

Source: https://www.moes.gov.in/sites/default/files/LS-English-2992-06082021.pdf

Figure 4. 18**Thunderstorm Map of Meghalaya.**

4.10.5.1 Mitigation

- Ensure quick restoration of road connectivity and access to vulnerable areas
- A driver should try to exit the roadway and park safely. Stay in the vehicle and turn on the emergency flashers until the heavy rain ends. Avoid touching metal or other surfaces that conduct electricity in and outside the vehicle.
- The lessons learned from previous incidents, particularly regarding gaps in rescue and relief works and the shortcomings experienced in the process, should be dealt with carefully.
- Disruption of communication and transportation services and undue delays in clearing the fallen trees, electricity poles, and hoardings on the roads and streets that further delay the immediate transportation of the injured to nearby hospitals remains a significant challenge. The hierarchical structure for execution needs to be formalized so that all efforts are appropriately coordinated. Coordination for relief distribution is equally important to ensure qualitative and timely delivery, the lack of which may lead to duplication of efforts at some locations while leaving some others wholly starved.
- Guidelines for Preparation of Action plan - Prevention and Management of Thunderstorm & Lightning/ Squall/Dust/Hailstorm and Strong Winds 2018 prepared by the National Disaster Management Authority Government of India should be followed for further mitigation.

Source : (Guidelines for Thunderstorm & Lightning 2021 - Gujarat State Disaster Management Authority (GSDMA).).

4.10.6 Landslides

Landslides are the down-slope movements of rock debris or earth masses due to shear failure. Landslides may occur suddenly or through a prolonged period, with or without any apparent provocation. Landslides and other mass movements are common where the terrain is young, particularly in active mountain belts. Some of the structural & non-structural measures that can be undertaken to reduce the impact of landslides are:-

- As landslides mainly occur due to heavy precipitation, identify all stream runoff and clear congested areas before the rainy season to avoid blockade.
- Maintain and protect both sides of the river and stream to avoid erosion and improve the channels for unrestricted water flow.
- Training engineers and geologists for landslide mapping, investigation techniques, analysis, and observational practices.
- Develop an inventory of the existing built environment in areas around existing landslides and high hazard zones as per the landslides hazard Zone (LHZ) maps and along strategic road
- Monitoring landslide-prone areas either through an automated system or by preparing hazard area maps and following up ground checks on such vulnerable areas during monsoon or raining season.
- Laws should be enforced to regulate or prevent construction in vulnerable areas and ensure that any construction or developmental activities in high-hazard areas are cleared only after appropriate remedial measures are in place.
- Soil testing should be mandatory before permission is considered for any new construction. Organize public awareness campaigns on warning and protective measures, the importance of insurance, and structural mitigation measures.
- Conduct LHZ and prepare Landslide Incidences mapping.
- Paleoslide zones should be identified and mapped.

Fig. 4.19 shows a Landslide susceptibility map of Meghalaya using AHP prepared by Agrawal and Dixit 2021. High landslide susceptibility was observed at Baghamara, Maheshkola, Nekora, Ganganagar Cheragaon Ranikor Bagli, Balat, and Barson. It is vital to do the landslide mitigation technique in this section.

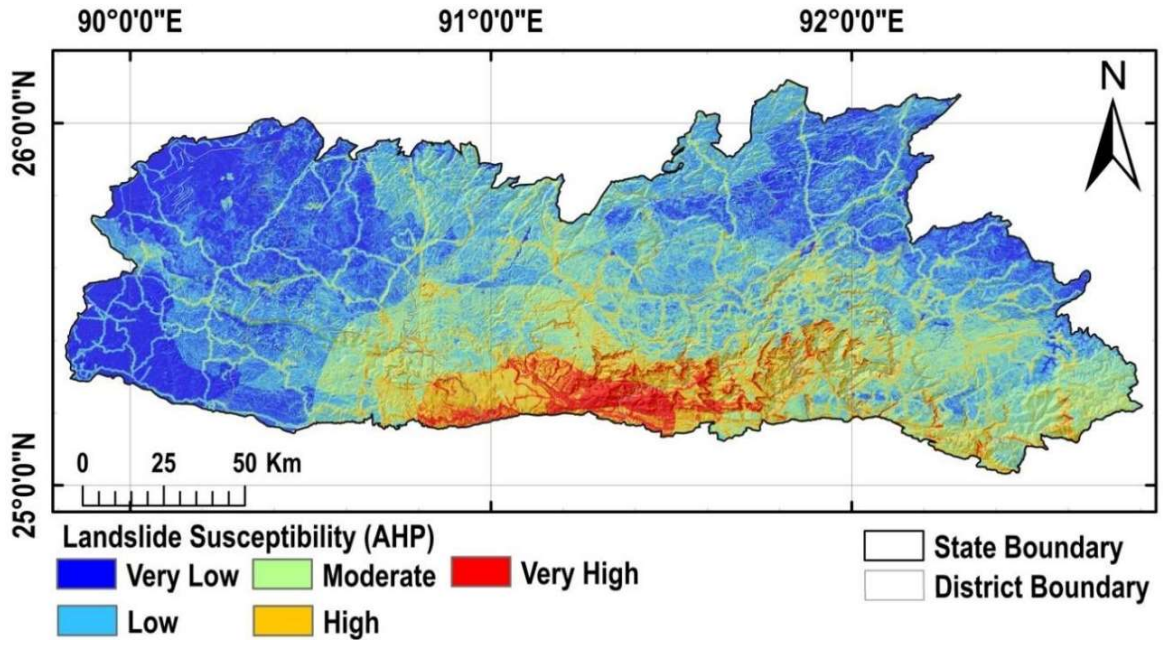


Figure 4. 19**Landslide susceptibility map of Meghalaya using AHP**

Analysis of landslides was made based on their occurrence, and alternate routes were identified in case of landslides. These routes or mitigation are shown in figure 4.20 shown below.

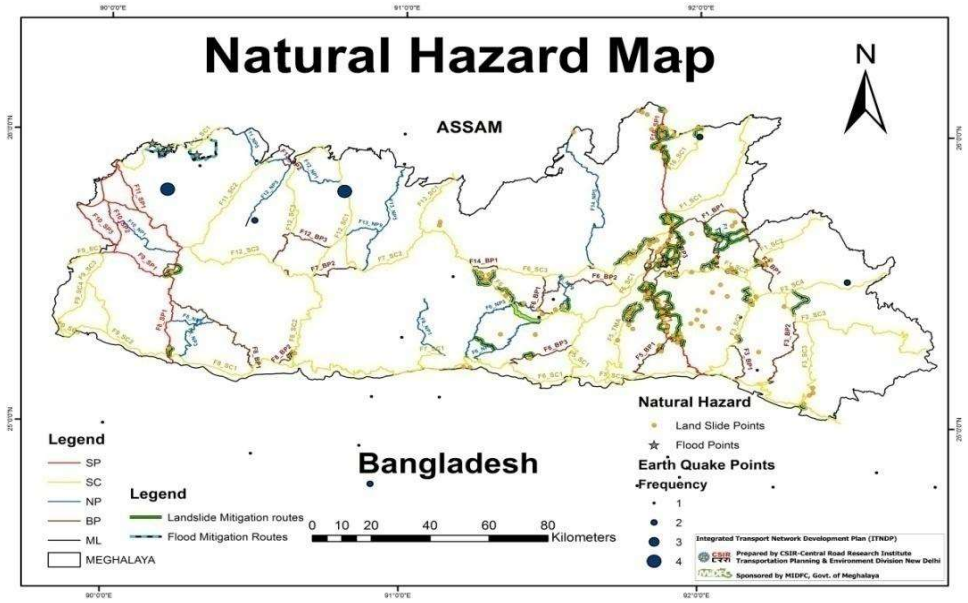


Figure 4. 20**Natural hazardous map showing landslide and their mitigation routes**

4.11 Gap Analysis of Road network

The number of additional roads was one indicator established as Transport Demand Need. The total number of km was broken down into the number of new NH (%4 Growth per annum), SH (0.6%), MDR (1.6%), and ODR (-1.6%), as shown below. A detailed discussion of the development of the transportation indicators as mentioned above.

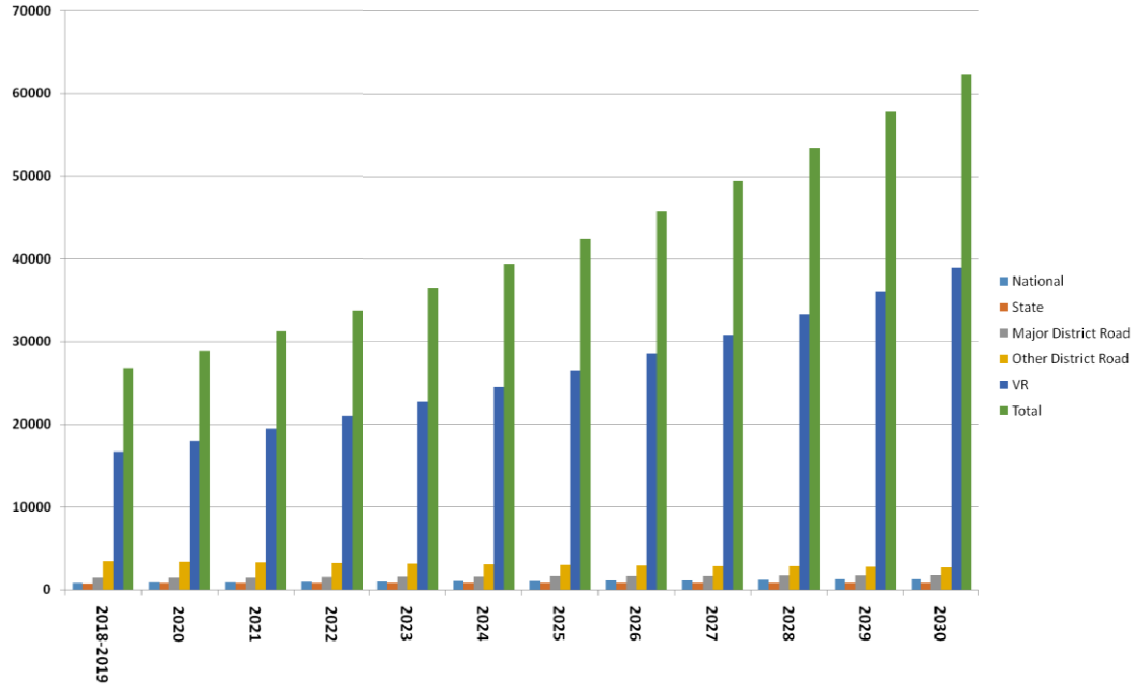


Figure 4. 21 **Trends in Road network development in Meghalaya**

Keeping the business as usual scenario, there is a gap between current and future, as shown in Table 4.9 below. This scenario shows a need to convert SH to NH, keep the growth, or convert MDR to SH and ODR to MDR. Also, the existing condition of roads is not good enough for speed and traffic flow. The village road and track will be continued to increase at a faster rate as compared to NH and SH.

Either they do not have proper maintenance or widen as per traffic requirement.

Table 4. 9 **Gap Analysis of projected road required versus current road network.**

Year	National(km)	State(km)	Major District Road(km)	Other District Road(km)	VR (km)	Total (km)
2021	884	777	1496	3314	19426	25897
2030	1259	820	1726	2688	38833	45326
Gap	375	43	230	-626	19407	19429
%	42	6	15	-19	100	75

IRC 52: 2019 suggested a Guideline for Alignment Survey and Geometric Design in Hill Roads. The projection has been made for traffic in PCU per day for the carriageway width, and the existing width of the carriageway does not sustain the growth of vehicles @5-6% per annum in the state. The roads will be qualifying for lane up-gradation as follows.

3.5-meter lane width will qualify for medium lane 5.5-meter width in the next 14 years as per the rate of growth observed in Table 4.10.

The existing intermediate lane of 5.5-meter width will qualify for two streets in the next three years.

The existing two lanes of 7.5-meter width will qualify for four lanes of 14-meter lanes in the next eight years.

Table 4. 10 Required carriageway width in different horizon year

Low Curvature			Projected PCU per day			
Type of road	Carriage width	Traffic (Pcu/day)	10 years @ 11.50%	20 years @ 11.1074%	25 years @ 10.88	30 years @ 10.65
Single lane	3.5m	1600	4753	13152	21188	33311
Intermediate lane	5.5m	5200	15447	42743	68860	108261
Two lane	7.5m	7000	20794	57539	92696	145737
Multilane	4LANE	16334	48519	134255	216264	339181
High Curvature						
Single lane	3.5m	1400	4159	11508	18539	29147
Intermediate lane	5.5m	4500	13368	36989	7544	93688
Two lane	7.5m	5000	14853	41099	66212	104098

Source IRC 52: 2019: https://law.resource.org/pub/in/bis/irc/irc.gov.in.052.2019.pdf

4.11.1 Causes of Gaps

There is increased vehicle registration in the state, along with population growth. Additional lane km might be constructed to relieve congestion in the existing road system or serve new development areas in the northeast region. These additions of roads part of the Meghalaya road network can also reduce trip distances and give travelers more route options.

The BAU scenario needs a higher amount of new lane km for village roads than the other scenarios because there is a lack of transportation alternatives in a rural area. In the "BAU" scenario, the transportation system has less investment in transit and non-motorized transportation infrastructure in

villages or rural areas. There is also a greater separation distance between town and work and school. As distances increase, people are less likely to walk.

Because the transportation system remains relatively vehicles dependent, more people drive. This creates higher traffic volumes on the existing road system. Another reason for the gap in the number of lane kilometers needed for NH and SH is the more suburban development pattern in Meghalaya. New development stretches into new areas or greenfield sites. While the roads directly associated with new private development are paid from Government funding, the strategic location of Meghalaya, the spread of population and employment into new areas creates new travel patterns, the external trip from different parts of Meghalaya, new areas of congestion, and a need for new transportation links.

Compare this to the State vision, where new development happens in areas with an already existing product, and much of it occurs as infill development. There is very little development along transportation corridors, which helps maintain efficiency. Trips on village roads and villages are shorter and more walkable need special treatment.

4.11.2 Apply measures to close the Gap

1. From an international strategic perspective, 14 roads have been proposed. Figure 4.22 showed below the identified roads and called as International Corridor. The table shows the list of roads that requires different work categories.

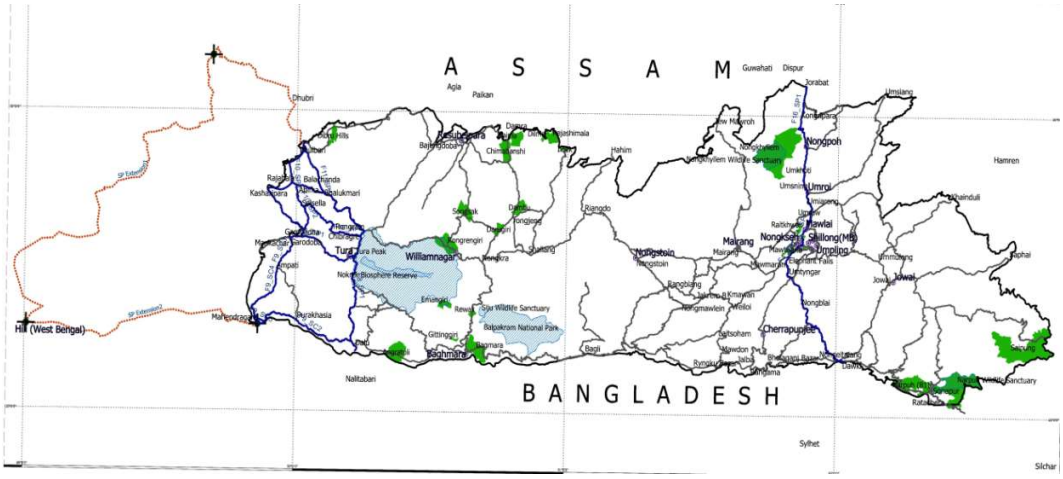


Figure 4. 22**International Corridor strategic**

Table 4. 11 IC Road identified in ITNDP

Road Code	Name of The Roads	District	Block	Classification of Roads	Category of Road	Length of Upgrading / Total Length(km)	Existing Lane Width	Traffic Based Qualification for upgradation	Category of Works
SP1/F-4	Shillong-Dawki	EKH, WJH	Laitkroh-Khadarshnong_Block, Mylliem_Block, Pynursla_Block	IC	NH	79/79	5.58m	3	Intermediate to Double lane /Four lane
SP1/F-16	UMSNING - Jorabat	RB	Umling_Block, Umsning_Block	IC	NH	47.2/47.2	14	10	Widening into six lane
SP-3/F-10	AMPT Road	WGH	Selsella_Block	IC	NH	22/44	5.5	3	2.00Km (Ch: 67th - 89th Km) Intermediate to double lane
SP-1/F-8	Barengapāra, Dalu-Rongram	WGH	Dalu_Block, Gambegre_Block, Rongram_Block	IC	NH	64.28/64.282	5.5	3	Intermediate to Double Lane
SP1/F-1	Shillong - UMSNING	EKH, RB	Mylliem_Block ,Umsning_Block	IC	NH	30.35/30.35	7.00 m	8	Periodic Maintenance & Widening is not possible on this road.
SC-4/F-09	Ampati bazar - Purakhasia	SWGH, WGH	Betasing,Zikzak	IC		47.9	7	8	Periodic Maintenance
SC-5/F-09	Mahendraganj Petrol pump - Sanjit Biswas - Near Mark Service station	SWGH	Zikzak	IC		5.8	5.5	3	Periodic Maintenance

SP-1/F-11	Rongram Phulbari (RP) Road	WGH	Dadenggre_Block, Rongram_Block	IC	SH	60/60	3.75	14	Single lane to Double lane
SP-1/F-9	Tura - Danakgre, Anggalgre, Harigaon, Goramara - Garobadha	WGH, SWGH	Rongram_Block, Selsella_Block	IC	SH	30/30	5.5	3	Intermediate to Double Lane
SC-3/F-09	Garodoba - Ampati bazaar	SWGH, WGH	Betasing Portion	IC	SH/ MDR	20	5.5	3	Widening to double lane
SP-2/F-10	GSB Road	WGH, SWGH	Selsella_Block	IC	NH/ MDR	22/22	5.5	3	Intermediate to Double Lane
NP-1/F-10	Selsella - Chibragre	WGH	Selsella_Block, Rongram_Block	IC		35.7/35.7	5.5	3	Intermediate to Double Lane, No allocation required.
SC-2/F-09	Barengapara -Nokchi - Purakhasia	WGH	DALU	IC	SH	28	5.5	3	Widening to double lane
SP-4/F-10	GSB Road	WGH	Selsella_Block	IC	MDR /VR	13	3.75	10	(single to Double lane)
SP exte-1	Phulbari (Meghalaya) to Hili(West Bengal)	WGH, Assam Bangladesh		IC	NH	245 km			The strategic treaty, encroachment clearance, and up-gradation are required.
SP Ext-2	Mahendragunj (Meghalaya) to Hili(West Bengal)	SWGH, Bangladesh		IC	NH	609 km			The strategic treaty, encroachment clearance, and up-gradation are required.

2. From a national connectivity perspective, 30 noads have been proposed. Figure 4.23 shows below the identified routes and called as National Corridor. The table shows the roads that require different work categories like safety improvement, widening, and maintenance (routine and periodic).

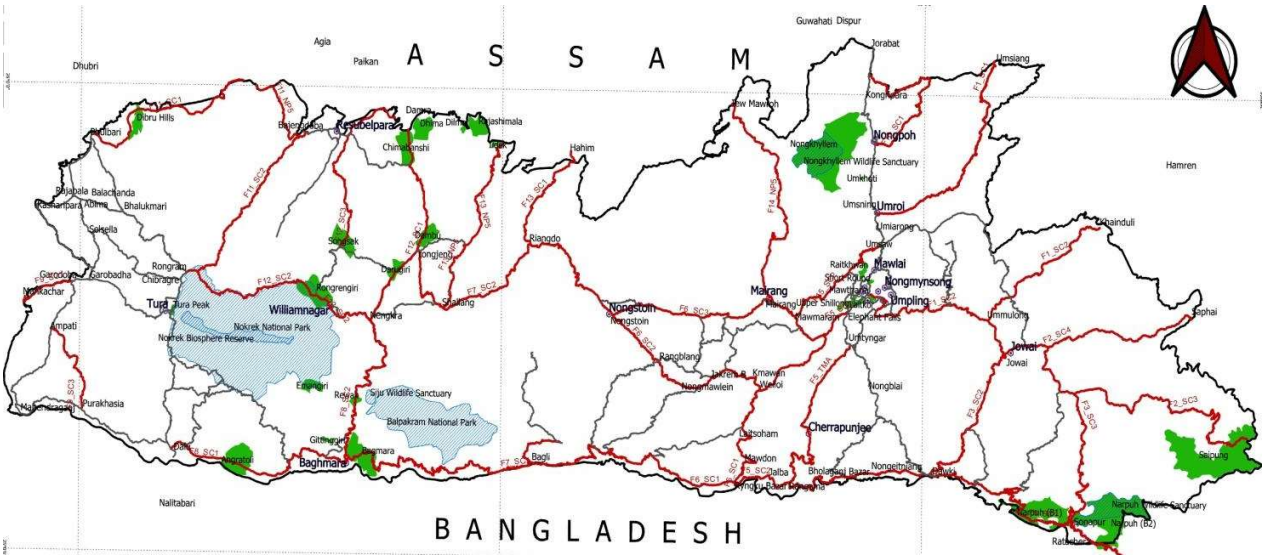


Figure 4. 23**National Connectivity Corridor**

Table 4. 12NC Road identified in ITNDP

Ranking of Roads	Road Code	Name of The Roads	District	Block	Classification of Roads	Category of Road	Length of Upgrading / Total Length(km)	Existing Lane Width	Traffic Projection	Category of Works	Agency
1	SC1/ F-5	Shillong - Karang	EKH	Mawphlang_Block, Mawsynram_Block, Mylliem_Block	NC	SH=50 .43 Kms MDR= 30 Km	80.43/ 80.43	3.75	14	Widening to double lane	NHIDCL
2	SC3/ F-3	Lad Rymbai Dongwah - Ratachera	EJH, WJH	Khliehriat_Block, Thadlaskein_Block, Laskein_Block	NC	NH-6	112/112	5.5	3	Widening to double lane	NHAI/BHARATMALA
3	SC2/ F-1	Khanduli-Ummulong	EKH, WJH	Mawryngkneng_Block, Mylliem_Block, Thadlaskein_Block	NC	NH/SH/MDR	51.3/101.3	5.5	3	51.30km to double lane and periodic maintenance	MORTH
4	SC2/ F-3	Dawki-Ummulong	WJH	Amlarem_Block, Thadlaskein_Block	NC	NH	67.78/ 67.78	Varies from 7 - 14m	8	Work Is In Progress Already	PWD
5	SC2/ F-7	Rongjeng - Shallang/Riangdo - Nonbah Taxi Stand, NH 44E, Upper New-Nongstoin	EGH, WKH	Dambo-Rongjeng_Block, Mawshynrut_Block, Nongstoin_Block	NC	NH-127B	102.8/ 102.8	7	8	Improve Geometry for road Safety measures and periodic maintenance	PWD
6	SC1/ F-12	Darugre - Dobu Rimding - Nengkhra	EGH, NGH	Dambo-Rongjeng_Block,Kharkutta_Block, Resubelpara_Block, Samanda_Block, Songsak_Block	NC	NH	62/62	5.5	3	Widening to double lane	Bharatmala
7	SC-2/F-12	Nengkhra - Sawilgre - Asanang	WGH, EGH	Rongram_Block, Samanda_Block	NC	NH, SH	62/70	5.5	8	(widening to double lane)	PWD
8	TMA 1/F-5	Dhorom - Umtyngar	EKH	Laitkroh-Khadarshnong_Block, Shella-Bholaganj_Block	NC	SH	62/62	6.2	3	Upgradation into the intermediate lane	PWD
9	SC-2/F-11	Rongram Bazar-Norangkol	EGH, NGH, WGH	Resubelpara_Block, Rongram_Block, Songsak_Block	NC	NH	62.13	8.80, 10.00 & 7.00	8	Widening to Standard 14m	Bharatmala
10	SC1/ F-7	Nongjri,Nonghyllam - Maweit Rd - Nekora - Baghmara	SWKH, SGH	Ranikor_Block, Rongara_Block	NC	SH	112.4	3.75	14	SINGLE LANE TO DOUBLE	NHIDCL
11	SC1/ F-13	Riangdo - Athiabari	WKH	Mawshynrut_Block	NC	SH	37.64/ 37.64	3.75	14	Widening from Single to Double Lane	MORTH

12	SC1/ F-8	Rongram - Williamnagar - Nengkhra	SGH, WGH	Baghmara_Block, Dalu_Block, Gasuapara_Block	NC	SH	60/60	3.75	14	Upgradation from Single Lane to Double Lane	MORTH
13	SC1/ F-6	Umtyllun - BAGLI COAL DEPOT	EKH, SWKH	Mawsynram_Block, Ranikor_Block	NC	NH,SH ,MDR, ODR	87/87	54km of3.75m / 7 kM OF 3.75 m / 26 kM of 3.00 m	14	Capacity Augmentation and Widening	PWD
14	NP5/ F-14	Mariang - Iew Mawroh (Sukurbaria)	WKH, RB	Jirang_Block, Mairang_Block	NC	SH	78.914	5.5	3	Existing BT is Damaged. Now road under up-gradation to be provided leveling course with WBM, BM, and SDBC.	PWD
15	SC2/ F-8	Nengkhra - Siju - Baghmara Circuit House	EGH, SGH	Samanda_Block, Baghmara_Block	NC	NH	71/71	54 Km =3.75 17 Km = 5.50	3	Upgradation of a Road to Double Lane	MORTH
16	SC2/ F-5	Dawki - Katrang	EKH, WJH	Shella-Bholaganj_Block, Pynursla_Block, Mawsynram_Block	NC	NH/SH/MDR	68.925 /68.925	5.5 &3.75m	3,14	Capacity Augmentation and Widening	PWD
17	SC4/ F-2	Phramer-Saphai	WJH	Laskein_Block	NC	SH	20/47	5.5	3	BT (SDBC) RENEWAL/ IMPROVE GEOMETRY	PWD
18	SC2/ F-6	Nonbah Taxi stand - Weiloi Catholic Church	EKH, SWKH, WKH	Mawkyrwat_Block, Nongstoin_Block	NC	MDR/ ODR	70.6/70.6	3.75	14	(Widening to double labe)	MORTH
19	SC-1/F-11	Phulbari - Hatogaon Pt.1	WGH	Dadenggre_Block, Selsella_Block, Tikrikilla_Block	NC	NH/SH	10.8/52.8	5.5	3	9.00 Km (Ch 32.00 Km - 41.00 Km)WMM-BT or CC-E	PWD
20	SC1/ F-1	UMSNING - Umsiang Maiong	RB	Umsning_Block	NC	MDR	40/80	3.75	14	PROPOSAL FOR INTERMEDIATE LANE (5.5 CARRIAGE WIDTH)	PWD
21	SC3/ F-6	Nongstoin-Mawngap	EKH, WKH	Mairang_Block, Mawphlang_Block, Mawthadraishan_Block, Nongstoin_Block	NC	NH	71.39/ 71.39	7	8	(Widening to 14m)	PWD
22	NP5/ F-13	Adokri - Shigrang, Memillan, Mitegittim, NengkraM, Simseng Atimbo, Mangsang Rangme Agal, Dalbot A - Shallang	EGH, NGH, WKH	Dambo-Rongjeng_Block, Kharkutta_Block, Mawshynrut_Block	NC	NH/MDR	46/57	NH=7m MDR - 5.50 ODR-3.75 PMGSY-3.00 Other Road-5.00	3	Improve geometry for road safety measure	PWD, PMGSY

23	F12/SC3	Songsak - Koksinengsat, Dagal, Sepikol, Thapdarenchi, Babupara, Salpara, Kashdiuripara, Damas - Damra Kashkona	EGH, NGH	Resubelpara_Block, Songsak_Block	NC	MDR	72/72	5.5	3	upgrade to double lane	PWD
24	SC1/F-9	Mankachar - Garodoba - Garobadha	SWGH	Betasing_Block	NC	SH	5/15	5.5	3	BT or CC Renewal	PWD
25	SC1/F-3	Sin Lung Hotel, Sonapur-Dawki	EJH, WJH	Amlarem_Block, Khliehriat_Block	NC	MDR/ODR	97/97	3.75	14	1. L=25 Km - F (BT Renewal) 2. L= 35 Km-C & H (Earth to BT)	PWD
26	SC1/F-16	Nongpoh - Khulia	RB	Umling_Block	NC	MDR/ODR	58/58	3.75	14	Two Layers of WBM & BT	PWD
27	NP5/F-11	Warangre - Kimbaldam	NGH	Resubelpara_Block	NC	MDR	22/22	3.75	14	Proposed to upgrade to double Lane	PWD
28	SC3/F-2	DSSMH (Mookymp ad)-Moulsei	EJH	Khliehriat_Block, Saipung_Block	NC	MDR/PMGSY	84/84	(12-18 Km), W=7.00 m 2. (19-52 Km), W=3.75 m(52-65.50 Km)=3.75m	8	1. (12-18 Km)= F (BT Renewal) 2. (19-52 Km)= F& H (BT Renewal, improvement, and Widening). 3.(52-65.50 Km)= D (WBM to BT) 4.(65.50-84 Km)= C (Earth to BT)	PWD
29	SC3/F-9	Purakhasia - Garodoba	SWGH, WGH	Zikzak_Block, Dalu_Block	NC	SH	24.68/24.68	5.5	3	Widening to double lane	NHIDCL
30	SC2/F-15	Mawmaram - Umiam	EKH, RB,WKH	Mairang_Block, Mylliem_Block, Umsning_Block	NC	MDR	43/43	3.75	14	Widening to Double lane	PWD

3. From reducing congestion on in the city perspective, 24 needs have been proposed in different districts. Figure 4.24 shows below the identified roads and called Bypass. The table shows the list of roads that requires different work categories like safety improvement, widening, capacity up-gradation, maintenance (routine and periodic).

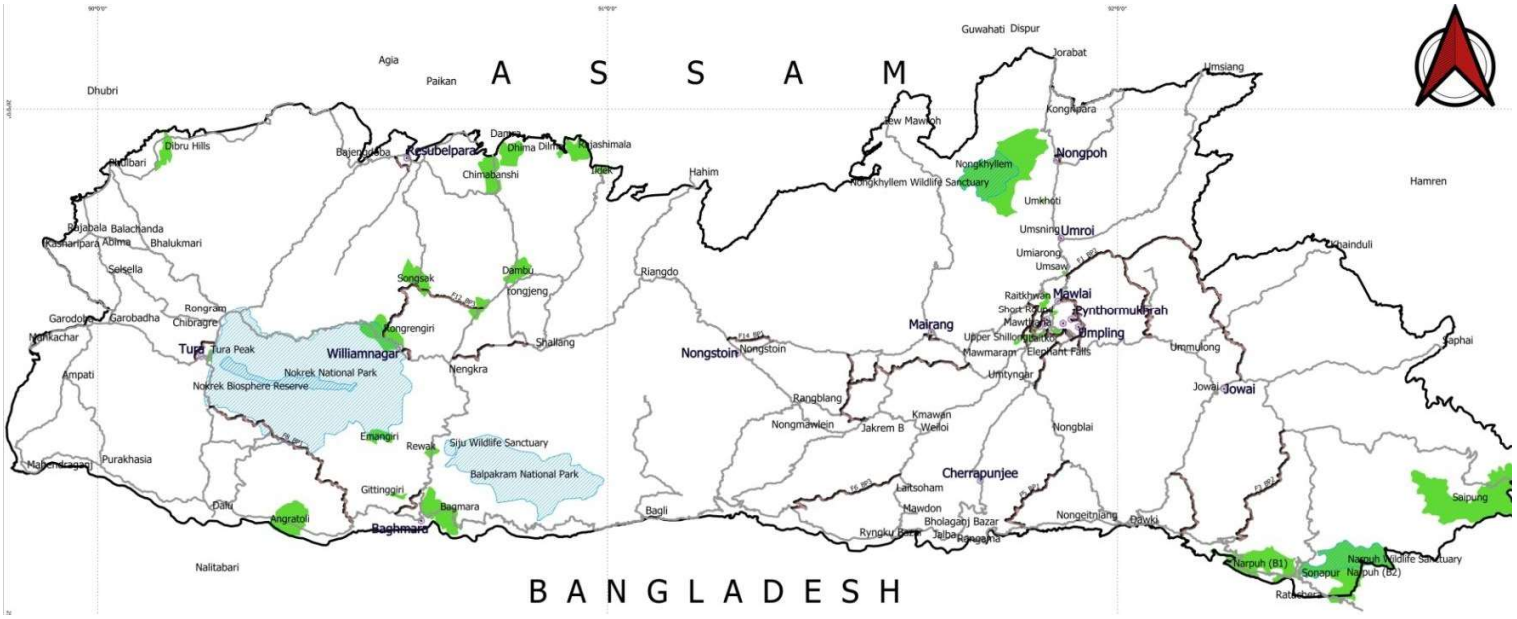


Figure 4. 24**Bypass Connectivity**

Table 4. 13BP Road identified in ITNDP

Ranking of Roads	Road Code	Name of The Roads	District	Block	Classification of Roads	Category of Road	Length of Upgrading / Total Length(km)	Existing Lane Width	Traffic Projection Year	Category of Works

1	F3/BP1	Amlarem - Muktapur	WJH	Amlarem_Block	BP	MDR	24.6/24.6	3.8	8	WBM to BT or CC
2	F1/BP1	Nartiang -Wah Umkhen	RB, WJH	Thadlaskein_Block, Umsning_Block	BP	MDR	38/48	0-10 (5.5m) 11-26 (3.75m) 26-48 (3.75m)	3,14	Strengthening from 11th km to 26thkm BT or CC Renewal-F, I- to Improve Geometry for road safety measures for 26 to48 km.
3	F1/BP2	Mawryngkneng-Umiam T Point at GS Road near Botanical Garden	EKH, RB	Mawryngkneng_Block, Umsning_Block	BP	NH	50.9/50.9	3.75	14	Widening into double lane
4	F12/BP3	SH1 near Siso Bibra - Dalbot Bollonggre, Rongsak, Songsak, Rongre Bazar, Nadingre - SC1 near Nengbret	EGH	Dambo-Rongjeng_Block, Samanda_Block, Songsak_Block	BP	**NH**	16/48	7	8	Improve Geometry for road Safty measure
5	F12/BP1	PWD Rd - Nengkra ,Kusimkolgre, Rangmal Badim SDA Company Seventh-day Adventist church - Jakobgre, Samgong Market, Williamnagar SDA Church - Circuit House	EGH	Samanda_Block	BP	MDR, Urban roads	4.5/4.5	3.8	14	periodic maintenance
6	F1/BP3	Umphyrnai - Wah Umkhen - Nongnysong bypass - Pynthor Mukhran	EKH	Mawryngkneng_Block, Mylliem_Block - Byepass division	BP	ODR, Others road	12.7/30.55	3.8	14	periodic maintenance
7	F1/BP4	3.5 mile - Demthring	EKH	Mylliem_Block	BP	Other roads	16.98/16.98	3.75	3	Earthen to BT
8	F3/BP2	Bataw-Paradise Restaurant, Ladrymbai Rymbai road	EJH	Khliehriat_Block	BP	MDR	48.75	1. L=7.00Km, W=7.00 m 2. L=41.75 Km), W=3.75 m	8	(BT Renewal)
9	F16/BP1	Ïew Nongpoh - Nonpoh Bus stop	RB	Umling_Block	BP	ODR	2.59/2.59	3.8	14	One layer of WBM & BT
10	F6/BP1	Nongshilong - Jakrem B	WKH, SWKH	Mawkyrwat_Block, Mawthadraishan_Block	BP	MDR	15/29	3.75	14	PMGSY=7.00 km PWD=22.00km WBM to BT or CC
11	F15/BP1	Junction of NH-40 (6th Mile Farm)-Mawdun	EKH	Mylliem_Block	BP	VR	15	3.8/3.8	14	Upgradation/ Earth to BT
12	F5/BP1	Bholaganj Bazar-Pynursala	EKH	Pynursla_Block	BP	MDR	47.24/47.24	3.8	14	periodic maintenance
13	F7/BP2	Nengkra - Sudugre - NH127B near Dabol	EGH, SGH,	Baghmara_Block, Mawshynrut_Blo	BP	VR (STATE)	25/25	3.8		Earth to BT or CC

		Nongben	WKH	ck, Samanda_Block						
14	F4/BP1	Laitkore - Ksehbilat	EKH	Laitkroh-Khadarshnong_Block, Mylliem_Block	BP	MDR	15.57		14	No Upgradation, just periodic maintenance
15	F1/BP5	Rhino Shopping Arcade – St; Edmund's School Sports T Point	EKH	Mylliem_Block-Jowai central division	BP	NH, VR, Others	15	8	8	No Upgradation
16	F2/BP1	Moorap-Jowai	WJH	Thadlaskein_Block	BP	SH	20/20	5.5	3	WBM-BT Renewal- / / Improve Geometrics
17	F8/BP1	Daluagre(Baro Mile) - Chigisimgre, Dobagre, Chokpot, Daromgre, Bethagre - Sibbari Border Haat	SGH, WGH	Chokpot_Block, Gasuapara_Block	BP	MDR	62/62	3.75	14	Widening from Single Lane to Intermediate Lane
18	F6/BP3	Mawshaliah - Mawsynram	EKH	Mawsynram_Block	BP	SH	33.94/33.94	3.75	14	Capacity augmentation, Widening into the intermediate lane.
19	F6/BP2	Sohiong Pariong Road	WKH, EKH	Mawthadraishan_Block, Mawphlang_Block	BP	MDR, PMGSY, OTHERS	42.4/42.4	3.75	14	Capacity augmentation, Widening into an intermediate lane.
20	F10/BP1	Matchakolgre-Eden Bari	WGH	Rongram_Block	BP	VR and URBAN roads	10.5/10.5	3.8	14	Earth to BT or CC-
21	F12/BP2	Boda Apal - Resubelpara Municipal Board	NGH	Resubelpara_Block	BP	ODR	5.5/5.5	3	14	Earth to BT and Proposed for intermediate lane
22	F14/BP1	Nongspung-Nongstoin	WKH	Nongstoin_Block	BP	NH, URBAN ROADS	4.5/13.5	3.75	14	periodic maintenance
23	F14/BP2	MeECL - Mawlong Presbyterian Church	WKH	Mairang_Block	BP	VR AND PMGSY	5.38/5.38	3	14	(Periodic Maintenance)
24	F8/BP2	Jaksongram (NH62) - Gitinggre - Masighat (NH62)	SGH	Baghmara_Block	BP	VR and Other Roads like Border Roads, tracks, trail, etc	10.4/10.4	3.8	14	Earthen to BT (Double Lane), Widening from Single Lane to Intermediate Lane

4. From Border Hat, Agriculture, Market and Mines Connectivity perspective, ten numbers of roads have been proposed in different districts. Figure 4.25 shows below the identified roads and called New Proposal in Phase1. Table 4.14 shows the roads that require different work categories like new construction, widening, capacity up-gradation, safety improvement, maintenance (routine and periodic), and Renewal.

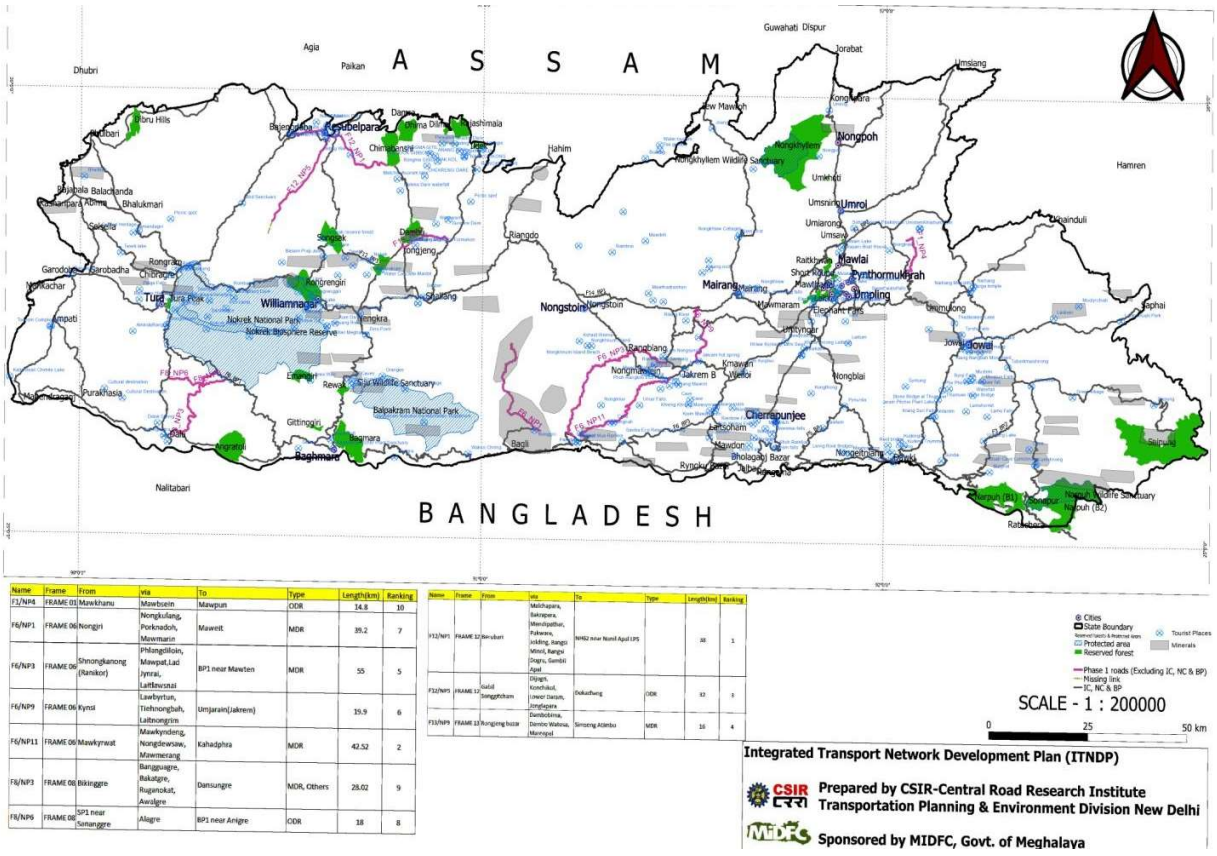


Figure 4. 25**New Proposal (NP) from Border Hat, Agriculture Market, and Mines Connectivity**

Table 4. 14NP Road identified in ITNDP

Ranking of Roads	Road Code	Name of The Roads	District	Block	Classification of Roads	Category of Road	Length of Upgrading / Total Length(km)	Existing Lane Width	Up-gradation Year projection	Category of Works
1	F12/NP1	Berubari - NH62 near Nanil Apal LPS	NGH	Resubelpara_Block	NP	MDR/ODR	38/38	5.5	3	new construction

2	F6/NP11	Mawkyrwat-Khadphra	SWKH	Mawkyrwat_Block, Ranikor_Block	NP	MDR	42.52/42.52	3.75,5.5	14,3	widening into the intermediate lane
3	F12/NP5	Gabil Songgitcham - Dijogri, Konchikol, Lower Daram, Jonglapara - Dekachang	NGH, EGH	Resubelpara_Block, Songsak_Block	NP	ODR	32/32	3.75	14	Upgradation Earthen to BT and an upgrading from single lane to double lane
4	F13/NP9	Rongjeng bazar - Dambobima, Dambo Watesa, Mareapal - Simseng Atimbo	EGH	Dambo-Rongjeng_Block	NP	MDR	5.5/16	NH - 7.50 MDR- 5.50 PMGSY - 3.00	3	Upgrading to Double Lane
5	F6/NP3	Shnongkanong-Mawten	SWKH	Mawkyrwat_Block, Ranikor_Block	NP	MDR	55/55	3.75	14	widening from single lane to double lane to MDR and for VR single lane to intermediate lane
6	F6/NP9	Kynsi - Umjarain	WKH, SWKH	Mawthadraishan_Block, Mawkyrwat_Block	NP	MDR/ODR	5/19.9	3	14	WBM to BT or CC and Widening
7	F6/NP1	Nongjri - Maweit	WKH, SWKH	Nongstoin_Block, Ranikor_Block	NP	MDR	39.2/39.2	3.5	3	Earth to BT or CC-(Propose to intermediate lane
8	F8/NP6	SP1 near Sananggre - Alagre - BP1 near Anigre	SGH, WGH	Dalu_Block, Chokpot_Block	NP	ODR	18/18	3.75	14	BT or CC Renewal-F
9	F8/NP3	Bikinggre - Bangguagre, Bakatgre, Ruganokat, Awalgre - Dansungre	SGH, WGH	Gasuapara_Block, Chokpot_Block	NP	MDR/VR	23.2/28.02	3	14	Improve Geometry for road Safety measures and Earthen to BT
10	F1/NP4	Mawkhanu - Mawpun	RB, EKH	Mawryngkneng_Block, Umsning_Block	NP	ODR	14.8/14.8	3.75	14	Five

5 Prioritization and Financing

5.1 Introduction

Over the last decade, National Highways have improved significantly due to implementing several projects related to strengthening and widening 2-lane roads to 4-lane dual carriageway standards.

Following the success of the Ministry of Road Transport and Highway, Govt. of Meghalaya has taken up a study Integrated Transport Network Development Plan for improvement of N.H., S.H., M.D.R., O.D.R., R.R.

The funds available to State Plan are generally limited compared to the length of roads that need improvement. Therefore, it is necessary to prioritize these sections and carry out the initial selection of NH/SH/MDR/RR sections for revision as per the priority. Once road sections are selected as per the prioritization, a pre-feasibility/ feasibility study may be carried out to identify the most suitable improvement option commensurate with available funding. Then a detailed project report may be prepared before execution of the recommended improvement proposal.

Funds for the development of roads in Meghalaya has been distributed into various plan and schemes, as mentioned below.

1. **General State (O.D.R.) and Special Plan Fund (SPF-MDR) (State Plan) -**In this plan implementing schemes for construction, metalling & blacktopping, improvement/strengthening of damaged pavement, and construction of R.C.C. bridges/re-construction of Semi-Permanent Timber bridges to permanent R.C.C. structures are considered. Priority has been considered for roads leading to market areas, educational institutions, health centers, and villages that do not cover under the guidelines of the P.M.G.S.Y. program. For further enhancement of road development in the State, especially in rural areas, the State Government provides funds to the Department by availing a loan from N.A.B.A.R.D. under Rural Infrastructure Development Fund (R.I.D.F.).

2. Special Plan Assistance (S.P.A.)

The existing pavement in many **stretches** of State Highways (S.H.s), Major District Roads (M.D.R.s), and Urban Roads are badly damaged, thus plying vehicular traffic. Their safety has

been adversely affected. Because of the above, the State Government sanctioned funds for immediate restoration and up-gradation of heavily damaged pavement under Special Plan Assistance (S.P.A.). Some of the examples are as below

- Upgradation of S.H.s and M.D.R.s,
- Improvement of critical feeder roads & missing gaps,
- Replacement of S.P.T. bridges,
- Strengthening and up-gradation of link roads under Mahendraganj Town,
- A new highway connecting Jongchetpara village with O.D.R. Salmanpara - Mellim road,

3. **Special Central Assistance**- Externally Aided Project (E.A.P.) under A.D.B., State Share EAP/ADB, Periodical Renewal of existing S.H. roads, Periodical Renewal of existing District & Other Roads,

1. State Share for N.E.C., State Share for Non-Lapsable Central Pool of Resources (N.L.C.P.R.).

4. **Asian Development Bank (A.D.B.)**

This is a centrally sponsored scheme with 100% central funding, and A.D.B. will provide loans to the project on a 70:30 basis. State Government is to bear the cost of land acquisition, resettlement, rehabilitation, environmental mitigation, utility service re-location, and road maintenance for 5 (five) years after construction and the project implementation unit.

The sanctioned project is taken under North Eastern State Roads Investment Programme (N.E.S.R.I.P.) under A.D.B. loan Number 2770, Package Number M.L.-C.W.1. The project road, M.L.N. 1, in the State of Meghalaya, referred to as Garobadha – Dalu Road (with N.H.-51), is a State Highway (SH-12) and is a part of connectivity corridor between Tura, the headquarter of West Garo Hills District skirting within the international border with Bangladesh in the south-west corner of the State, connecting N.H.-51 at Dalu near Bangladesh border. This road has been prioritized as Tranche-1 road due to its strategic importance. The length of the road project as per design in the D.P.R. is 93.40 km, and the sanctioned amount is ₹ 19682.00 lakh. The project is progressing well, and as of December 2016, the physical progress is 54%, and the financial gain is ₹ 9004.76 lakh.

5. **Special Accelerated Road Development Programme SARDP-NE**

On the initiatives of the Prime Minister, the Ministry of Road Transport and Highways has taken up an ambitious Special Accelerated Road Development Programme (SARDP-NE) for the development of road networks in the northeastern states of the Country. This program envisages providing road connectivity to all the district headquarters in the northeast region by minimum two-lane highway standards apart from road connectivity to backward and remote areas, areas of strategic importance, and neighboring countries. The program is planned in two phases (A & B), including Arunachal Package, Phase-A is under progress, and Phase-B is in the conceptual stage. Road under the different program of N.H. is given below.

Table 5. 1Road under different programmes of NH

Road type	program	Length
BMP	Bharatmala	91 Km
Bharatmala		331.861 Km
JICA		317 Km
NK	In Principal NH	182 Km
SARDP	Special Accelerated Road Development Programme	260.845 Km

6. **North East Special Infrastructure Development Scheme (N.E.S.I.D.S.)** - The N.E.C., under the Ministry of DONER, has been funding the road schemes in the State right from the 5th Plan onwards till date. The different road scheme funded by N.E.C. includes Construction of New roads, Improvement, and widening, including Metalling and Blacktopping, and Reconstruction of Semi-permanent Timber bridges / B.U.G. Bridges to R.C.C. double-lane bridges. The funding pattern is 90% Central Share, and 10% is State Share. There are no proper criteria for the selection of schemes under N.E.C. However, selecting projects is generally considered mainly on the roads that can benefit more than two States. As of 01-04-2016, there are seven ongoing schemes, of which 5 (five) have been completed. The Bank of Sanction is ₹ 19.35 crores. Ministry of DONER does not allow provision for consultancy and the State P.W.D. bears the cost for the same, keeping requirement in the P.W.D. Budget for making necessary payments

to the consultants. As of 01-01-2017, there are 12 numbers of ongoing schemes having a Bank of Sanction of ₹ 5216.134 lakh.

7. Inter-State Connectivity (I.S.C):

The Central Government has also identified the project of road or Bridge on State Highways and Major District Roads to be sanctioned under Interstate Connectivity (I.S.C.) in consultation with the State Government. This scheme should facilitate inter-State connectivity and ensure thorough communication between adjacent States. It is 100% funded by the Central Government. As of 01-01-2017, there are three ongoing schemes with a Bank of Sanction of ₹ 6951.74 lakh.

8. North East Special Infrastructure Development Scheme (N.E.S.I.D.S.)

The N.E.C., under the Ministry of DONER, has been funding the road schemes in the State right from the 5th Plan onwards till date. The different road scheme funded by N.E.C. includes Construction of New roads, Improvement, and widening, including Metalling and Blacktopping, and Reconstruction of Semi-permanent Timber bridges / B.U.G. Bridges to R.C.C. double-lane bridges. The funding pattern is 90% Central Share, and 10% is State Share. There are no proper criteria for the selection of schemes under N.E.C. However, selecting projects is generally considered mainly on the roads that can benefit more than two States. As of 01-04-2016, there are seven ongoing schemes, of which 5 (five) have been completed. The Bank of Sanction is ₹ 19.35 crores. Ministry of DONER does not allow provision for consultancy and the State P.W.D. bears the cost for the same, keeping requirement in the P.W.D. Budget for making necessary payments to the consultants. As of 01-01-2017, there are 12 numbers of ongoing schemes having a Bank of Sanction of ₹ 5216.134 lakh,

9. Pradhan mantra gram sadak yojana (P.M.G.S.Y.)

- For the implementation of road works under the P.M.G.S.Y. program, the State P.W.D. created a P.M.G.S.Y. Cell in the year 2003.

- P.M.G.S.Y. was implemented in Meghalaya from 2000-2001 to complete erstwhile B.M.S. Schemes total 208 in number. This was termed Phase I. An amount of ₹ 34.95 crores for 468.81 km of road length was released for Phase I projects.
- Since the inception of Regular P.M.G.S.Y. in Meghalaya from 2001 to 2013, the G.O.I. has sanctioned 645.24 Km of road under four subsequent phases of works at an amount of ₹ 27228.00 Lakhs and benefitting 230 eligible habitations. At present, 223 habitations have been connected, including 182 targeted eligible habitations and 41 incidental eligible habitations with a road length of 608.45 Km.

  Meghalaya is one of the eight states selected under World Bank-funded P.M.G.S.Y. Rural Roads Project-II (RRP-II). Road Connectivity is being accelerated through World Bank Funding under Rural Roads Project II. The State was accorded sanction in three tranches to the tune of ₹ 81042.00 Lakhs. This includes 290 road works for a length of 1112.839 Km and 36 long-span bridges covering 297 eligible habitations. At present, 71 road works covering 318.712 Km have been completed, and 48 habitations

Table 5. 2 Allocation of budget in Meghalaya for different programmes

Program	Program	Allocation (in lakhs)2021
National Highways Development In Meghalaya	MORTH(NH)	60000
General State & Special Plan Fund	(GS&SPA)	43280.93
Special Plan Assistance	SPA	829.070
RIDF (NABARD's Loan)	RIDF	8000
Special Central Assistance	SCA	14462.000
NESIDS	NESIDS	4600.000
NLCPR	NLCPR	8446.000
NEC/NERSDS	NEC/NERSDS	1140.000
PMGSY	PMGSY	58609.610
Central Road FUND	CRF	3102.43
Normal repair(3054)	NR(3054)	26633.94
GRAND TOTAL		**229103.98**

  In phase 1 and Phase 2 of the scheme, against the set target of 1,300 kilometers,
- Meghalaya has completed 1,000 kilometers. The State is now approaching phase 3; by the start of 2022, it will start. The target is a 1,250 KM up-gradation of existing roads that have been connected.

5.2 Budget Allocation in Meghalaya for roads and Bridge

There is always a gap in funding; therefore, it is essential to identify the NH/SH/MDR sections that are eligible to be considered under different focus area funding schemes and then select cells

as per the priority for further detailed investigations and improvement. Funding in Meghalaya for roads and bridges is done through Central and state government and loan assistance. Table 5.1 shows the allocation in 2021. The central government has allocated 65.27 % of the total funding, comprised 26.19% of the total budget for NH, 25.58% total on P.M.G.S.Y. roads, and 13 5% from C.R.F. Only less than 34.73% are met from the state budget (see Figure 5.1 below). General State & Special

Plan Fund and Special Plan Assistance share 19% of the budget.

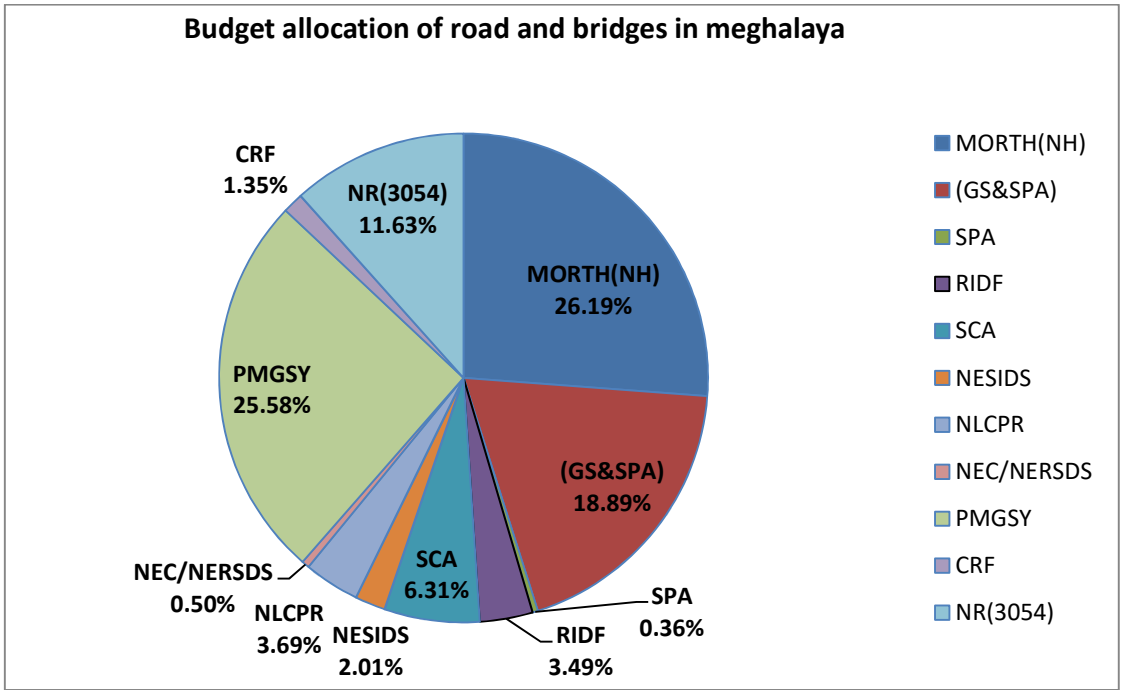


Figure 5. 1 % Budget allocation

The influencing factors and methodology for prioritization are directly linked with the purpose or context mentioned in Chapter 3. Also, the purpose or the context of prioritization factors in the present study is different from those reported in the literature. With this background, the study suggested a rational methodology for prioritization of NH/SH/MDR/ODR sections which will be used for the initial selection of road sections for carrying out feasibility/ feasibility study and preparation of detailed project report (D.P.R.). It includes identifying techno-economic factors, strategic factors, aspects importance of techno-economic factors in prioritization, the importance

of causal factors in potential safety hazards, and the estimation of the priority index for each road section.

Importance of Techno-Economic Factors in Prioritization: After identifying the techno-economic factors, it was necessary to derive the relative importance of these factors in prioritization. A survey instrument was designed to collect the significance of these factors and their marks, and the data were analyzed using Technique for Order Preference by Similarity to Ideal Solution (T.O.P.S.I.S.). Although these methods are well established and available in the literature, a brief outline of the application of T.O.P.S.I.S. of methods is given below for International connectivity (I.C.). The techno-economic factors included Volume/Capacity ratio, Number missing link, Time-saving, Population directly served by per km road parameter related with economic importance. The parameters in terms of its coverage to strategic section were considered as techno-economic factors were defined so that higher the value was the priority for improvement. Road safety is a significant issue in the Indian context, and therefore, it was necessary to consider the same during prioritization. Nine input parameters were extracted from all roads. (Refer Annexure 12 for Ranking procedure of all roads).

Table 5. 3 Extraction of Parameters of road identified from International Connectivity perspective

Road Name	Codes	Possibility in terms of cost of construction (Total Cost in Lakhs)	Connectivity (No. of villages connected, Total population on covered) (TOTAL)	Economic Importance(Connecting Tourist center, market centers, agriculture producing centers with more commercial crops, industries (medium/small/micro industries),) (in Number)	Coverage (Connecting International routes, roads, in border areas, Connecting National Highway, State Highways/inter-district roads connecting number of village roads including PMGSY roads,)(IN NUMBERS)	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity) (0-5)	Time-Saving (Condition of roads from traffic and inventory data,) (0-10)	Local Demand (Potential source of safety, Hazards, Border Area, Border Hat, Any other Significance) (0-10)	Pre-Feasibility width/Curve visual (Available carriageway) (0-10)
		X_{i1}	X_{i2}	X_{i3}	X_{i4}	X_{i5}	X_{i6}	X_{i7}	X_{i8}	X_{i9}
SP1/F-1	X_{1j}	910.5	17832	16	0	1.47	3.5	1.5	5.0	6.2
SP1/F-4	X_{2j}	158000	21364	22	1	6.38	4.9	9.2	9.2	8.5
SP1/F-16	X_{3j}	51733	28862	13	1	1.47	3.5	1.5	5.0	6.2
SP-1/F-11	X_{4j}	54420	9625	8	0	8.39	4.4	8.4	10.3	9.1
SP-1/F-8	X_{5j}	69101	5421	11	1	8.39	4.4	8.4	10.3	9.1
SP-2/F-10	X_{6j}	31900	4417	3	0	8.39	4.4	8.4	10.3	9.1
SP-1/F-9	X_{7j}	43500	9427	6	0	8.39	4.4	8.4	10.3	9.1
SP-3/F-10	X_{8j}	13200	20490	2	2	8.39	4.4	8.4	10.3	9.1
SP-4/F-10	X_{9j}	11791	3713	0	0	8.39	4.4	8.4	10.3	9.1
NP-1/F-10	X_{10j}	21600	6898	3	0	8.39	4.4	8.4	10.3	9.1
SC-2/F-09	X_{11j}	18200	5274	0	0	8.39	4.4	8.4	10.3	9.1
SC-3/F-09	X_{12j}	13000	4669	3	0	8.38	3.9	13.2	11.2	4.8
SC-4/F-09	X_{13j}	2395	33648	9	0	8.38	3.9	13.2	11.2	4.8
SC-5/F-09	X_{14j}	200	16735	2	1	8.38	3.9	13.2	11.2	4.8

Step 1: Normalization of Matrix:

Extracted data were further normalized using the equation for Table 5.3.

$$\overline{X}_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{n} X_{ij}^2}}$$

----------**Equation 5.1**

Table 5. 4 Normalized Matrix

Road Name	Codes	$\overline{X}_{i1}$	$\overline{X}_{i2}$	$\overline{X}_{i3}$	$\overline{X}_{i4}$	$\overline{X}_{i5}$	$\overline{X}_{i6}$	$\overline{X}_{i7}$	$\overline{X}_{i8}$	$\overline{X}_{i9}$
SP1/F-1	$\overline{X}_{1j}$	0.00	0.29	0.45	0.00	0.05	0.22	0.04	0.14	0.21
SP1/F-4	$\overline{X}_{2j}$	0.79	0.35	0.62	0.35	0.22	0.31	0.27	0.25	0.29
SP1/F-16	$\overline{X}_{3j}$	0.26	0.47	0.37	0.35	0.05	0.22	0.04	0.14	0.21
SP-1/F-11	$\overline{X}_{4j}$	0.27	0.16	0.23	0.00	0.29	0.28	0.24	0.28	0.31
SP-1/F-8	$\overline{X}_{5j}$	0.35	0.09	0.31	0.35	0.29	0.28	0.24	0.28	0.31
SP-2/F-10	$\overline{X}_{6j}$	0.16	0.07	0.08	0.00	0.29	0.28	0.24	0.28	0.31
SP-1/F-9	$\overline{X}_{7j}$	0.22	0.15	0.17	0.00	0.29	0.28	0.24	0.28	0.31
SP-3/F-10	$\overline{X}_{8j}$	0.07	0.33	0.06	0.71	0.29	0.28	0.24	0.28	0.31
SP-4/F-10	$\overline{X}_{9j}$	0.06	0.06	0.00	0.00	0.29	0.28	0.24	0.28	0.31

NP-1/F-10	$\bar{X}_{10j}$	0.11	0.11	0.08	0.00	0.29	0.28	0.24	0.28	0.31
SC-2/F-09	$\bar{X}_{11j}$	0.09	0.09	0.00	0.00	0.29	0.28	0.24	0.28	0.31
SC-3/F-09	$\bar{X}_{12j}$	0.07	0.08	0.08	0.00	0.29	0.25	0.39	0.30	0.16
SC-4/F-09	$\bar{X}_{13j}$	0.01	0.55	0.25	0.00	0.29	0.25	0.39	0.30	0.16
SC-5/F-09	$\bar{X}_{14j}$	0.00	0.27	0.06	0.35	0.29	0.25	0.39	0.30	0.16

Step 2: Weighted Normalized Matrix was calculated using the Weight multiplied by above table 5.3.

$V\_ij = X\bar{}\_ij \times W\_j$ ----------**Equation 5.2**

The weights obtained from the need score as mentioned in an earlier chapter.

Table 5. 5 Normalized Matrix

		W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9
Weightage		10.39	14.49	20.60	18.06	7.22	3.76	8.59	8.99	7.91
	Codes	V_{i1}	V_{i2}	V_{i3}	V_{i4}	V_{i5}	V_{i6}	V_{i7}	V_{i8}	V_{i9}
SP1/F-1	V_{1j}	0.05	4.20	9.34	0.00	0.37	0.84	0.37	1.22	1.65
SP1/F-4	V_{2j}	8.25	5.03	12.84	6.38	1.61	1.16	2.30	2.25	2.28
SP1/F-16	V_{3j}	2.70	6.80	7.59	6.38	0.37	0.84	0.37	1.22	1.65
SP-1/F-11	V_{4j}	2.84	2.27	4.67	0.00	2.12	1.05	2.10	2.51	2.42
SP-1/F-8	V_{5j}	3.61	1.28	6.42	6.38	2.12	1.05	2.10	2.51	2.42
SP-2/F-10	V_{6j}	1.67	1.04	1.75	0.00	2.12	1.05	2.10	2.51	2.42
SP-1/F-9	V_{7j}	2.27	2.22	3.50	0.00	2.12	1.05	2.10	2.51	2.42
SP-3/F-10	V_{8j}	0.69	4.83	1.17	12.77	2.12	1.05	2.10	2.51	2.42
SP-4/F-10	V_{9j}	0.62	0.87	0.00	0.00	2.12	1.05	2.10	2.51	2.42
NP-1/F-10	V_{10j}	1.13	1.63	1.75	0.00	2.12	1.05	2.10	2.51	2.42
SC-2/F-09	V_{11j}	0.95	1.24	0.00	0.00	2.12	1.05	2.10	2.51	2.42
SC-3/F-09	V_{12j}	0.68	1.10	1.75	0.00	2.11	0.93	3.31	2.72	1.30
SC-4/F-09	V_{13j}	0.13	7.93	5.25	0.00	2.11	0.93	3.31	2.72	1.30
SC-5/F-09	V_{14j}	0.01	3.94	1.17	6.38	2.11	0.93	3.31	2.72	1.30

Step 3: Calculation of ideal best (Vij maximum) and ideal worst (Vij minimum) value for each parameter

Table 5. 6 Ideal best and Ideal worst values

Ideal best	**V+**	8.252	6.801	12.837	12.769	2.117	1.160	2.302	2.511	2.423
Ideal worst	**V-**	0.048	0.875	0.000	0.000	0.371	0.838	0.369	1.217	1.646

Step 4: Calculation of Euclidian distance from ideal best Step 5: Calculation Euclidean distance from ideal worst.

$$S_i^+ = \left[\sum_{j=1}^{m}\left(V_{ij} - V_j^+\right)^2\right]^{0.5}$$

$$S_i^- = \left[\sum_{j=1}^{m}\left(V_{ij} - V_j^-\right)^2\right]^{0.5}$$ ----------Equation 5.4

Table 5. 7Ideal Best and Worst

Roads	Si+	Si-
SP1/F-1	16.08	9.91
SP1/F-4	6.65	17.23
SP1/F-16	10.41	11.85
SP-1/F-11	16.72	6.32
SP-1/F-8	11.58	10.16
SP-2/F-10	19.04	3.75
SP-1/F-9	17.52	5.23
SP-3/F-10	14.05	13.74
SP-4/F-10	20.53	2.95
NP-1/F-10	19.07	3.63
SC-2/F-09	20.30	3.05
SC-3/F-09	19.45	4.19
SC-4/F-09	17.04	9.56
SC-5/F-09	15.98	8.10

Step 6: Calculation of Performance score and ranking accordingly

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-}$$ ---------- Equation 5.5

Table 5. 8 **Performance index and Ranking**

Pi	Ranking	Roads
0.38	5.00	SP1/F-1
0.72	1.00	SP1/F-4
0.53	2.00	SP1/F-16
0.27	8.00	SP-1/F-11
0.47	4.00	SP-1/F-8
0.16	11.00	SP-2/F-10
0.23	9.00	SP-1/F-9
0.49	3.00	SP-3/F-10
0.13	14.00	SP-4/F-10

0.16	12.00	NP-1/F-10
0.13	13.00	SC-2/F-09
0.18	10.00	SC-3/F-09
0.36	6.00	SC-4/F-09
0.34	7.00	SC-5/F-09

Similar exercise has been carried out for BP, NC and NP to rank all the roads

5.3 Roads identified and ranking under ITNDP Phase 1:

The road length of 3451 km has been identified under NH, SH MDR, ODR, VR, and PMGSY in the first phase towards developing ITNDP detail is given in the table below and Fig 5;2. The road lengths under this category are categorized into NH/SH/MDR/ODR/VR and PMGSY.NH share 32%, SH24%, MDR 32%, ODR 7%, remaining from urban roads, PMGSY, and other roads. Roads under ITNDP classified as IC (14%), NC (59%), BP (18%), and NP (9%) categories. Their ranking has been done based on the acriteria mentioned above. The lists of the roads are given in Table 5.11 below. Their district-wise proposal is given in table 5.9.

Table 5. 9 Road length under development in ITNDP

	NH	SH	MDR	ODR	VR	PMGSY	Urban roads	Other Roads	TOTAL
IC	254	204	29	0	5	0	0	0	491
NC	739	573	566	133	0	16	0	5	2031
BP	105	54	324	21	65	2	8	46	625
NP	2	0	182	92	12	14	0	2	303
	1100	831	1101	245	82	32	8	53	3451

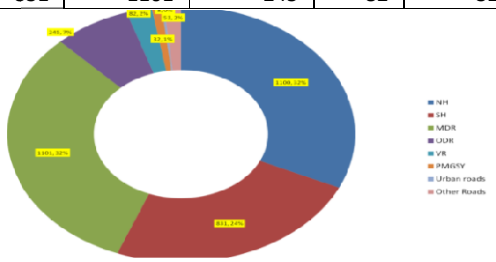


Figure 5. 2 **Classification of Roads under ITNDP Phase 1**

Table 5. 10 District wise proposal for ITNDP Phase-1

	District wise Phase 1 ITNDP road									
District	Phase 1 roads	SP	SP(km)	SC	SC(km)	BP	BP(km)	NP	NP(km)	Total Road Length (km)
EGH	12	0	0	6	121	3	43.24	3	52.8	2236.306
EJH	4	0	0	3	225.6	1	47.3	0	0	1986.667
EKH	20	2	90.1	8	337	9	200.6	1	6.2	3954.57
NGH	8	0	0	3	67.5	1	5.3	4	95.6	1304.619
RB	10	2	62.4	3	144.2	3	46.8	2	43.2	2714.019
SGH	8	0	0	3	202.5	3	79.5	2	40.8	1964.883

SWGH	6	2	14.1	4	106	0	0	0	0	1421.126
SWKH	8	0	0	3	127	1	16.1	4	127.8	1368.614
WGH	18	6	301	7	142.5	2	14	3	45.5	4834.478
WJH	9	1	2	5	211	3	66	0	0	2172.093
WKH	14	0	0	5	203.7	5	52.4	4	90.8	4392.952
Total	**117**	**13**	**469.6**	**50**	**1888**	**31**	**571.24**	**23**	**502.7**	**28350.00**

Road ranking details are given below in Table 5.10

Table 5. 11 List of Road Ranking of ITNDP

Ranking of Roads	Road Code	Name of The Roads	District	Block	Classification of Roads	Category of Road
1	SP1/F-4	Shillong- Dawki	EKH, WJH	Laitkroh-Khadarshnong_Block, Mylliem_Block, Pynursla_Block	IC	NH
2	SP1/F-16	UMSNING - Jorabat	RB	Umling_Block, Umsning_Block	IC	NH
3	SP-3/F-10	AMPT Road	WGH	Selsella_Block	IC	NH
4	SP-1/F-8	Barengapāra, Dalu-Rongram	WGH	Dalu_Block, Gambegre_Block, Rongram_Block	IC	NH
5	SP1/F-1	Shillong - UMSNING	EKH, RB	Mylliem_Block,Umsning_Block	IC	NH
6	SC-4/F-09	Ampati bazar - Purakhasia	SWGH, WGH	Betasing,Zikzak	IC	
7	SC-5/F-09	Mahendraganj Petrol pump -Sanjit Biswas - Near Mark Service station	SWGH	Zikzak	IC	
8	SP-1/F-11	Rongram Phulbari (RP) Road	WGH	Dadenggre_Block, Rongram_Block	IC	SH
9	SP-1/F-9	Tura - Danakgre, Anggalgre, Harigaon, Goramara - Garobadha	WGH, SWGH	Rongram_Block, Selsella_Block	IC	SH
10	SC-3/F-09	Garodoba - Ampati bazaar	SWGH, WGH	Betasing Portion	IC	SH/MDR
11	SP-2/F-10	GSB Road	WGH, SWGH	Selsella_Block	IC	NH/MDR
12	NP-1/F-10	Selsella - Chibragre	WGH	Selsella_Block, Rongram_Block	IC	
13	SC-2/F-09	Barengapara -Nokchi - Purakhasia	WGH	DALU	IC	SH
14	SP-4/F-10	GSB Road	WGH	Selsella_Block	IC	MDR/VR
1	SC1/F-5	Shillong - Katrang	EKH	Mawphlang_Block, Mawsynram_Block, Mylliem_Block	NC	SH=50.43 Kms MDR=30 Km
2	SC3/F-3	Lad Rymbai Dongwah - Ratachera	EJH, WJH	Khliehriat_Block, Thadlaskein_Block, Laskein_Block	NC	NH-6
3	SC2/F-1	Khanduli-Ummulong	EKH, WJH	Mawryngkneng_Block, Mylliem_Block,	NC	NH/SH/MDR

				Thadlaskein_Block		
4	SC2/F-3	Dawki-Ummulong	WJH	Amlarem_Block, Thadlaskein_Block	NC	NH
5	SC2/F-7	Rongjeng - Shallang/Riangdo - Nonbah Taxi Stand, NH 44E, Upper New-Nongstoin	EGH, WKH	Dambo-Rongjeng_Block, Mawshynrut_Block, Nongstoin_Block	NC	NH-127B
6	SC1/F-12	Darugre - Dobu Rimding - Nengkhra	EGH, NGH	Dambo-Rongjeng_Block,Kharkutta_Block, Resubelpara_Block, Samanda_Block, Songsak_Block	NC	NH
7	SC-2/F-12	Nengkhra - Sawilgre - Asanang	WGH,EGH	Rongram_Block, Samanda_Block	NC	NH,SH
8	TMA1/F-5	Dhorom - Umtyngar	EKH	Laitkroh-Khadarshnong_Block, Shella-Bholaganj_Block	NC	SH
9	SC-2/F-11	Rongram Bazar-Norangkol	EGH, NGH, WGH	Resubelpara_Block, Rongram_Block, Songsak_Block	NC	NH
10	SC1/F-7	Nongjri,Nonghyllam - Maweit Rd - Nekora - Baghmara	SWKH, SGH	Ranikor_Block, Rongara_Block	NC	SH
11	SC1/F-13	Riangdo - Athiabari	WKH	Mawshynrut_Block	NC	SH
12	SC1/F-8	Rongram - Williamnagar - Nengkhra	SGH, WGH	Baghmara_Block, Dalu_Block, Gasuapara_Block	NC	SH
13	SC1/F-6	Umtyllun - BAGLI COAL DEPOT	EKH, SWKH	Mawsynram_Block, Ranikor_Block	NC	NH,SH,MDr, ODR
14	NP5/F-14	Mariang - Iew Mawroh (Sukurbaria)	WKH, RB	Jirang_Block, Mairang_Block	NC	SH
15	SC2/F-8	Nengkhra - Siju - Baghmara Circuit House	EGH, SGH	Samanda_Block, Baghmara_Block	NC	NH
16	SC2/F-5	Dawki - Katrang	EKH, WJH	Shella-Bholaganj_Block, Pynursla_Block, Mawsynram_Block	NC	NH/SH/MDR
17	SC4/F-2	Phramer-Saphai	WJH	Laskein_Block	NC	SH
18	SC2/F-6	Nonbah Taxi stand - Weiloi Catholic Church	EKH, SWKH, WKH	Mawkyrwat_Block, Nongstoin_Block	NC	MDR/ODR
19	SC-1/F-11	Phulbari - Hatogaon Pt.1	WGH	Dadenggre_Block, Selsella_Block, Tikrikilla_Block	NC	NH/SH
20	SC1/F-1	UMSNING - Umsiang Maiong	RB	Umsning_Block	NC	MDR
21	SC3/F-6	Nongstoin- Mawngap	EKH, WKH	Mairang_Block, Mawphlang_Block, Mawthadraishan_Block, Nongstoin_Block	NC	NH
22	NP5/F-13	Adokri - Shigrang, Memillan, Mitegittim, NengkraM, Simseng Atimbo, Mangsang Rangme Agal, Dalbot A - Shallang	EGH, NGH, WKH	Dambo-Rongjeng_Block, Kharkutta_Block, Mawshynrut_Block	NC	NH/MDR

23	F12/SC3	Songsak - Koksinengsat, Dagal, Sepikol, Thapdarenchi, Babupara, Salpara, Kashdiuripara, Damas - Damra Kashkona	EGH, NGH	Resubelpara_Block, Songsak_Block	NC	MDR
24	SC1/F-9	Mankachar - Garodoba - Garobadha	SWGH	Betasing_Block	NC	SH
25	SC1/F-3	Sin Lung Hotel, Sonapur-Dawki	EJH, WJH	Amlarem_Block, Khliehriat_Block	NC	MDR/ODR
26	SC1/F-16	Nongpoh - Khulia	RB	Umling_Block	NC	MDR/ODR
27	NP5/F-11	Warangre - Kimbaldam	NGH	Resubelpara_Block	NC	MDR
28	SC3/F-2	DSSMH(Mookympad)-Moulsei	EJH	Khliehriat_Block, Saipung_Block	NC	MDR/PMGSY
29	SC3/F-9	Purakhasia - Garodoba	SWGH, WGH	Zikzak_Block, Dalu_Block	NC	SH
30	SC2/F-15	Mawmaram - Umiam	EKH,RB,WKH	Mairang_Block, Mylliem_Block, Umsning_Block	NC	MDR
1	F3/BP1	Amlarem - Muktapur	WJH	Amlarem_Block	BP	MDR
2	F1/BP1	Nartiang -Wah Umkhen	RB, WJH	Thadlaskein_Block, Umsning_Block	BP	MDR
3	F1/BP2	Mawryngkneng- Umiam T Point at GS Road near Botanical Garden	EKH, RB	Mawryngkneng_Block, Umsning_Block	BP	NH
4	F12/BP3	SH1 near Siso Bibra - Dalbot Bollonggre, Rongsak, Songsak, Rongre Bazar, Nadingre - SC1 near Nengbret	EGH	Dambo-Rongjeng_Block, Samanda_Block, Songsak_Block	BP	**NH**
5	F12/BP1	PWD Rd - Nengkra ,Kusimkolgre, Rangmal Badim SDA Company Seventh-day Adventist church - Jakobgre,Samgong Market, Williamnagar SDA Church - Circuit House	EGH	Samanda_Block	BP	MDR,Urban roads
6	F1/BP3	Umphyrnai - Wah Umkhen - Nongnysong bypass - Pynthor Mukhran	EKH	Mawryngkneng_Block, Mylliem_Block - Byepass division	BP	ODR, Others road
7	F1/BP4	3.5 mile - Demthring	EKH	Mylliem_Block	BP	Other roads
8	F3/BP2	Bataw-Paradise Restaurant, Ladrymbai Rymbai road	EJH	Khliehriat_Block	BP	MDR
9	F16/BP1	Ïew Nongpoh - Nonpoh Bus stop	RB	Umling_Block	BP	ODR
10	F6/BP1	Nongshilong - Jakrem B	WKH, SWKH	Mawkyrwat_Block, Mawthadraishan_Block	BP	MDR
11	F15/BP1	Junction of NH-40 (6th Mile Farm)- Mawdun	EKH	Mylliem_Block	BP	VR
12	F5/BP1	Bholaganj Bazar-Pynursala	EKH	Pynursla_Block	BP	MDR
13	F7/BP2	Nengkra - Sudugre - NH127B near Dabol Nongben	EGH, SGH, WKH	Baghmara_Block, Mawshynrut_Block, Samanda_Block	BP	VR (STATE)
14	F4/BP1	Laitkore - Ksehbilat	EKH	Laitkroh-Khadarshnong_Block,	BP	MDR

				Mylliem_Block		
15	F1/BP5	Rhino Shopping Arcade - St,. Edmund's School Sports T Point	EKH	Mylliem_Block- Jowai central division	BP	NH, VR,Others
16	F2/BP1	Moorap-Jowai	WJH	Thadlaskein_Block	BP	SH
17	F8/BP1	Daluagre(Baro Mile) - Chigisimgre, Dobagre, Chokpot, Daromgre, Bethagre - Sibbari Border Haat	SGH,WGH	Chokpot_Block, Gasuapara_Block	BP	MDR
18	F6/BP3	Mawshaliah - Mawsynram	EKH	Mawsynram_Block	BP	SH
19	F6/BP2	Sohiong Pariong Road	WKH, EKH	Mawthadraishan_Block, Mawphlang_Block	BP	MDR, PMGSY, OTHERS
20	F10/BP1	Matchakolgre-Eden Bari	WGH	Rongram_Block	BP	VR and URBAN roads
21	F12/BP2	Boda Apal - Resubelpara Municipal Board	NGH	Resubelpara_Block	BP	ODR
22	F14/BP1	Nongspung- Nongstoin	WKH	Nongstoin_Block	BP	NH , URBAN ROADS
23	F14/BP2	MeECL - Mawlong Presbyterian Church	WKH	Mairang_Block	BP	VR AND PMGSY
24	F8/BP2	Jaksongram (NH62) - Gitinggre - Masighat (NH62)	SGH	Baghmara_Block	BP	VR and Other Roads like Border Roads, tracks, trail, etc
1	F12/NP1	Berubari - NH62 near Nanil Apal LPS	NGH	Resubelpara_Block	NP	MDR/ODR
2	F6/NP11	Mawkyrwat-Khadphra	SWKH	Mawkyrwat_Block, Ranikor_Block	NP	MDR
3	F12/NP5	Gabil Songgitcham - Dijogri, Konchikol, Lower Daram, Jonglapara - Dekachang	NGH, EGH	Resubelpara_Block, Songsak_Block	NP	ODR
4	F13/NP9	Rongjeng bazar - Dambobima, Dambo Watesa, Mareapal - Simseng Atimbo	EGH	Dambo-Rongjeng_Block	NP	MDR
5	F6/NP3	Shnongkanong- Mawten	SWKH	Mawkyrwat_Block, Ranikor_Block	NP	MDR
6	F6/NP9	Kynsi - Umjarain	WKH, SWKH	Mawthadraishan_Block, Mawkyrwat_Block	NP	MDR/ODR
7	F6/NP1	Nongjri - Maweit	WKH, SWKH	Nongstoin_Block, Ranikor_Block	NP	MDR
8	F8/NP6	SP1 near Sananggre - Alagre - BP1 near Anigre	SGH, WGH	Dalu_Block, Chokpot_Block	NP	ODR
9	F8/NP3	Bikinggre - Bangguagre,Bakatgre, Ruganokat, Awalgre - Dansungre	SGH, WGH	Gasuapara_Block, Chokpot_Block	NP	MDR/VR
10	F1/NP4	Mawkhanu - Mawpun	RB, EKH	NP	ODR	

5.4 Transport Proposal

Transport is a critical element of the infrastructure and essential for promoting development. It plays a significant role in influencing the pattern of distribution of economic activity and improving productivity. It acts as a lifeline linking markets, agriculture, tourist, mining and industrial development, educational and health institutions. Above all, it connects the mosaic of cities, towns & villages of Meghalaya, thereby underpinning its unity and integration.

The transport system comprises several modes in Meghalaya like Buses, waterways & Ferry, Helipad, Airport, Rail, Mineral transportation Check post, agriculture market center for freight logistics, and tourist last-mile connectivity. Each has to be developed to meet its specific demand within the requirements of the transport system as a whole. The system must be viewed at each step as an integrated structure, keeping in mind the relationship between different transport services.

Despite impressive achievements in the past, the transport system in Meghalaya remain remains deficient in several respects. Worldwide transport growth has been consistently higher than the economic growth due to specialization, material sourcing on a broader scale, just-in-time strategies, further increase and dispersal of retail and wholesale activities, etc. Prices of transport services have been falling due to increased productivity due to competition among suppliers of transport services and pressure from users who face relentless pressure from global competition in their markets.

An efficient transportation system is necessary for increasing productivity and enabling Meghalaya to compete effectively in the world market. Adequacy and reliability of transport infrastructure and services are important factors that contribute to Meghalaya's ability to compete in international trade and attract foreign direct investment with Bangladesh and ASEAN Country. As a hilly state, travel time is too high. Also, the cost of travel remains high. There is a need to supply transport for competitive pricing and coordination between alternative modes to provide an integrated transport system that assures the mobility of goods and people maximum efficiency and minimum cost. With this objective in view, the Integrated Transport proposal has

been made based on gap analysis as mentioned in last chapter 4. The list of transport proposals is shown in the Table with details Table 5.12 and 5.13.

A unique circuit for tourist and agriculture connectivity has been identified of 998 km and 2259 km.

Table 5. 12 List of Transport Proposal in ITNDP

Transport Terminal Integrated	Existing	Proposed by CRRI	Length/area of the proposal	No of Proposal
Major Bus Terminal	5	9		9
Rail	1	3(1Toy train, 2 line extension of Mendipathar line to border Dalu)	283km	3
Mineral Check post with weigh in motion	17	7		7
Waterway Terminals	Seven by IWAI	Eight by CRRI		8
Ropeway for Goods Terminal	1 beltway for Limestone	8	20km	
Helipad (each districts)	2	13	112 Acre	13
Airport with Cargo facilities		2		2

Table 5. 13 Special Circuit

	Existing	Proposed by CRRI	Length/area of the proposal	No of Proposal
Tourist	5	33	Phase1(CRRI): 938kms Swadesh darshan:553.7 km NE Council : 548.2kms	Twenty-eight roads from Phase 1 are serving this circuit.
Agriculture			2259kms	39 roads from Phase 1

Mineral areas		Phase 1 roads		38 roads serve 1 or more mining areas
Industrial areas		Phase 1 roads		Four roads serve industrial areas
EV Infrastructure				
EV Charging stations	NA	77: Shillong 15: Tura		92

5.5 Initial Road Financial Plan-ITNDP

The ITNDP project is located in Meghalaya and involves widening (62%), periodic maintenance (16%), BT Renewal (9%), Earth to BT (6%), WMB to BT (5%), and new construction (1%) as shown in Figure 5.3 below. New construction and widening may require Environmental clearance as per Govt. of India's norm.

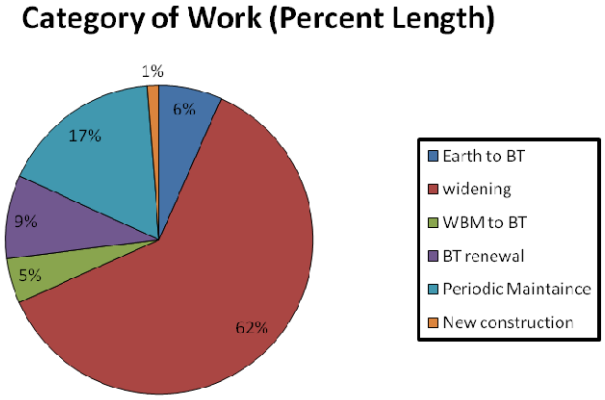


Figure 5. 3 **Category of Work**

The project may require immediate action, land acquisition in some cases of new construction, inception, feasibility, DP preparation before any execution of work at the site. Accordingly, ITNDP has been divided into a 14-year development plan from 2021 to 2036. The commencement of construction within the existing ROW in area 1 is reflected in the schedule below. Tentative Estimate of Upgrading of Road Per Km (In Crores) for NH, SH, MDR, VR for Phase-1 is given below in Figure 5.4. Deatiled calculation of typical road is given in Annexure 9.

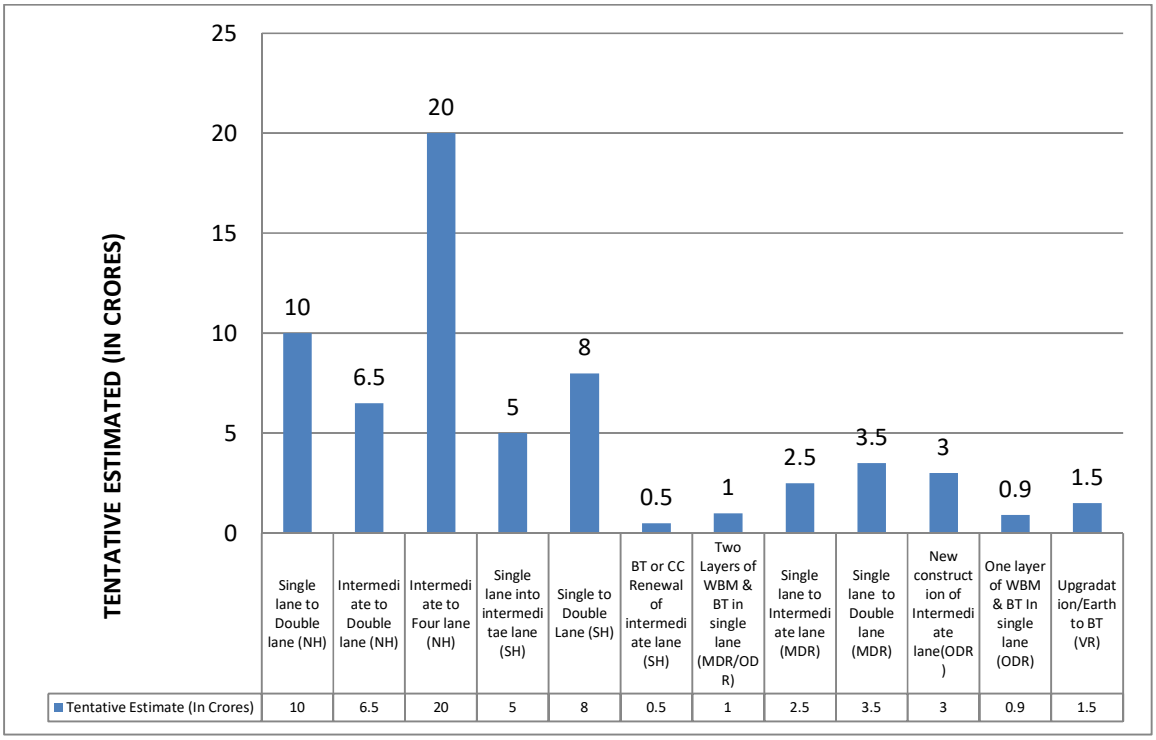


Figure 5. 4 **Category of Work**

5.5.1 ITNDP Road and Bridge Cost

The total project cost is 14808 Crore. The project cost by phase and by sanctioned budget can be found in the table within this report section. A tabular depicting the breakout for the number of the project in IC, NC, BP, and NP categories is reflected below.

Table 5. 14 Cost of the project in ITNDP Phase -1 for IC, NC, BP, and NP

Road Type (A)	No of roads (B)	Total Cost(In Crores)-C	Sanctioned under Schemes (IN CRORES)-D	Break up for widening head (Crores)-E=C-D	Breakup for other Heads (Crores) -F	Total Estimated Budget (Crores)-E+F
IC	14	4899.55	2962.51	1937.04	0	1937.04
NC	30	15697.66	9913.42	5784.24	2958	8742.24
BP	24	1660.64	710.5	950.14	1925.45	2875.59
NP	10	653.98	0	653.98	599.6	1253.58
Total	78	22911.83	13586.43	9325.4	5483.05	14808.45

The cost related expenditure rupees are mentioned year wise phasing as shown in Table 5.14 below.

Table 5. 15 Phase wise distribution of total cost in ITNDP(Crore)

Road Type (A)	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029	2029-2030	2030-2031	2031-2032	2032-2033	2033-2034	2034-2035	2035-2036
IC	19	16.1	187.6	374.9	227.33	50	100	200	270	197.91	100	50	50	50	44.2
NC	105	420.07	236	758.35	989.53	581	463	1250	814	957	600	513.25	498.55	361	195.52
BP	84.2	379.9	83.58	0	134.9	253	378.75	100	0	0	0	0	394.15	453.4	614.21
NP	0	71.55	211.35	57.1	96	50	100	0	0	0	0	132.28	100	110	325.3
Total	208.2	887.62	718.53	1190.35	1447.76	934	1041.75	1550	1084	1155	700	695.53	1042.7	974.4	1179.23

The estimate includes costs for immediate widening, BT Renewal, periodic maintenance, etc., and improvement of Roads for landslide, floods, heavy rains, earthquakes, or any other disaster. The above estimate is only considering the cost of the road (The land acquisition cost is not considered). In IC roads, the cost of the bridges is not considered). Also, prices of miscellaneous (traffic signs, signals, markings, etc.) are not considered in BP and LOR roads. The Allocation of Budget per year based on ranking and traffic volume. The road-wise cost of the project is given in Annexure 9.

5.5.2 ITNDP PROJECT FUNDS

This project is currently funded with i) General State Plan ii) Special Plan Fund (SPF 2015-16) (State Plan), RIDF (NABARD's Loan), Special Plan Assistance, Special Central Assistance, State Share for NEC State Share for NLCPR, NLCPR, NESIDS, NEC/NERSDS Maintenance & Repair(i) Normal Repair ii) Maintenance of Competed PMGSY works, iii) CRF. Also, the Ministry of Road Transport and Highway funds NHAI, NHIDCL, and Regional Office Assam to Meghalaya. The yearly growth is 20% in state fund, whereas, in the Central fund, growth is 75% for 2023.

The total project cost for ITNDP road project is 14810 crores approximately which need to be met in 14 years from state and Centre. Figures 5.5 shows Cost breakup shows 59% for National Connectivity, 19% for Bypass, 13% for IC, and 9% for New proposal for MDR/VR/PMGSY roads,

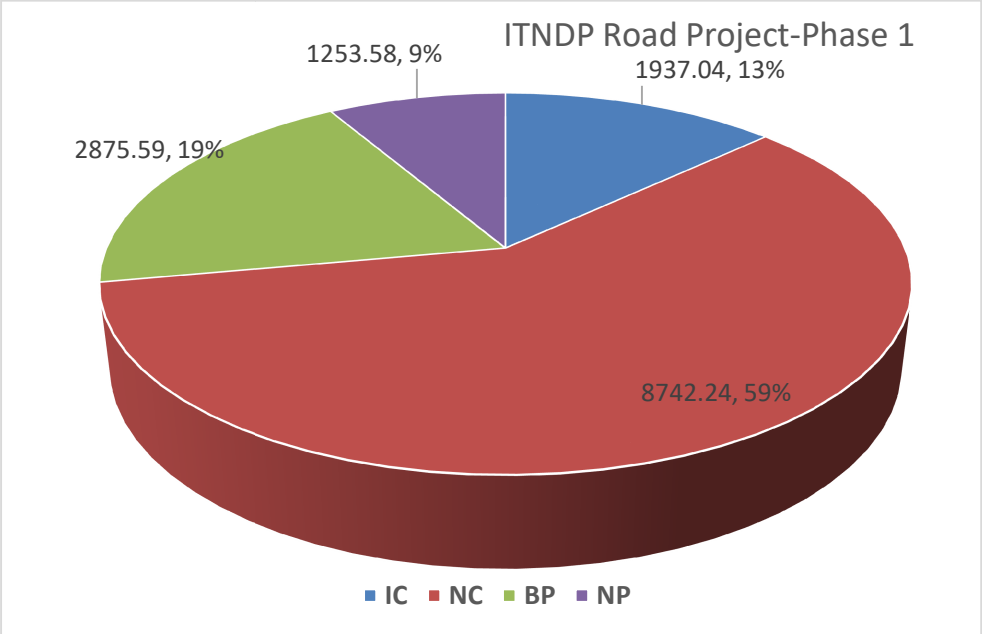


Figure 5. 5 **: Financial Break for Phase 1 road in ITNDP (NH/SH/MDR)**

Table 5. 16 Budget Allocation & Expenditure during the Last Five Years

Programme	2016-17		2017-18		2018-19		2019-20		2020-21	
	Allocation	Expdr.	Allocation	Expdr.	Allocation	Expdr.	Allocation	Expdr.	Allocation	Expdr. Up to Sept 2020
1	2	3	2	3	4	5	6	7	8	9
5054- Roads & Bridges										
i) General State Plan	9654.88	9654.88	19704.98	8411.21	25351.50	11900.73	27000.00	7289.03	43280.93	16647.09
ii) Special Plan Fund (SPF 2015-16) (State Plan)				11293.77		13350.77		6581.10		2165.88
Sub Total	***9654.88***	***9654.88***	***19704.98***	***19704.98***	***25351.50***	***25251.50***	***27000.00***	***13870.14***	***43280.93***	***18812.97***
RIDF (NABARD's Loan)	3082.00	3082.00	5375.02	5375.02	9092.00	9092.00	4227.00	4227.00	8000.00	7087.59
Special Plan Assistance										
a) SPA(2012-13)-MIDB	1557.85	1557.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
b) SPA(2013-14)										
i) Upgradation of SHs and MDRs	1276.96	802.66	0.00	0.00	560.00	560.00	0.00	0.00	19.85	0.00
ii) Improvement of critical feeder roads & missing gaps	1105.60	907.95	0.00	0.00	657.00	657.00	0.00	0.00	120.74	0.00
iii) Replacement of SPT bridges	1163.80	619.95	1110.00	530.00	781.00	781.00	130.00	50.00	488.48	427.00
iv) Strengthening and up-gradation of link roads under Mahendraganj Town	150.00	80.00	0.00	0.00	161.00	161.00	60.00	60.00	40.00	0.00
v) New road connecting Jongchetpara village with ODR Salmanpara - Mellim road	150.00	80.00	0.00	0.00	88.00	88.00	0.00	0.00	60.00	0.00
c)SPA(2014-15)	1851.60	1190.12	0.00	0.00	4626.00	4626.00	431.00	431.00	100.00	92.33

Special Central Assistance										
a) Ongoing SCA Proposals	2500.00	100.00	0.00	0.00	694.00	694.00	410.70	410.70	100.00	96.67
EAP under ADB	4964.34	4964.34	5307.97	5307.97	2616.79	2616.79	4469.48	4469.48	2500.00	0.00
State Share EAP/ADB	250.00	0.00	0.00	0.00	235.20	235.20	0.00	0.00	0.00	0.00
PMGSY	23554.17	23551.17	28192.03	5707.20	19798.80	19642.00	25000.00	19550.00	51579.00	51579.00
State Share PMGSY	0.00	0.00	2000.00	2000.00	2500.00	2500.00	2500.00	2172.22	5731.00	5731.00
SPF (17-18) (State Plan)	7000.00	7000.00	6000.00	6000.00	6500.00	6500.00	5371.82	5339.19	9500.00	6452.00
Common Outlay (Salary etc.)	1695.12	1050.92	21967.84	19920.22	0.00	0.00	0.00	0.00	0.00	0.00
Periodical Renewal of existing SH roads	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1000.00	0.00
Periodical Renewal of existing District & Other Roads	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1362.00	0.00
Sub Total Periodical Renewal of existing roads	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***2362.00***	***0.00***
TOTAL	**59956.32**	**54641.84**	**89657.84**	**64545.38**	**73661.29**	**73404.48**	**69600.00**	**50579.72**	**123882.00**	**90278.55**
State Share for NEC	0.00	0.00	0.00	0.00	61.00	40.69	242.20	0.00	40.00	0.00
State Share for NLCPR	0.00	0.00	0.00	0.00	335.00	180.55	547.00	0.00	1868.00	1568.97
NLCPR	3900.00	1896.89	1080.00	6044.20	3353.00	1067.21	4262.00	120.30	6578.00	0.00
NESIDS	0.00	0.00	0.00	0.00	0.00	0.00	1900.00	0.00	4600.00	1807.34
GRAND TOTAL	**63856.32**	**56538.73**	**90737.84**	**70589.58**	**77410.29**	**74692.93**	**76551.20**	**50700.02**	**136968.00**	**93654.86**
4552 - NEC										
NEC/NERSDS	3423.00	865.90	1450.00	1215.55	653.00	400.00	2179.00	0.00	1100.00	508.17
3054 Maintenance & Repair										
i) Normal Repair	15354.50	15354.00	13921.45	13921.44	16277.50	16277.50	20627.07	20612.53	26633.94	10693.83
ii) Maintenance of Competed PMGSY works	835.00	835.00	700.00	700.00	1200.00	1200.00	1310.00	1310.00	1299.61	649.80
iii) CRF	35.42	0.00	1600.00	1372.00	2853.00	2853.00	3910.00	3910.00	3102.43	1723.00
TOTAL	**16224.92**	**16189.00**	**16221.45**	**15993.44**	**20330.50**	**20330.50**	**25847.07**	**25832.53**	**31035.98**	**13066.63**

Table 5. 17: Gap Analysis based on the assumption

	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029	2029-2030	2030-2031	2031-2032	2032-2033	2033-2034	2034-2035	2035-2036

SH, MDR, ODR, PMGSY budget allocation	1105	1326	1591	1909	2291	2749	3299	3959	4751	5701	6841	8210	9851.8	11822	14187
NH allocation (12.5%)	600	1065	1198	1348	1516	1706	1919	2159	2429	2733	3074	3458	3890.7	4377	4924.2
Total allocation	1705	2391	2789	3257	3808	4455	5218	6118	7180	8434	9916	11668	13742	16199	19111
Required allocation in phase-1	208	887.6	718.5	1190	1448	934	1042	1550	1084	1155	700	695.5	1042.7	974.4	1179.2
Tentative estimate required in phase-2 and phase-3	NA	2830	2830	2830	2830	2830	2830	2830	2830	2830	2830	2830	2830.1	2830.1	2830.1
Total tentative cost required per year	208	3718	3549	4021	4278	3764	3872	4380	3914	3985	3530	3526	3872.8	3804.5	4009.3
Gap analysis including nh budget	1497	-1327	-759	-763.3	-471	691.3	1346	1738	3266	4449	6386	8143	9869.7	12395	15101
Gap analysis for the next 15 years	897	-2392	-1958	-2111	-1987	-1015	-573	-420.9	836.9	1716	3311	4684	5979	8017.6	10177

- Over the last seven years (FY2014-15 to FY2021-22), MoRTH has invested Rs. 3736 Cr. Of expenditure on NH works in the state of Meghalaya. In 2021 the ministry was targeting to incur the expenses of Rs. 600Cr. In 2022-23 the target is to increase the price to Rs. 1065 Cr. by taking up additional projects. The annual growth rate of 2021-2022 is 12.5%.
- The Total allocation budget for 2020-21 is 1104.94 Cr. for SH, MDR, ODR & PMGSY roads and bridges. The annual percentage growth rate for Budget Allocation is 20%.
- Based on this rate, the allocated funds are shown in Table 5.16
- Average cost per km for ODR Roads in PHASE-2 and PHASE-3 = 2.1 Cr. per Km
- Average cost per km for VR+ PMGSY Roads in PHASE-2 and PHASE-3 = 1.7 Cr. per Km

- Tentative cost required in PHASE-2 and PHASE-3 = 39621.35 Cr.
- Average cost per year for the next 14 years in Phase2 and Phase-3 roads construction is 2830.1 Cr. Per year.

An estimate was made, and a viable gap was determined by subtracting the Growth of allocation and total tentative road project required per year as mentioned in Table. However, there is no inflation or discounting is done. Also, this analysis allocates no additional cost of periodic maintenance for every five years. Assumption will be further down in Phase 2 and Phase 3 reports once detailed estimates are available. However, there is a substantial gap in funding in 3 to 4 years. Financial analysis was done based on assumptions in data segregation for SH, MDR, Ogrowth reiterate of growth in allocation. The initial project funding gap is visible 3000-3500 crore (470 Million USD) in up to 4-5 year. However, these estimates will be further readjusted based on phase 2 and phase 3 of ITNDP. Remain can be met from Ministry of Road transport and State fund.

5.5.3 Financing Issues and Risk

- This project can be currently funded with the World Bank, MIDFC, and other sources of states for any gap in funding.
- Fund utilization in Meghalaya is low, which needs to speed with prior clearance of land for Right of Way Acquisition and environment clearance and any other clearance, avoiding any conflict with already ongoing existing project and speeding up the project awarding process.
- IC has good potential for opening international routes in the future; these roads can be further upgraded to the Asian Highway number for funding.
- In IC and NC, few roads are interstate routes with financing potential from joint Assam and Meghalaya or NEC fund.
- Few state roads (High ranking) can be handed over to the Ministry of Road Transport and Highway if funding is a shortage in the state.
- All the new alignment land cost, DPR, bridge cost, and other safety associated expenditures should be added extra.

- All the Transportation facilities proposed at the planning stage in ITNDP need further pre-feasibility/feasibility/DPR by their stakeholder before arriving the cost for transport. The above analysis of finance is only for PWD.

5.6 Annual Update Cycle

The submission date of the Initial Financial Plan is February 2022. The first annual update should be submitted by July 1, 2023, and based on a "data as of" date of February 2022. Future yearly updates should be modified by Concern stakeholders by July 1 of that year, with a "data as of" date of April 30 of that year.

6 Chapter Characteristic of ITNDP and Recommendations

6.1 Introduction

Meghalaya is a landlocked state. There are both opportunities and challenges ahead to the development of Meghalaya. Being placed strategically, shares a 450km border with Bangladesh, Gateway for western India to eastern state Assam (Silchar, Tripura, Mizoram, and Manipur), it has much potential for increasing trade internationally integrated transport network is developed. There is the local availability of agriculture, minerals, industry, and tourist scenic and rivers, that potential can be further tapped. Demand Assessment and Gap analysis in chapter 4 show these potentials in detail. Being in a strategic location, local reason of economic growth continues increasing GDP. Per capita income, a state needs proper infrastructure development in terms of roads and transport facilities for the movement of people and goods seamlessly with last-mile connectivity. Based on the analysis as mentioned earlier, projects were identified and ranked for financial implementation.

6.2 Proposal for Road Project

As per funding requirement, national connectivity as high cost **9913** Crore, International connectivity as medium costs 2963 crore, bypass cost 711 crores, minor and new connectivity proposal cost 654 crores as a minor component of the total project. Their implementation plan is already discussed in Chapter 5 in the financing plan.

The overall cost of the road project is **22912** Crore. The sanctioned under different schemes is **13586** Crores, and the additional requirement is **9325** Crores. The total length of a proposal is **3154** of **3487** km. Entire 78 number roads are selected, and their nomenclature and number are already given in the previous chapter.

Road Projects of International Connectivity are as follows for further development (Periodic maintenance, widening, upgradation, etc.).

1. Shillong- Dawki
2. UMSNING - Jorabat
3. AMPT Road
4. Barengapāra, Dalu- Rongram
5. Shillong - UMSNING
6. Ampati bazar - Purakhasia
7. Mahendraganj Petrol pump -Sanjit Biswas - Near Mark Service station

8. Rongram Phulbari (RP) Road
9. Tura - Danakgre, Anggalgre, Harigaon, Goramara - Garobadha
10. Garodoba - Ampati bazaar
11. GSB Road
12. Selsella - Chibragre
13. Barengapara -Nokchi -Purakhasia
14. GSB Road

The total cost of the project is 4900 Crore. The sanctioned under different schemes is 2963 Crores, and the additional requirement is 1937 Crores. The full length of a proposal is 505 of 527 km.

Possibility to Connect Shillong to Chattogram Port via Sabroom Maitree Bridge 667 Km (Via Sylhet 515 km) should be explored.

Alternate Chicken neck passage to India: The Siliguri corridor, known as India's 'chicken neck,' became a crucial passageway after the India-China Doklam crisis in 2017. Located in West Bengal, the gallery is 60 km long and 20 km wide and connects the North-East with the rest of India. It is an important trade route and an essential gateway to Southeast Asia. In case of emergency, the following are the option for connection to India by road.

- Phulbari (Meghalaya) to Hili(West Bengal): Currently, it takes 14 hours for 516 km using a Chicken neck. Time-saving will be 7 hours via Phulbari if a strategic corridor is used via Bangladesh. The total length will be 245 km, only travel 6.65 hours.
- Mahendraganj (Meghalaya) to Hili(West Bengal): Currently, it takes 16.5 hours for 609 km using Chicken neck. Time-saving will be 14 hours via Mahendraganj if the strategic corridor is used via Bangladesh by constructing a bridge on Brahmputra. The total length will be 98 km, only travel 2.65 hours.
- IC has good potential for future opening international routes; these roads can be further upgraded to the Asian Highway number for funding and maintenance in the future.

Road Projects of National Connectivity are as follows for further development (Periodic maintenance, widening, upgradation, etc.).

1. Shillong - Katrang
2. Lad Rymbai Dongwah - Ratachera

3. Khanduli-Ummulong
4. Dawki-Ummulong
5. Rongjeng - Shallang/Riangdo - Nonbah Taxi Stand, NH 44E, Upper New-Nongstoin
6. Darugre - Dobu Rimding - Nengkhra
7. Nengkhra - Sawilgre - Asanang
8. Dhorom - Umtyngar
9. Rongram Bazar-Norangkol
10. Nongjri,Nonghyllam - Maweit Rd - Nekora - Baghmara
11. Riangdo - Athiabari
12. Rongram - Williamnagar - Nengkhra
13. Umtyllun - BAGLI COAL DEPOT
14. Mariang - Iew Mawroh (Sukurbaria)
15. Nengkhra - Siju - Baghmara Circuit House
16. Dawki - Katrang
17. Phramer-Saphai
18. Nonbah Taxi stand - Weiloi Catholic Church
19. Phulbari - Hatogaon Pt.1
20. UMSNING - Umsiang Maiong
21. Nongstoin- Mawngap
22. Adokri - Shigrang, Memillan, Mitegittim, NengkraM, Simseng Atimbo, Mangsang Rangme Agal, Dalbot A - Shallang
23. Songsak - Koksinengsat, Dagal, Sepikol, Thapdarenchi, Babupara, Salpara, Kashdiuripara, Damas - Damra Kashkona
24. Mankachar - Garodoba - Garobadha
25. Sin Lung Hotel, Sonapur-Dawki
26. Nongpoh - Khulia
27. Warangre - Kimbaldam
28. DSSMH(Mookympad)-Moulsei
29. Purakhasia - Garodoba
30. Mawmaram - Umiam

The total cost of the project is **15698** Crore. The sanctioned under different schemes is **9913** Crores, and the additional requirement is **5784** Crores. The full length of a proposal is **1838** of **2031** km.

Road Projects of Bypass Connectivity are as follows for further development (Periodic maintenance, widening, up-gradation, etc.).

1. Amlarem - Muktapur
2. Nartiang -Wah Umkhen
3. Mawryngkneng- Umiam T Point at GS Road near Botanical Garden
4. SH1 near Siso Bibra - Dalbot Bollonggre, Rongsak, Songsak, Rongre Bazar, Nadingre - SC1 near Nengbret
5. PWD Rd - Nengkra ,Kusimkolgre, Rangmal Badim SDA Company

Seventh-day Adventist church- Jakobgre, Samgong Market, Williamnagar SDA Church - Circuit House

1. Umphyrnai - Wah Umkhen - Nongnysong bypass - Pynthor Mukhran
2. 3.5 mile - Demthring
3. Bataw-Paradise Restaurant, Ladrymbai Rymbai road
4. Ïew Nongpoh - Nonpoh Bus stop
5. Nongshilong - Jakrem B
6. Junction of NH-40 (6th Mile Farm)- Mawdun
7. Bholaganj Bazar- Pynursala
8. Nengkra - Sudugre - NH127B near Dabol Nongben
9. Laitkore - Ksehbilat
10. Rhino Shopping Arcade - St. Edmund's School Sports T Point
11. Moorap-Jowai
12. Daluagre(Baro Mile) - Chigisimgre, Dobagre, Chokpot, Daromgre, Bethagre - Sibbari Border Haat
13. Mawshaliah - Mawsynram
14. Sohiong Pariong Road
15. Matchakolgre-Eden Bari

16. Boda Apal - Resubelpara Municipal Board
17. Nongspung- Nongstoin
18. MeECL - Mawlong Presbyterian Church
19. Jaksongram (NH62) - Gitinggre - Masighat (NH62)

The total cost of the bypass project is **1661** Crore. The sanctioned under different schemes is **711** Crores, and the additional requirement is **950** Crores. The full length of a proposal is **538** of **625** km.

Road Projects of New Proposal Connectivity is as follows for further development (Periodic maintenance, widening, up-gradation, etc.).

1. Berubari - NH62 near Nanil Apal LPS
2. Mawkyrwat-Khadphra
3. Gabil Songgitcham - Dijogri, Konchikol, Lower Daram, Jonglapara - Dekachang
4. Rongjeng bazar - Dambobima, Dambo Watesa, Mareapal - Simseng Atimbo
5. Shnongkanong- Mawten
6. Kynsi - Umjarain
7. Nongjri - Maweit
8. SP1 near Sananggre - Alagre - BP1 near Anigre
9. Bikinggre - Bangguagre,Bakatgre, Ruganokat, Awalgre - Dansungre
10. Mawkhanu – Mawpun

The total cost of the bypass project is **654** Crore. The sanctioned under different schemes is **nil, and the** additional requirement is 654 Crores. The full length of a proposal is **273** of **303** km.

Recommendation for Bridge: Bridges are facing maintenance issues such as Corrosion of various structural elements, Overloading of vehicles due to sand /mining, damaged expansion joint at the junction, jam in expansion joints, **Safety issue,** and Signage, **Replacement of timber** components of the bridge deck surface due to its higher maintenance cost.) and construction of Missing linkage. Shortages of maintenance funds also warrant the attention of PWD**.**

6.3 Transport facility-related recommendation

Since the road has limitations in construction due to many structures in Meghalaya due to hill cutting, forest area, environmental issues, it is essential to have better transport facilities to supplement the economic development and reduce the cost of travel and travel time-saving. Based on the demand of the different economic importance and keeping the future vision of the state to increase the income level to double the current state, it is equally important to focus on transport requirements both from capital level to village level. In this regard, agriculture-based supply chain planning and tourist-based last-mile connectivity planning have been done. Agriculture and tourist have been classified into primary, medium, and minor categories for analysis, and Phase 1 road has been identified which overlap these center and their routes. Their detailed plan has been given in Annexure1 & 2.

6.3.1 Agriculture market centers supply chain connectivity

2259 km of road has been identified, which serves agriculture market centers. Thirty-nine routes from Phase 1 are linking to the agriculture market center. The following 11 are recognized as a significant agriculture hub

1. Jowai
2. Mylliem
3. Lewduh
4. Tura
5. Mawiong
6. Williamnagar
7. Garobadha
8. Ampati
9. Byrnihat
10. samanda
11. Nongpoh

Where as 7 are identified as medium hub is

1. Khliehriat
2. Baghmara
3. Dadenggiri
4. Rongram

5. Tikrikilla
6. Wahiajer
7. Rom Bazar

The Remaining has been identified as a collector center.

These hubs need freight, parking, loading-unloading, and proper digital and hardware infrastructure to facilitate agriculture-based development in Meghalaya.

6.3.2 Tourist circuit

CRRI has proposed 938kms of Tourist circuit, an additional circuit from Swadesh Darshan (553.7 Km), and the NE Council circuit (548.2kms). The 28 roads from Phase 1 are serving this circuit.

All these centers need proper infrastructures like motels, restaurants, parking, toilet, and adequate access to roads and other recreational amenities.

6.3.3 Bus terminal:

There is currently Inter-State Bus Terminus (ISBT) in Meghalaya. Based on the future demand and distance between the existing bus stand, seven more bus terminal has been proposed. Their lists of existing airports are given below.

I. Phulbari,
II. Tura,
III. Williamnagar,
IV. Sonapahar,
V. Shillong

Their lists of proposed terminals are given below.

1. Resubelpara,
2. Baghmara,
3. Nongstoin,
4. Mairang,
5. Cherrapunji,
6. Nongpoh,
7. Jowai.

It requires a detailed pre-feasibility study, DPR, and other EIA clearance for further development as a full-fledged project.

6.3.4 Airport, Helipad, and Railway

Based on the current growth in the aviation sector, freight and passenger transport will increase, and it is required to develop the Cargo facilities at Shillong and Tura terminal. However, these are subjected to clearance of AAI and availability of land.

Based on the current growth and flexibility of travel by Helicopter, it is proposed to have twelve helipads in Meghalaya. However, all these locations need to be finalized as per CAR rule with a preferability study.

Location	Phasing
Shillong	First Phase
Tura	First Phase
Wahiaejer	First Phase
Resubelpara	Second Phase
Nogstion	Second Phase
Mawkrywat	Second Phase
Dawki	Second Phase
Williamnagar	Second Phase
Nongpoh	Phase 3
Mairang	Phase 3
Ampati	Phase 3
Baghmara	Phase 3

1. Based on the current growth in freight and travel by tourists, it is crucial to reduce the travel cost of tourists and locals. Currently, one railway station Mendipathar serves Meghalaya; however, the central govt's mandate is to connect all the capital by the railway station. In this regard, joining the railway station Tetliya to New Shillong of 128 km could be explored. Also, there could be an exploration of the Shillong Cherapunji line length of 51km as Toy Train. Another line can be the Extention from Mendipahtar-Resubelpara to Agangree near Dalu. It is suggested that a detailed preferability study, a feasibility study should be conducted to make a better project proposal as per Railway.

6.3.5 Waterway Terminals

There are already 5 National Waterway NW61 in SWKH district, NW 106 in WJH district, NW50 in WGH, NW39 in SWGH district. IWDA identifies these waterways. However, the Government of Meghalaya can use this water using some additional water terminal to transport

goods and people. The following are the different water terminals identified by CRRI based on mining and local service routes.

1. Rongram near Tura
2. Mashynrut near Williamnagar
3. Baghmara
4. Sohiong near Mairang
5. Mawkynrew
6. Nongstion
7. Baghmara near Siju

It is suggested that a detailed preferability study feasibility study should be conducted to make a better project proposal as per the requirement of IWDA.

6.3.6 Ropeway

The environment ministry has proposed to exempt ropeway projects from prior green clearances; days after the Centre announced the National Mission for Development of Ropeways - Parvatmala - in the budget 2022. The ropeway is also an ecologically sustainable alternative' in place of conventional roads in difficult hilly areas of Meghalaya. The Environment Ministry pointed out that ropeways have been excluded from the ambit of the Forest (Conservation) Act, 1980 in 2019, subject to certain conditions. Eight ropeways have been identified in Phase 1 of ITNDP. Their list is given below in the Table. One more identified at Chinma waterfall.

Code	From	To	Length(Km)
1	Ryngkew	Mawiang	3.156
2	Nolikata	Nayapara	0.233
3	Nongbah	Nongkdait	3.499
4	Nongdewsaw	Nongkdait	4.277
5	Thangrai	Mawmynsor	2.429
6	Mawden Nongbah	Mawden Kperblang	2.967
7	Mawlai Nongkwar	Lum Kshaid view point	1.815
8	Lummawbah	Krang Nongrum Centre	1.155

6.3.7 Mineral Transport Check post

Meghalaya government has decided to install computerized check gates at the various exit and entry points to stop illegal transportation of coal and plug the leakages in the transportation of mineral resources in and outside the state. The coal and other minerals movement take place

through different points such as Byrnihat, Ratacherra, Garampani and Bajengdoba, Dawki, Borsora, and Dalu. The continued growth in freight transport is due to increased minerals and goods transportation production. Additional 7 points are identified mineral transportation Check post at different location of exit from Meghalaya to a different part of Assam is given in proposal below. Phulbari is under construction, and there is a need to provide the Axle load facilities, other check facilities, and a computerized test center.

6.4 Recommendation of Natural Calamity and hazard

- Dadengri and Kharkutta block, Songsak block, and Laskin show higher frequencies of earthquakes. The road in these areas is susceptible to earthquakeneed aseismic reinforcement of road barriers.
- There are 133 points in Meghalaya that cover a total length of 548.2km alternative routes. There are 8 locations in the Raksamgre market, Tikrikilla, Tikrikilla-Holaidanga road, Rilbong, Mawlonghat, Wahingdoh, and Lachumiere Meghalaya, where heavy flood has been observed. This location gain needs alternate routes and mitigation. 64km length needs special attention from a flood point of view Annexure 7.
- There are challenges associated with construction during the rainy season. Meghalaya gets maximum rainfall in July (31% of SW monsoon rainfall) followed by June (30 % of SW monsoon rainfall). The rainfall analysis was carried out for five classes of rainfall intensity for different blocks in Meghalaya. (i) Very high - 7 blocks - 3769.1km2 (ii) High - 11 blocks - 5722.5 km2 (iii) Medium - 9 blocks - 5864.4km2 (iv) Low - 12 blocks - 5730km2 (v) Very low- 5 blocks - 1375.5km2. These identified blocks need eco-friendly construction techniques such as Cold Mix technology, and construction should be completed before the rain starts. Figure 3.11 shows the rainfall maps of different intensities.
- Conditional matrix for the construction of roads using cold mix technology for different months and different districts can be helpful to experiment with eco-friendly construction technology in a limited manner in a state considering the weather.
- In Phase 1 of ITNDP, about 21 roads have notified black spot points.
- The Flood Prone Areas of Meghalaya are the Western part of Meghalaya like Tikrikilla, Phulbari, Rajabala, Garobadha, Hallidaygunj, Bhaitbari, Fersakandi, Magurmari, Silkata,

Mahendraganj, etc. and Plain areas near Bangladesh like Baghmara, Balat, Shella, Dawki, etc.

- Urban Flooding in localized Shillong, Williamnagar, Tura, etc.
- Long-term inundation should be considered as a design parameter for designing roads.
- Localized areas of West Khasi Hills, South West Khasi Hills, East Khasi Hills, Jaintia Hills, and Ri-Bhoi Districts.
- Resistance of embankment against earthquake should be made in an earthquake zone.
- IRC codes, BIS codes for roads and bridges to include seismic zone factors, and SOP suggested by NDRF should be followed appropriately during design and earthquake time respectfully.
- High landslide susceptibility was observed at Baghamara, Maheshkola, Nekora, Ganganagar Cheragaon Ranikor Bagli, Balat, and Barson.
- Many landslides were found at Guwahati Shillong Dawki Roads, Shillong Jowai Dawki Roads, Nongstion, Makyrwat Cherapunji road. Alternate routes and landslide mitigation should improve traffic and accident safety (See Annexure 6).
- **Finance:** The total project cost for the ITNDP road project is approximately 14810 crores, which needs to be met in 14 years from the state and Centre budget.
- A financial analysis was done based on the assumption in data segregation for SH, MDR, ODR, and VR and the growth rate in allocation. The initial project funding gap is visible 3000-3500 crore (470 Million USD) in up to 4-5 years. However, these estimates will be further readjusted based on a report of phase 2 and phase 3 of ITNDP.
- All the Transportation facilities proposed at the planning stage in ITNDP need further pre-feasibility/feasibility/DPR by their stakeholder before arriving at the costing for transport.

6.5 Institutional development and capacity building

Currently States receives funding from Central Road Fund (C.R.F) Border Area Development Programme (BADP),Inter State Connectivity (I.S.C), N.L.C.P.R. projects are funded by the Ministry of DONER, North Eastern Council (NEC), North East Special Infrastructure Development Scheme (NESIDS), North East Road Sector Development Scheme (NERSDS) and the North Eastern Council (NEC) Ministry of Housing & Urban Affairs, Central Public Works Department, Ministry of external affairs The ASIDE Scheme and Export Development Fund for

North East Region (EDF-NER). The funding is coming in fragmented manner from different sources. These funds are allocated as per objective and mission of their departments. Notwithstanding for PMGSY, there is no unified database or plan that can identify the gaps which can supplements and fulfill the strategic need of state of Meghalaya. For example there is no traffic data base at state level, there is no past data of road condition and inventory, or there is no roughness/condition database at state level or central level which can help in development of integrated transport network of the state. Also at intuitional level or departmental level there is very little manpower that is trained and their skilled capacity meets to plan, priorities and allocate the different schemes. There is lack of planner and modeler, coordinators who can foresee the vision of state as a whole. There is PMGSY Central funding Scheme, District Rural Road Plan has been made basis for fund allocation for connecting population up to 250. But for SH/NH/ or other population below 250 there is no such plan which is ready made tools for engineer to decide the witch project they should be implementing. Similar problem is with border roads with 450 km length in Meghalaya. Also there are many Industry are developed without proper approach roads to Industry. Similar problem exists with connectivity to Agriculture, Mines and tourist. At the same time there is no single window scheme where the issue can be resolved at Institutional level. Such gaps in institution need further proper integrated transportation plan, capacity building and educational and intuitional training in this direction.

There is a need to have a dedicated High-power authority engineer to implement the integrated database of ITNDP. Proposed ITNDP development needs strengthening and capacity building of PWD and MIDFC by pooling expertise from Agriculture, tourist, industry, department of transport, and mines while doing a pre-feasibility study or feasibility study. Their team should be adequately trained, and a dedicated team should be working for ITNDP. At the same time, it is ensured that decision-making takes less time and doesn't hamper progress. All the cases can be dealt with online to reduce decision-making time further. Time-bound file movement may help to improve efficiency.

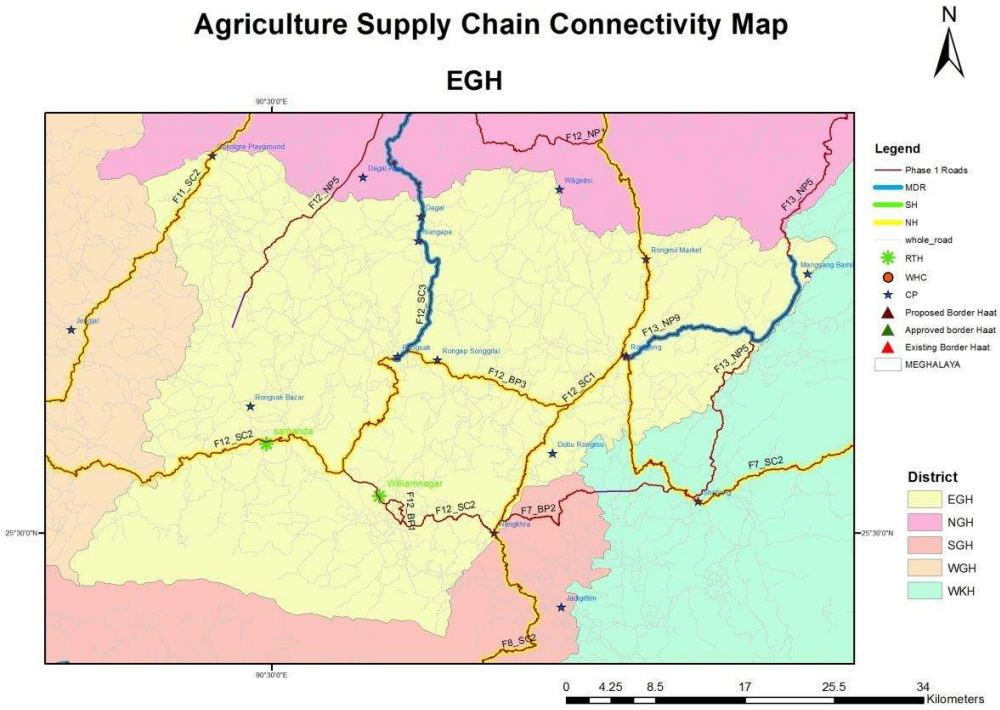
Annexure 1

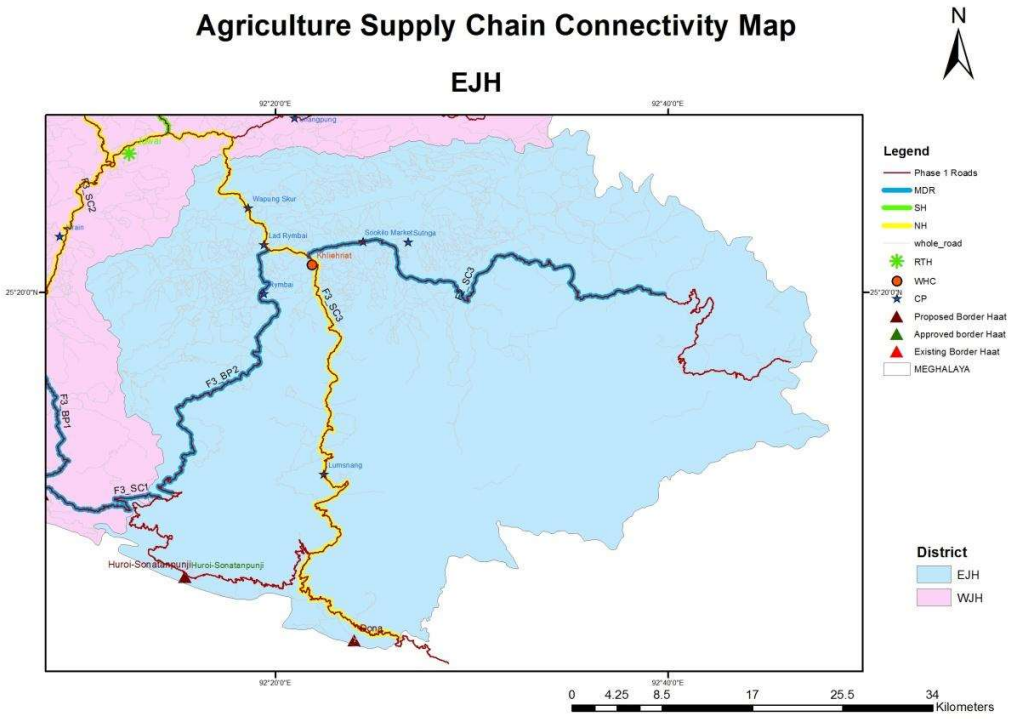
1 Agricultural Markets:

1. Major Markets – 11
   Jowai, Mylliem, Lewduh, Tura, Mawiong, Williamnagar, Garobadha, Ampati, Byrnihat, Samanda and Nongpoh.
2. Sub-Major Markets- 7
   Khliehriat, Baghmara, Dadenggiri, Rongram, Tikrikilla, Wahiajer and Rom Bazar.
3. Minor Markets –

No	Name	No	Name	No	Name	No	Name	No	Name
1	Rongjeng	26	Shallang	51	Selsella	76	Raksamgre	101	Rymbai
2	Gasuapara	27	Mawsynram	52	Rajabala	77	Nengkhra	102	Lumsnang
3	Jirang	28	Tyrsad	53	Siju	78	Dekachang	103	Sookilo Market
4	Kharkutta	29	Rambrai	54	Nengkong Mandagiri	79	Jonglapara	104	Bhoirymbong
5	Adokgii	30	Pynursla	55	Balkalasim	80	Resubelpara	105	Mawlasnai
6	Patharkhmah	31	Bajengdoba	56	Mahadeo	81	Dingok	106	Mawhati
7	Raliang	32	Mendipathar	57	Rongra	82	BalÄt	107	Jirang Block Office
8	Shangpung	33	Rongsak	58	Jengjal	83	Maweit	108	Dagal Apal
9	Laskein	34	Shella	59	Rongsak Bazar	84	Markasa	109	Dekachang
10	Kynshi	35	Nartiang	60	Gokolgre Playground	85	Myriaw	110	Dingok
11	Laitlyngkot	36	Raksamgiri	61	Rongap Songgital	86	Nongkhlaw	111	UmkiyÄng
12	Sohiong	37	20th Mile	62	Nangapa	87	Langpih		
13	Mawryngkneg	38	Umden	63	Dagal	88	Phodkroh		
14	Nongstoin Horti Hub	39	Umroi	64	Rongmil Market	89	Khainduli		
15	Raingdo	40	Sung Valley	65	Mangsang Bamil	90	Namdong		
16	Mairang	41	Mawdon	66	Dobu Rongmu	91	Mokaiaw		
17	Amlarem	42	Mawngap	67	Nengkhra	92	SÄsniyÄng		
18	Dawki Market	43	Kalaipara	68	ThÄpa Darenchi	93	Iooksi		
19	Mawshynrut	44	Mahendragan j	69	Damas	94	Kyndong Tuber		
20	Emangiri	45	Kherapara	70	Nogolpara	95	Jarain		
21	Sibbari	46	Dimapara	71	WÄgeÄsi	96	MuktÄpur		
22	Chokpot	47	Mandagre	72	Gairong Apal	97	Lad Rymbai		
23	Dalu	48	Bolchugre	73	Jadigittim	98	Wapung Skur		
24	Purakhasia	49	Betasing	74	Nongalbibra	99	Sohkymphor		
25	Smit	50	Damalgiri	75	Chibinang	100	Sutnga		

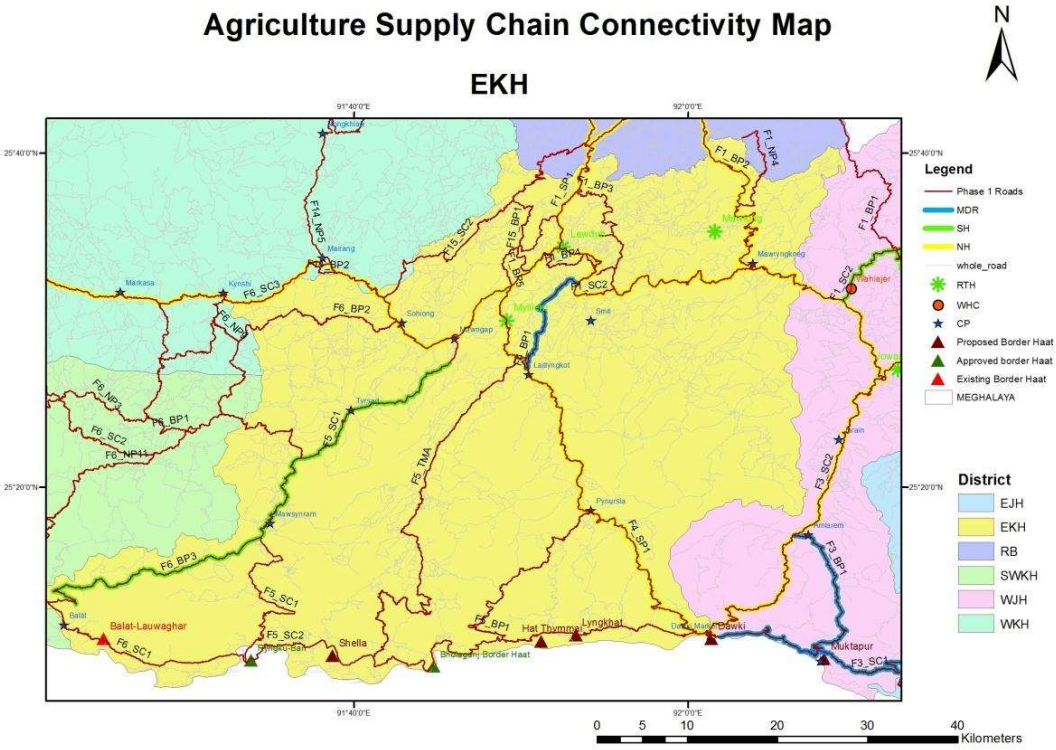
2 District wise Agrologistic maps:





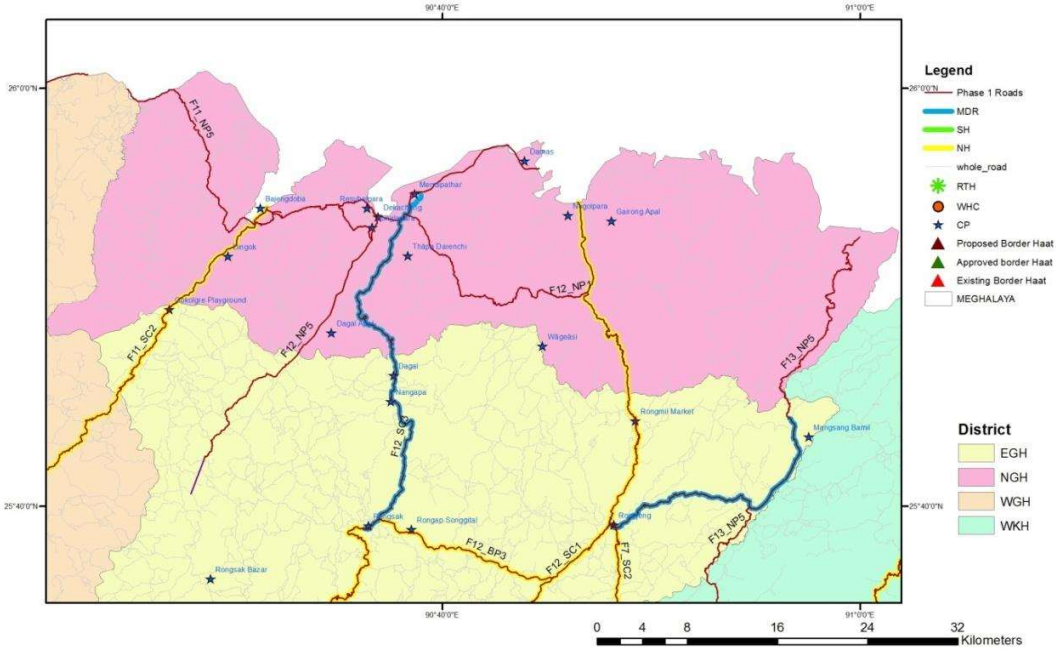
Agriculture Supply Chain Connectivity Map

EKH



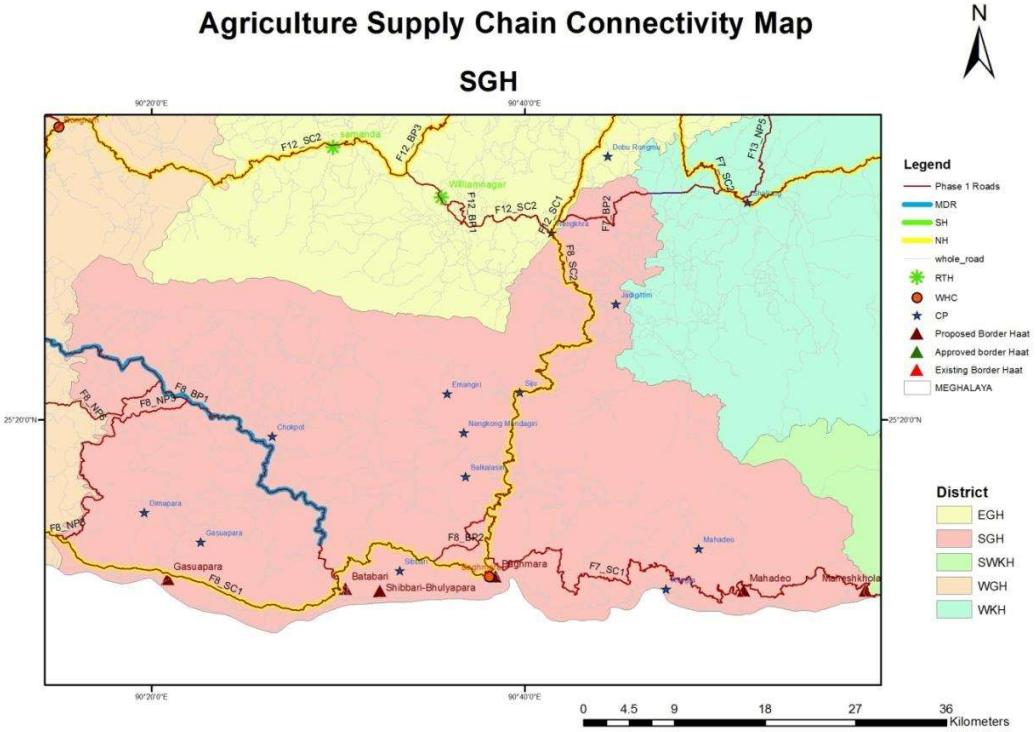
Agriculture Supply Chain Connectivity Map

NGH



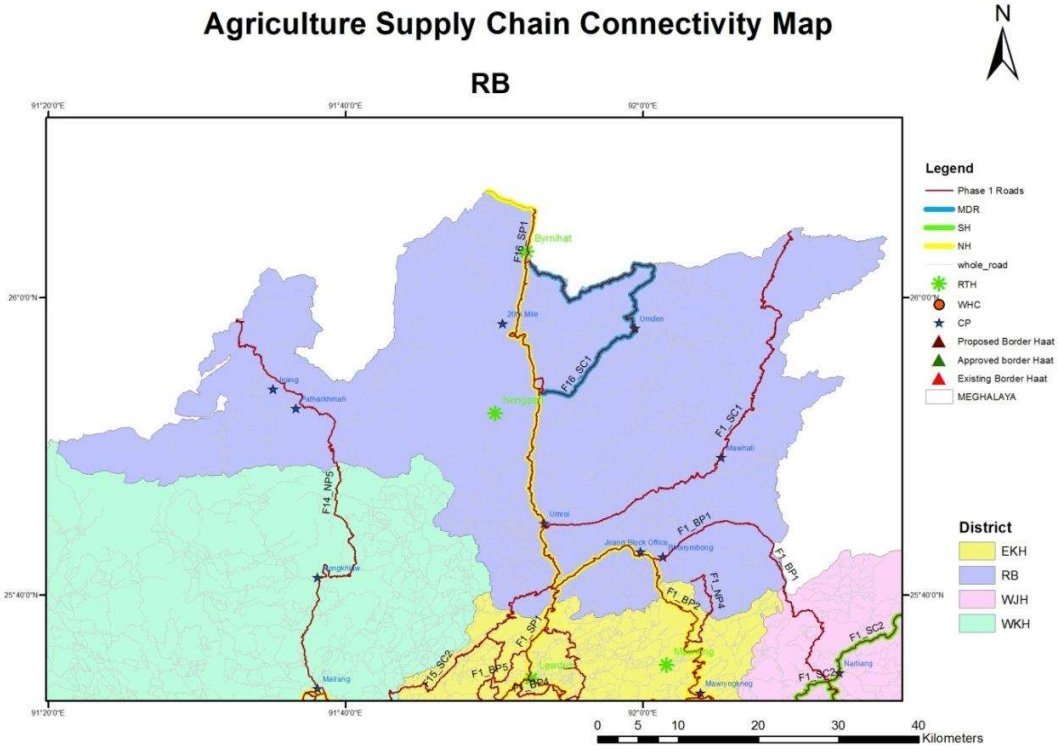
Agriculture Supply Chain Connectivity Map

SGH



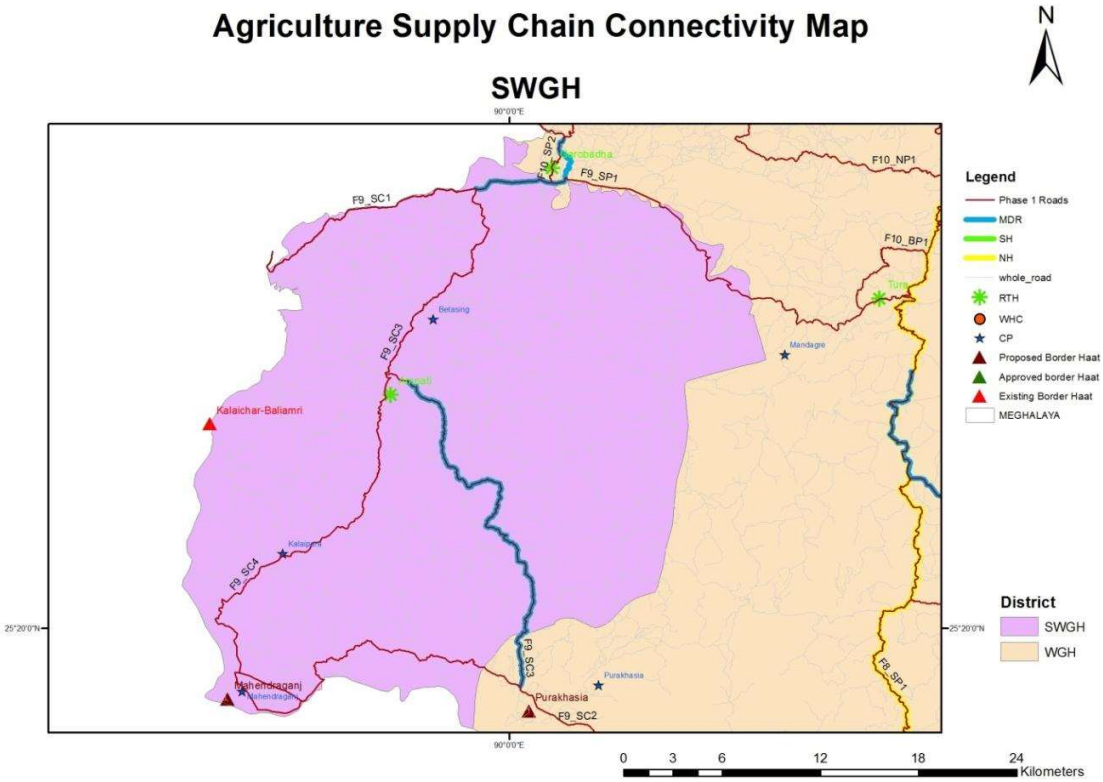
Agriculture Supply Chain Connectivity Map

RB



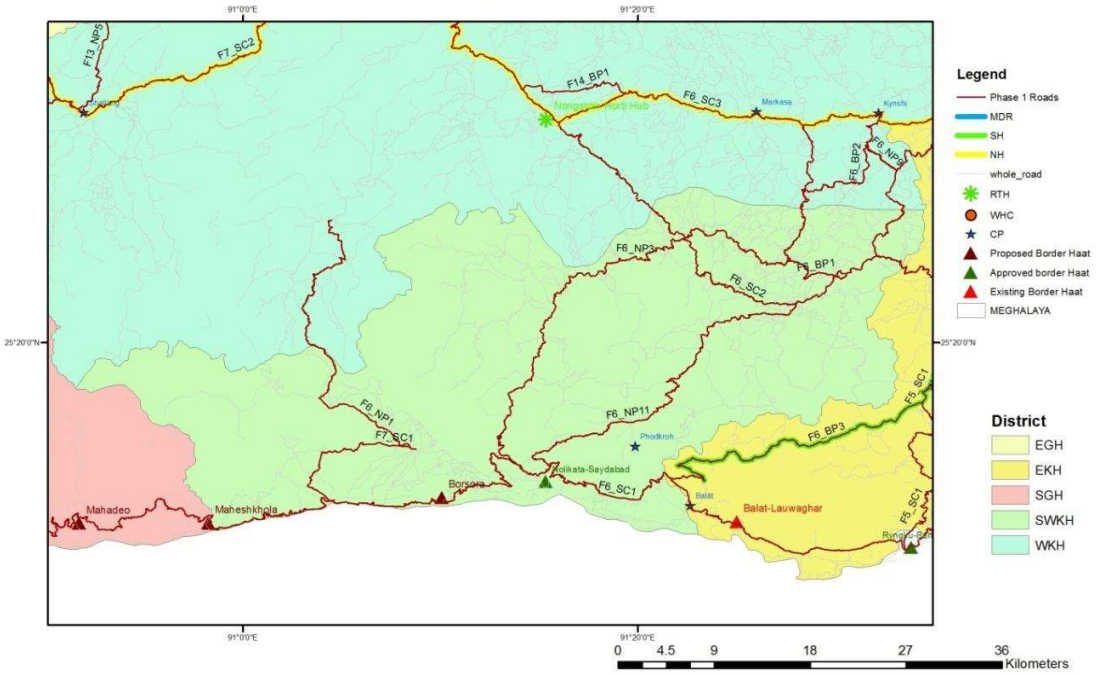
Agriculture Supply Chain Connectivity Map

SWGH

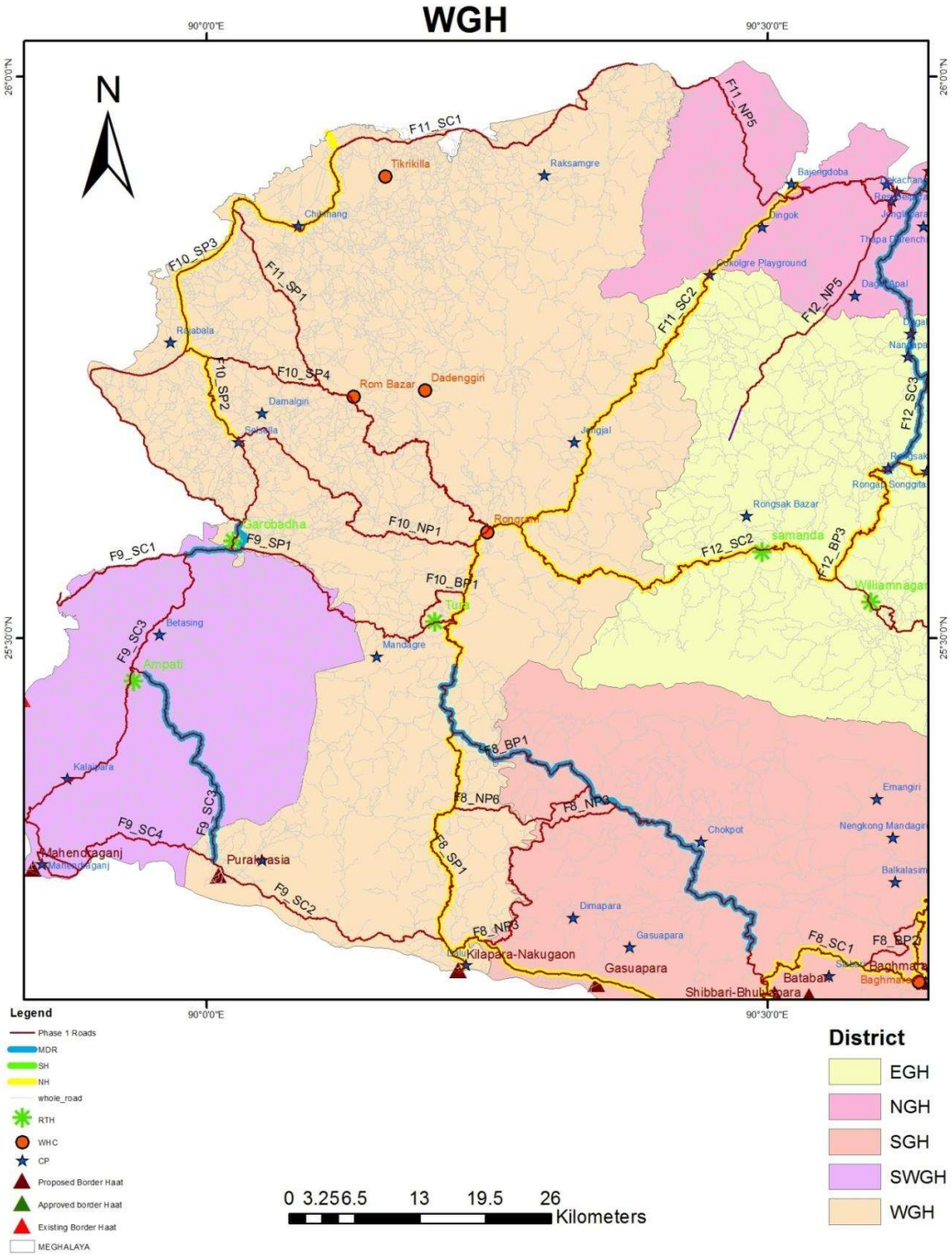


Agriculture Supply Chain Connectivity Map

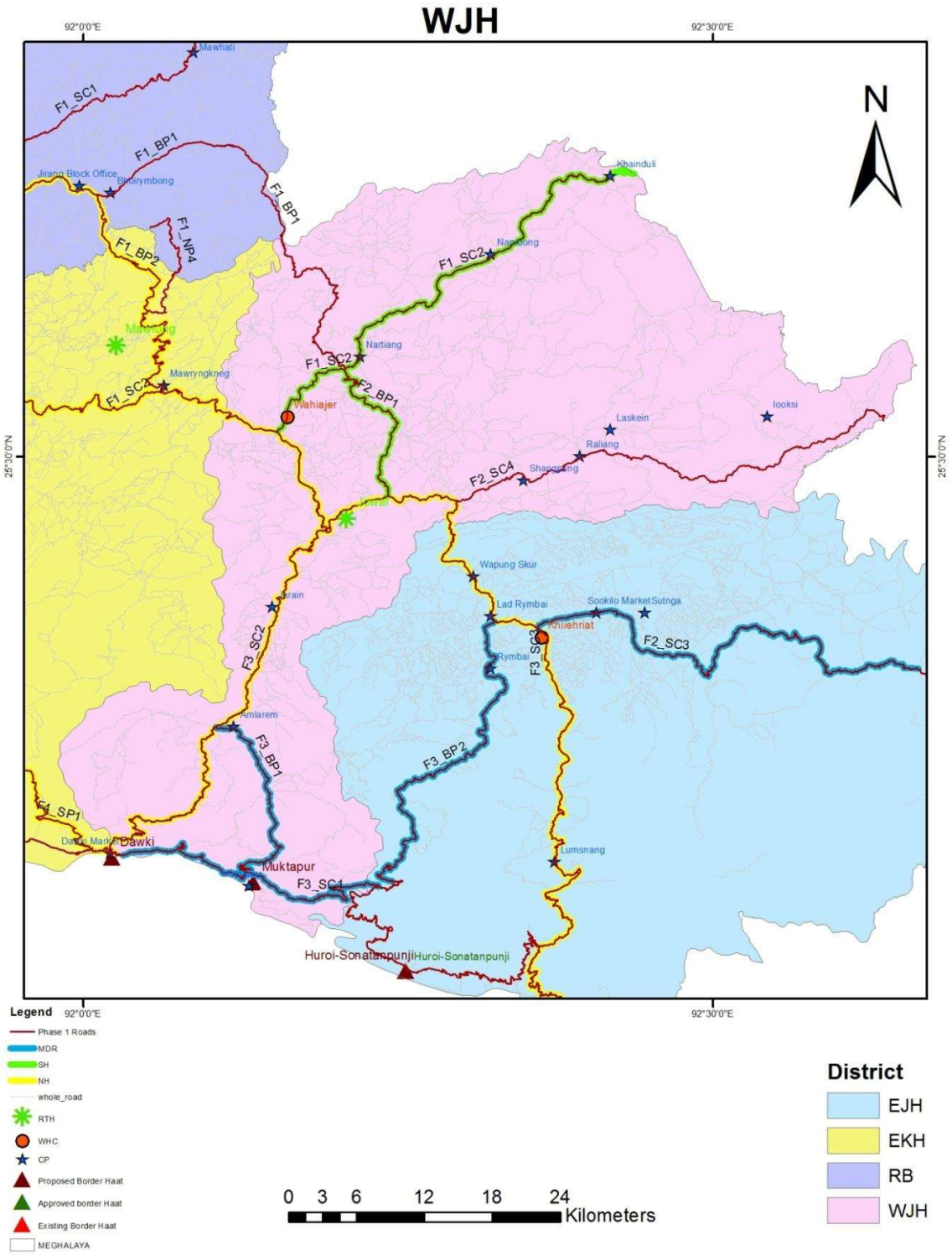
SWKH



Agriculture Supply Chain Connectivity Map

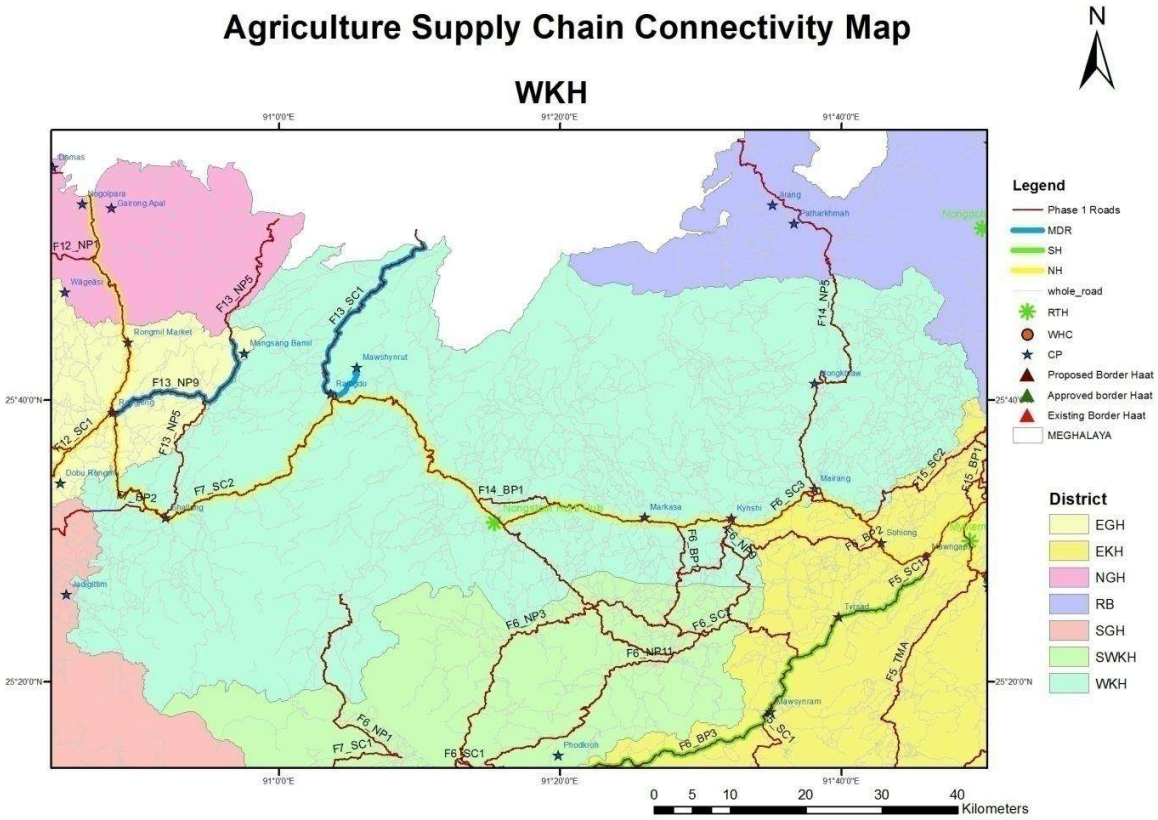


Agriculture Supply Chain Connectivity Map



Agriculture Supply Chain Connectivity Map

WKH



Annexure 2

1. Tourist points:

1) Major

No	Name	No	Name
1	Cherrapunjee	9	Noh Kalikai Falls
2	Dawki	10	Shillong peak
3	Elephant waterfalls	11	Tura
4	Jowai	12	Tura Peak
5	Living Root Bridges	13	Ward's lake
6	Mawlynnong	14	Chynnmadare Fall
7	Mawphlang	15	Don Bosco Museum
8	Mawsmai falls	16	Rangmanma falls

2) Medium

No	Name	No	Name
1	Phe Phe Falls	17	Nokrek National Park
2	Laitlum	18	Nokrek Peak
3	Urnar Falls	19	Rainbow Falls
4	Balpakram National Park	20	Siju Bird Sanctuary
5	Bidon & Bishop waterfalls	21	Siju Caves
6	Dainthlen Falls	22	Sweet waterfalls
7	David Scott Memorial	23	Thadlaskein Lake
8	Duba Falls	24	Tyrshi Falls
9	Khoh Rambah	25	Umiam Lake
10	Krang Suri Falls	26	Laitlum
11	Krem Mawjymbuin	27	Nongkhlaw Cottages
12	Kynrem falls	28	Mawdiangdiang
13	Lady Hydari park	29	Krem Tirot
14	Mawsynram	30	Khudoi Falls_Kohmang falls
15	Mawthadraishan	31	Chyrmang
16	Nartiang Monoliths	32	Katta Beel/ Chimite Lake

3) Minor

No	Name	No	Name
1	Nengmandal Cave	9	Lamo Falls
2	Memo Cave, Bolkinggre	10	Sahksaw fall
3	Chibok Dare	11	Kore Dare
4	Rangjokram Lake	12	Rynji Waterfalls
5	Jawa Wari	13	Moopun Falls

6	Sangsak reserve forest	14	Lumshyrmit
7	Ballongre Heritage Village	15	Kudengrim
8	Mrik Wari Meghalaya	16	Simsang River

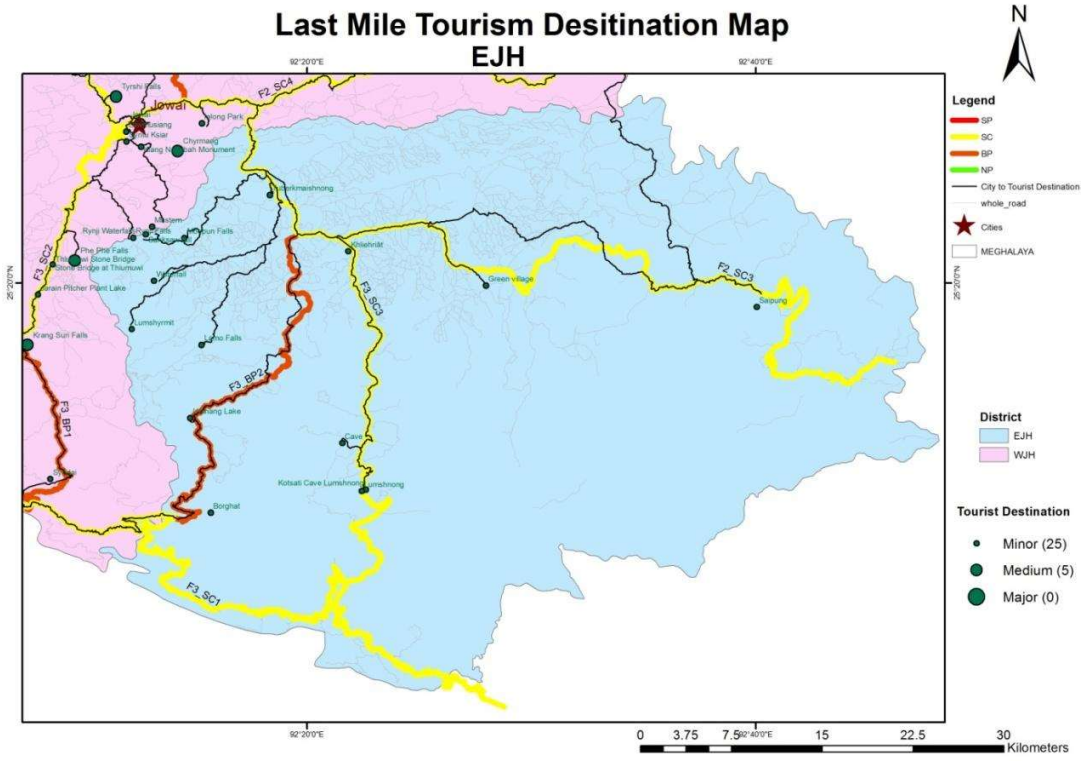
No	Name	No	Name	No	Name	No	Name	No	Name
17	Shnongpdeng	58	Laitkynsew	99	Syndai	140		181	Didok Spring
18	Kudeng Thymmai	59	Laskein	100	Syntu Ksiar	141	Banber	182	Cultural Heritage
19	Darrang	60	Lawmusiang	101	Tasek lake	142	Mawten	183	Picnic spot
20	Nongnah	61	Looksi-Kupli Park	102	Thlumuwi Stone Bridge	143	Nongmluv	184	Bird Sanctuary
21	Mootyrchiah	62	Lumshnong	103	Tuberkmaishnon g	144	Mawranglan g	185	
22	Rohbah Fish Santuary	63	Mahadeo Balpakram	104	Umhang Lake	145	Nongnad	186	Tasek
23	Rongma Gitil	64	Mairang	105	Umling	146	Cave	187	Lake
24	Lum Nongsynrith	65	Mawdem	106	Umsning	147	Cave	188	Mokma Dare waterfall
25	Pamdaba	66	Mawdoh	107	William Nagar	148	Cave	189	Matchok Auoram lake
26	Syntung	67	Mawkyrwat	108	Old Balpakram	149	Waterfall	190	Water Cascade Maldot
27	Nongtraw	68	Mawmluh-	109	Nonggrri	150	Cave	191	
28	Mawlam	69	Mustem	110	Wakso Chiring	151	CHINAGIJA	192	
29	Nongkhnum Island	70	Mylliem	111	Cleanest village	152	NAKA CHIKONG	193	
30	Rilang River	71	Napak	112	Hovercraft	153	Paragliding	194	
31	Khreng Khreng Mawsynram	72	Nartiang	113	Zero Point	154	RONGKOL WARI	195	Boating
32	Memo Lake	73	Nongkhnum Island Beach	114	Koredare	155	Jolding Wari	196	Water tourism
33	khlieh Umstem	74	Nongpoh	115	Oranges	156	Nokat Apal	197	Tea garden
34	Synrang Mawrin	75	Nongriat	116	Shiv Lingam (Radi Nokat)	157	Root bridge	198	Kyllang rock
35	Adokgre	76	Nongstoin	117	Â Asanang Tourist Lodge	158		199	
36	AmindaRangsa	77	Pelga Falls	118	Tourism Complex	159	ANANG WARI	200	
37	Amlarem	78	Pynursla	119	Do be Dare	160	CHEKRENG DARE	201	Mawkdok
38	Ampati	79	Rambrai	120	Mongmrang Rock Formation	161	DOBAK KOL	202	Kshaid Weinia
39	Asanang	80	Rangapani	121	Nongthliew	162	HOLLOCK GIBBONS		
40	Baghmara Pitcher Plant Sanctuary	81	Ranikor	122	Basam Prap Jating	163	MARENG ADIL SIKRAM		
41	Bajengdoba	82	Resubelpara	123	Chitimtim Dare	164	Omed & Ramke Jamdap		
42	Barapani Boat House	83	Rombagre	124	Â Donol Wari Fish Sanctuary	165	Paragliding		
43	BarengapÄra	84	Rongbang Dare	125	Saviba Eco Resort, Umpung	166	Rasna Dare		
44	Bhaitbari	85	Rongra	126	Khlaw Kyntang, Lum Swer	167	RONGMA GITIL		

45	Borghat	86	Rongram	127	Mawklot to Umaim trekking path	168	Darechikgre		
46	Chibragre	87	Rongrenggiri	128	Approach to Shillong View Point	169	Tosekgre		
47	Crinoline waterfalls	88	Rynji Falls	129	Sohbar	170	Daribokgre		
48	Dalu	89	Saipung	130	Phoh Rangksu Eco Park	171	Eco-camp		
49	Durga temple	90	Samandagiri	131	Kshaid Mua Ranikor	172	Gitokgre cave		
50	Ialong Park	91	Sasatgre	132	Lum Kyrphei	173	Eco-camp		
51	Jakram hot spring	92	Sasatgre Village	133	Jirang	174	Sundare Dare		
52	Jakrem	93	Sibbari	134	Khliehumstem	175	Wakkaram		
53	Jarain Pitcher Plant Lake	94	Sisobibra	135	Green village	176	Mrang Mrang		
54	Khatarshnong Laitkroh	95	Smit	136	Kongthong	177	Picnic spot		
55	KhliehriÄt	96	Sohpetbneng Peak	137	Nongshluid	178	Cultural destination		
56	Kiang Nangbah Monument	97	Sohra	138	Lawbah	179	Cultural Destination		
57	Kotsati Cave Lumshnong	98	Stone Bridge at Thiumuwi	139		180	Rongmeram		

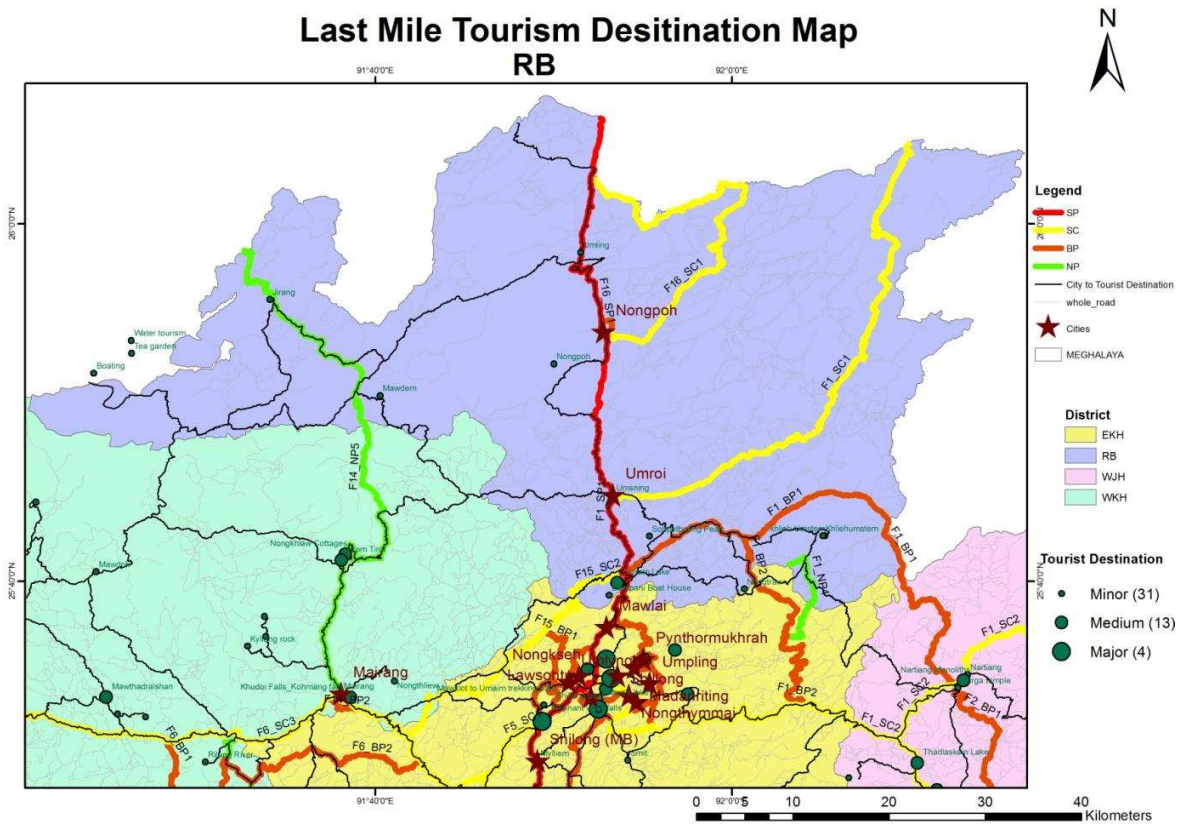
2. Last mile Tourist Connectivity map:


Last Mile Tourism Desitination Map
EGH
N
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EGH
NGH
SGH
WGH
WKH
Tourist Destination
Minor (48)
Medium (2)
Major (2)
Williamnagar
F12_NP1
F12_NP5
F11_SC2
F12_SC3
F12_BP3
F12_SC1
F12_SC2
F13_NP5
F7_SC2
F7_BP2
F8_SC2
F8_BP1
CHEKRENG DARE
Nokrek Peak
Nokrek National Park
90°20'0"E
90°40'0"E
25°40'0"N
0 3.75 7.5 15 22.5 30
Kilometers

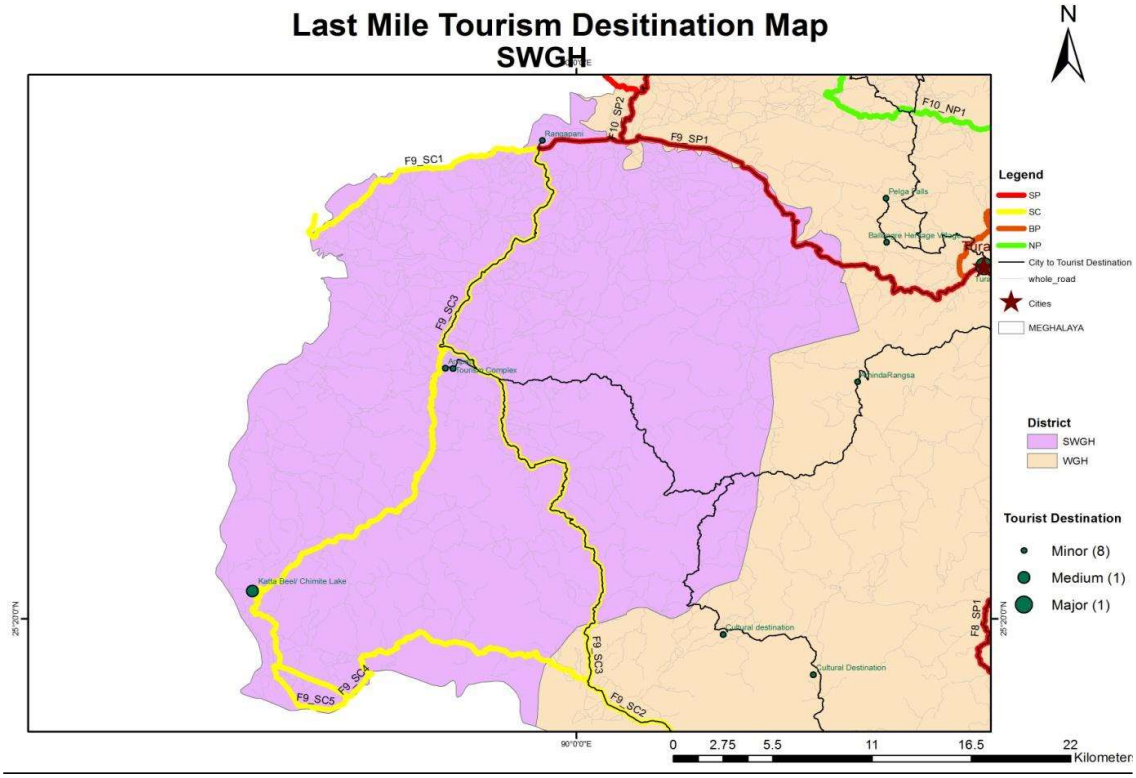

Last Mile Tourism Desitination Map
EKH
N
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EKH
RB
SWKH
WJH
WKH
Tourist Destination
Minor (57)
Medium (22)
Major (11)
Mawlai
Nongthymmai
Madanriting
Shillong (MB)
Mairang
Cherrapunjee
0 4.75 9.5 19 28.5 38
Kilometer


Last Mile Tourism Desitination Map
EJH
N
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EJH
WJH
Tourist Destination
Minor (25)
Medium (5)
Major (0)
Iowai
Borghat
0 3.75 7.5 15 22.5 30
Kilometers

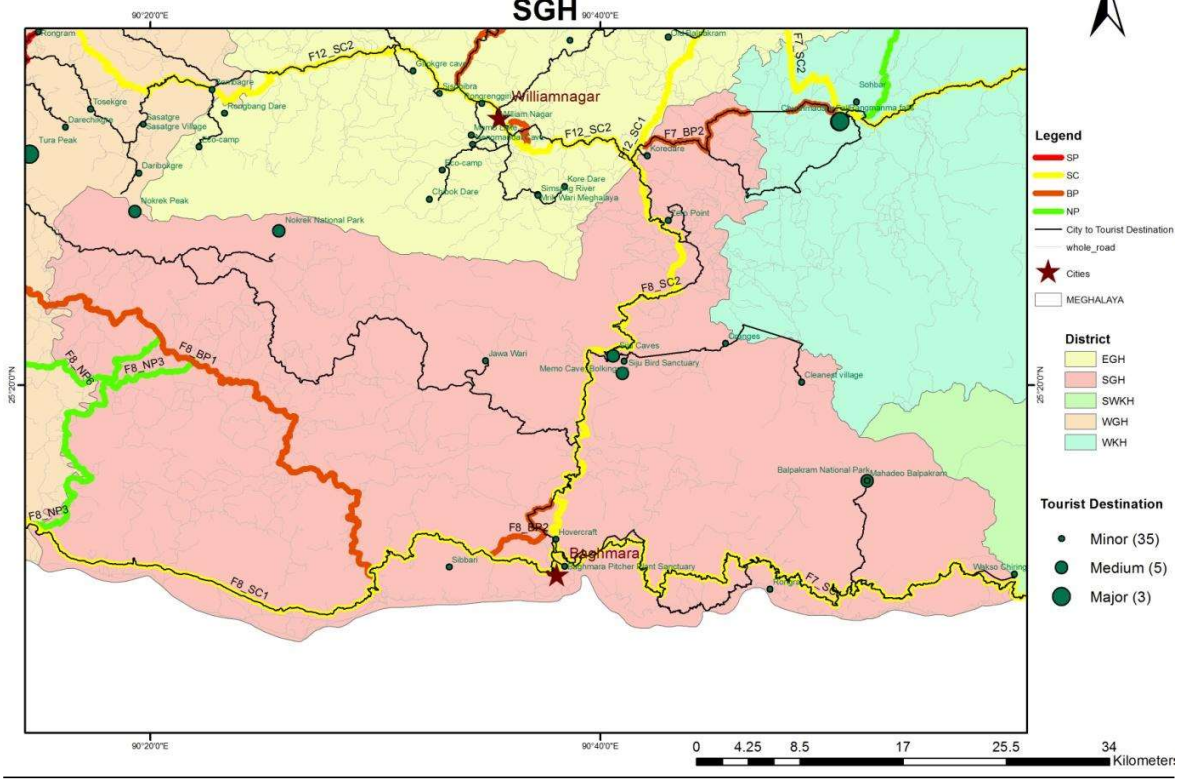

Last Mile Tourism Desitination Map
NGH
N
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EGH
NGH
WGH
WKH
Tourist Destination
Minor (41)
Medium (0)
Major (0)
Resubelpara
F11_SC1
F11_NP5
F12_SC2
F12_NP5
F12_NP1
F12_SC3
F12_BP3
F12_SC1
F13_NP5
F13_NP1
F7_SC2
0 3.75 7.5 15 22.5 30
Kilometers

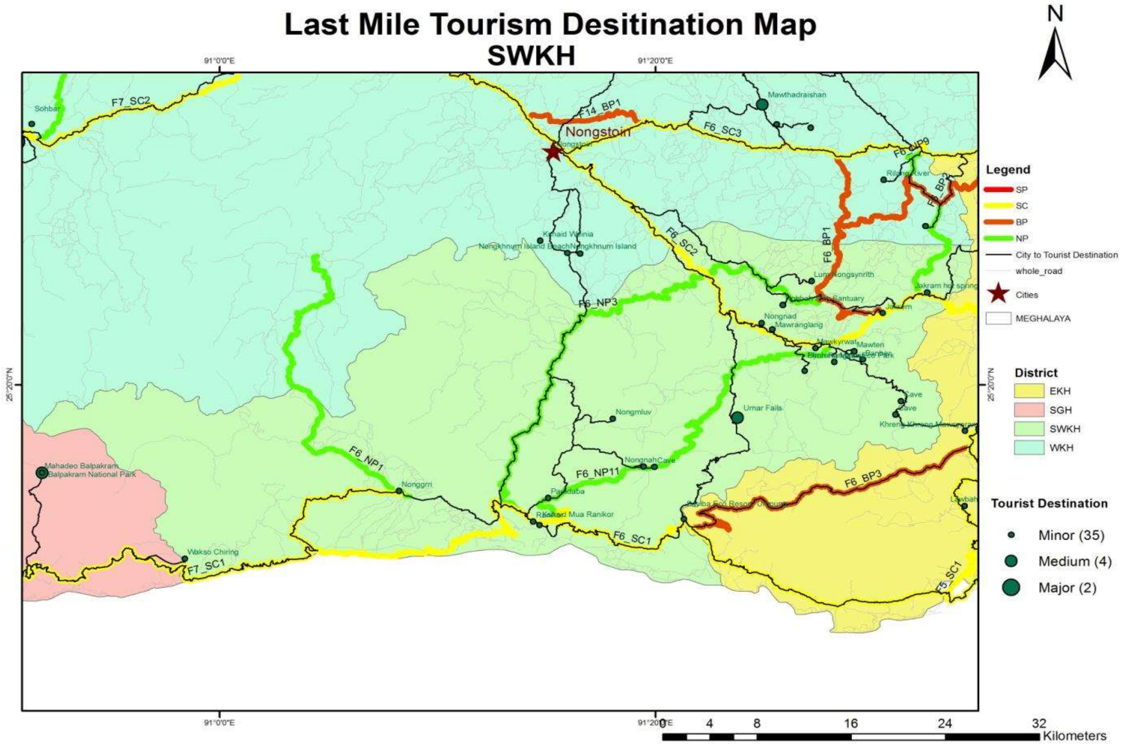

Last Mile Tourism Desitination Map
RB
N
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EKH
RB
WJH
WKH
Tourist Destination
Minor (31)
Medium (13)
Major (4)
Nongpoh
Umroi
Mawlai
Pynthormukhrah
Umpling
Shillong
Nongthymmai
Mawlang
Shillong (MB)
F16_SC1
F16_SP1
F1_SC1
F1_SP1
F1_BP1
F1_NP4
F1_SC2
F1_BP2
F2_BP1
F14_NP5
F15_SC2
F15_BP1
F5_SC1
F6_SC3
F6_BP1
F6_BP2
0 5 10 20 30 40
Kilometers

Last Mile Tourism Desitination Map
SWGH



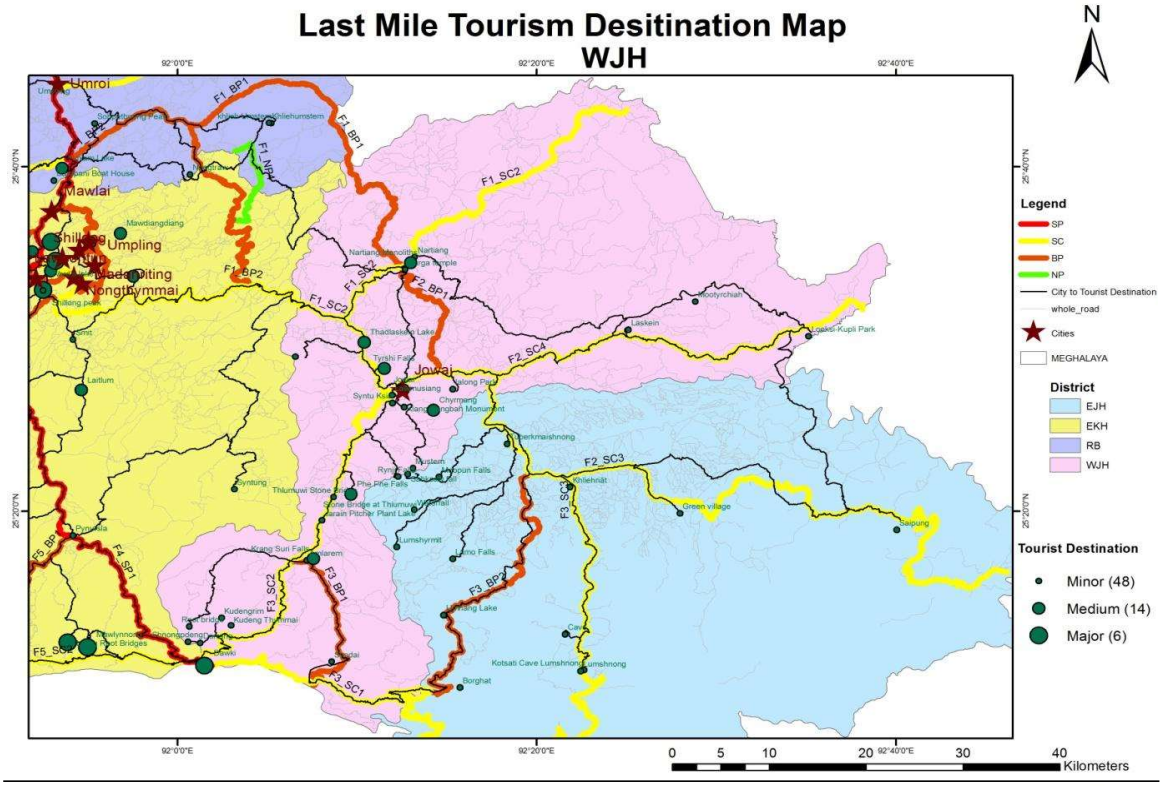
Last Mile Tourism Desitination Map
SGH

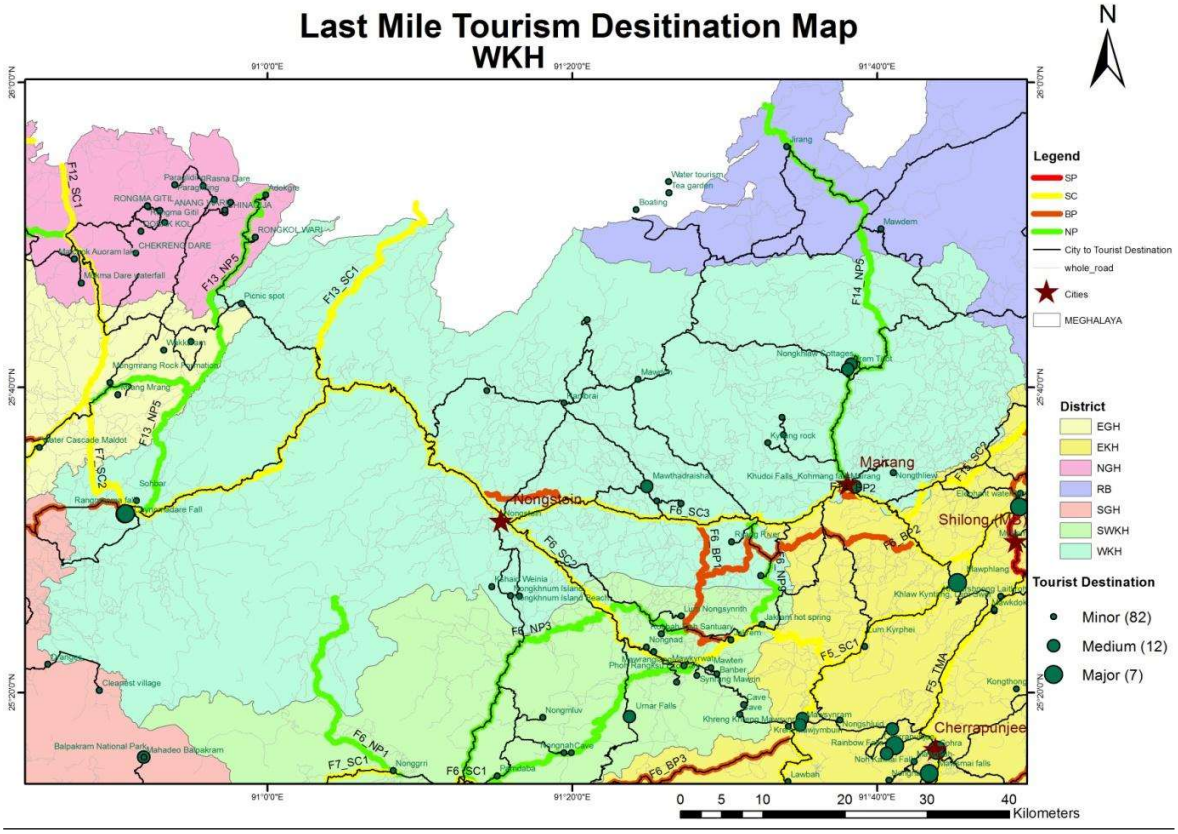




Last Mile Tourism Desitination Map
SWKH
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EKH
SGH
SWKH
WKH
Tourist Destination
Minor (35)
Medium (4)
Major (2)
Nongstoin
Kilometers

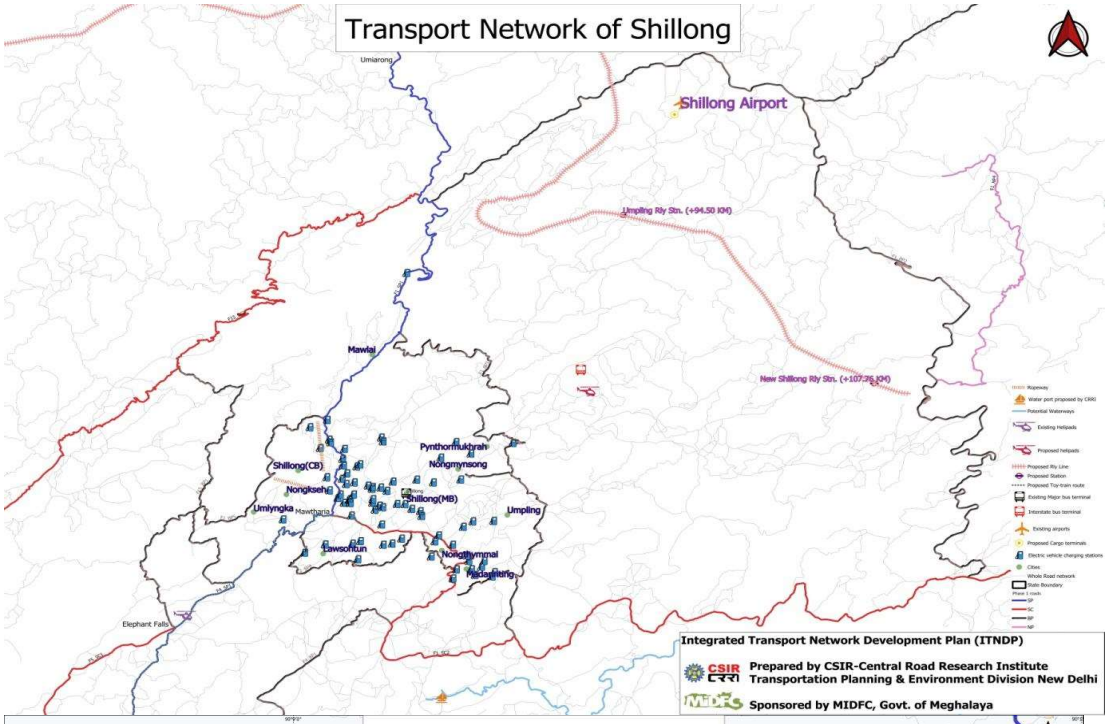
Last Mile Tourism Desitination Map
WGH
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EGH
NGH
SGH
SWGH
WGH
WKH
Tourist Destination
Minor (66)
Medium (5)
Major (2)
Resubelpara
Williamnagar
Tura
Kilometers

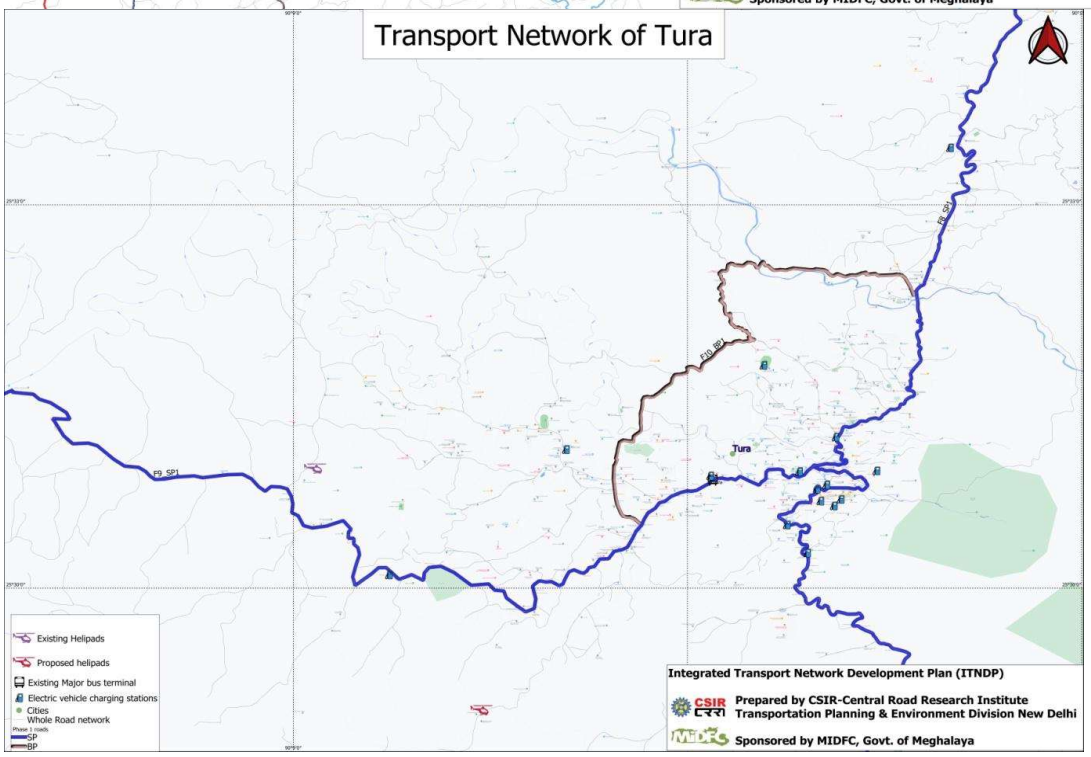

Last Mile Tourism Desitination Map
WJH
N
Umroi
Mawlai
Shillong
Umpling
Mawdiangdiang
Nongthymmai
Jowai
Laitlum
Laskein
Thadlaskein Lake
Tyrshi Falls
Syntung
Thlumuwi Stone Circle
Lumshyrmit
Lumi Falls
Kotsati Cave Lumshnong
Borghat
Green village
Saipung
Khliehriat
Umtasla
Kudengrim Falls
Kudeng Thymmai
Mawlynnong
Living Root Bridges
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EJH
EKH
RB
WJH
Tourist Destination
Minor (48)
Medium (14)
Major (6)
92°0'0"E
92°20'0"E
92°40'0"E
25°40'0"N
25°20'0"N
0 5 10 20 30 40
Kilometers


Last Mile Tourism Desitination Map
WKH
N
Nongstoin
Mawthadraishan
Mawdem
Mawsynram
Cherrapunjee
Shillong (Pt)
Laitkynsew
Mawphlang
Khliehshnong
Mawlynnong
Balpakram National Park
Cleanest village
Nongpoh
Umiam
Umiam Lake
Water tourism
Boating
Tea garden
Picnic spot
Mawmluh Cave
Nongmynsong
Nongthlieu
Khliehshnong
Legend
SP
SC
BP
NP
City to Tourist Destination
whole_road
Cities
MEGHALAYA
District
EGH
EKH
NGH
RB
SGH
SWKH
WKH
Tourist Destination
Minor (82)
Medium (12)
Major (7)
91°0'0"E
91°20'0"E
91°40'0"E
26°0'0"N
25°40'0"N
25°20'0"N
0 5 10 20 30 40
Kilometers

Annexure 3

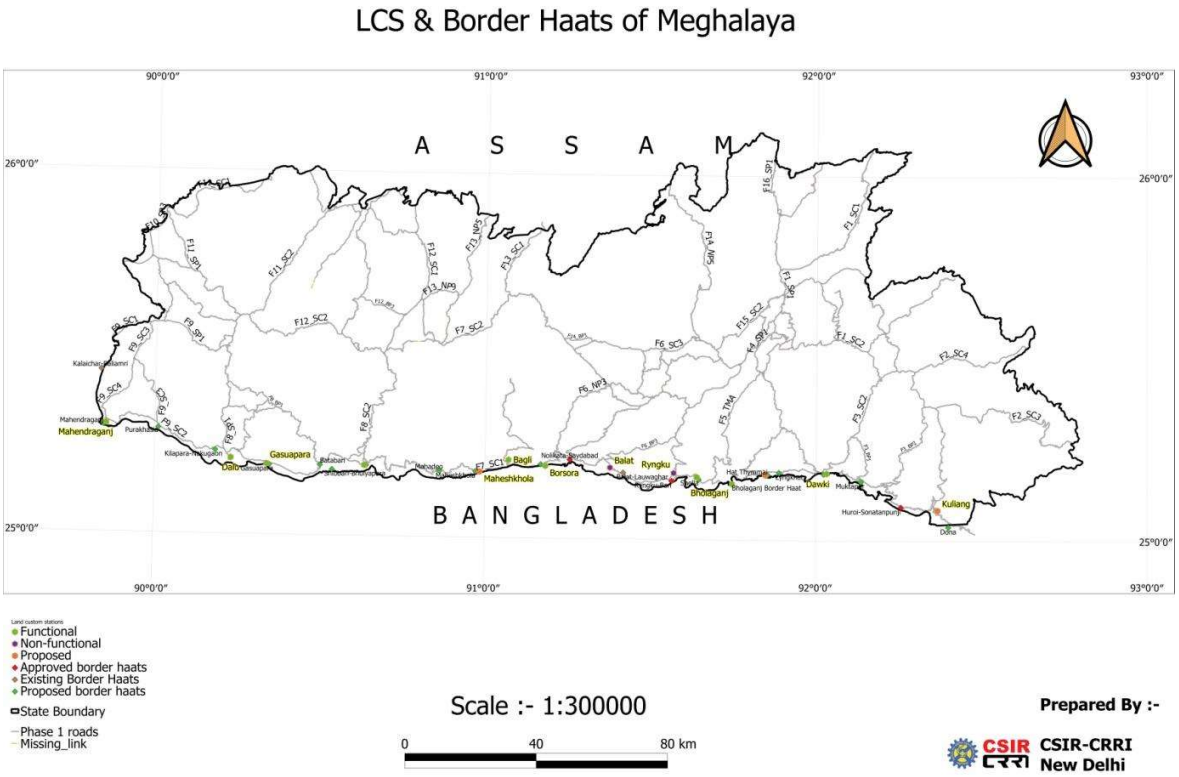
EV Charging stations map





Annexure 4

Map and List of Border Haats and LCS:



List of LCS:

Mahendraganj
Dalu
Gasuapara
Baghmara
Maheshkhola
Borsora
Balat
Shella Bazar
Ryngku
Bholaganj
Dawki
Hat Thymmai
Kuliang
Bagli

List of Border Haats:

1) Existing

Kalaichar-Baliamri
Balat-Lauwaghar

2) Approved

Bholaganj Border Haat
Huroi-Sonatanpunji
Nolikata-Saydabad
Ryngku-Bari

3) Proposed

Kilapara-Nakugaon
Huroi-Sonatanpunji
Hat Thymmai
Lyngkhat
Muktapur
Dona
Maheshkhola
Shella
Mahendraganj
Purakhasia
Dawki
Borsora
Batabari
Gasuapara
Baghmara
Shibbari-Bhulyapara
Mahadeo

Annexure 5

Weightage:

	Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways / inter-district roads connecting number of village roads including PMGSY roads,) (0-20)	**Connectivity** (No. of villages connected, Total population covered) (0-15)	**Economic Importance** (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/small /micro industries),) (0-20)	**Missing Links** (Missing links connectivity) (0-10)	**Capacity Constraints** (Volume/ Capacity,) (0-5)	**Time Saving** (Condition of roads from traffic and inventory data,) (0-10)	**Local Demand** (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)	**Pre-Feasibility** width/Curve visual (Available carriage way) (0-10)	**Possibility in terms** of cost of construction (0-10)			
	18	13	19	7	3	8	9	7	8	92		
Percentage	19.57	14.13	20.65	7.61	3.26	8.70	9.78	7.61	8.70	100.00		
	13	13	20	5	3	3	8	6	8	79		
Percentage	16.46	16.46	25.32	6.33	3.80	3.80	10.13	7.59	10.13	100.00		
	12	13	14	5	3	5	7	7	7	73		
Percentage	16.44	17.81	19.18	6.85	4.11	6.85	9.59	9.59	9.59	100.00		
	12	10	15	5	3	7	6	7	8	73		
Percentage	16.44	13.70	20.55	6.85	4.11	9.59	8.22	9.59	10.96	100.00		
	20	12	18	10	4	10	8	9	10	101		South Garo Hills
Percentage	19.80	11.88	17.82	9.90	3.96	9.90	7.92	8.91	9.90	100.00		
	13	13	20	5	3	3	8	6	8	79		
Percentage	16.46	16.46	25.32	6.33	3.80	3.80	10.13	7.59	10.13	100.00		
	16	12	15	6	3	7	10	8	9	86		
Percentage	18.60	13.95	17.44	6.98	3.49	8.14	11.63	9.30	10.47	100.00		
	4	0	4	0	0	3	3	3	0	17		
Percentage	23.53	0.00	23.53	0.00	0.00	17.65	17.65	17.65	0.00	100.00		
Average	18.41	13.05	21.23	6.36	3.32	8.55	10.63	9.73	8.73	100.00		

	12	6	12	7	3	5	5	6	5	61	
Percentage	19.67	9.84	19.67	11.48	4.92	8.20	8.20	9.84	8.20	100.00	
	20	15	15	10	5	10	10	8	8	101	
Percentage	19.80	14.85	14.85	9.90	4.95	9.90	9.90	7.92	7.92	100.00	
	20	12	18	0	3	2	2	6	8	71	
Percentage	28.17	16.90	25.35	0.00	4.23	2.82	2.82	8.45	11.27	100.00	
	15	8	11	9	3	8	8	7	5	74	
Percentage	20.27	10.81	14.86	12.16	4.05	10.81	10.81	9.46	6.76	100.00	
	15	10	15	8	3	8	8	7	8	82	West Khasi Hills
Percentage	18.29	12.20	18.29	9.76	3.66	9.76	9.76	8.54	9.76	100.00	
	15	10	12	6	2	6	8	6	5	70	
Percentage	21.43	14.29	17.14	8.57	2.86	8.57	11.43	8.57	7.14	100.00	
	20	15	12	8	5	10	10	10	8	98	
Percentage	20.41	15.31	12.24	8.16	5.10	10.20	10.20	10.20	8.16	100.00	
	12	8	10	5	3	5	6	6	5	60	
Percentage	20.00	13.33	16.67	8.33	5.00	8.33	10.00	10.00	8.33	100	
Average	21.15	13.46	17.49	8.58	4.25	8.61	9.02	9.00	8.46	100.00	
	0	4	1	0	0	0	0	0	0	5	
Percentage	0	80	20	0	0	0	0	0	0	100	
	10	12	13	Roads = 6 Num, Bridges = 10 Num	0	4	5	6	9	#VALUE!	
Percentage											
	0	4	2	0	0	0	0	0	0	6	
Percentage	0.00	66.67	33.33	0.00	0.00	0.00	0.00	0.00	0.00	100.00	
	15	12	15	0	0	5	8	6	7	68	
Percentage	22.06	17.65	22.06	0.00	0.00	7.35	11.76	8.82	10.29	100.00	
	15	12	15	9	4	8	9	8	8	88	
Percentage	17.05	13.64	17.05	10.23	4.55	9.09	10.23	9.09	9.09	100.00	
	15	10	12	6	3	6	5	7	8	72	
Percentage	20.83	13.89	16.67	8.33	4.17	8.33	6.94	9.72	11.11	100.00	
	15	12	16	8	3	8	9	8	8	87	
Percentage	17.24	13.79	18.39	9.20	3.45	9.20	10.34	9.20	9.20	100.00	
	15	8	14	5	3	6	4	4	5	64	
Percentage	23.44	12.50	21.88	7.81	4.69	9.38	6.25	6.25	7.81	100.00	
Average	14.37	31.16	21.34	5.08	2.41	6.19	6.50	6.15	6.79	100.00	

	20	15	20	8	3	10	10	10	10	106	
Percentage	18.87	14.15	18.87	7.55	2.83	9.43	9.43	9.43	9.43	100.00	
	14	10	5	6	4	6	7	5	6	63	
Percentage	22.22	15.87	7.94	9.52	6.35	9.52	11.11	7.94	9.52	100.00	
	18	13	15	5	4	8	10	10	10	93	
Percentage	19.35	13.98	16.13	5.38	4.30	8.60	10.75	10.75	10.75	100.00	
	20	2	15	10	2	5	10	10	10	84	
Percentage	23.81	2.38	17.86	11.90	2.38	5.95	11.90	11.90	11.90	100.00	
	15	9	10	6	4	6	7	7	9	73	
Percentage	20.55	12.33	13.70	8.22	5.48	8.22	9.59	9.59	12.33	100.00	
	15	10	15	5	3	8	8	8	7	79	
Percentage	18.99	12.66	18.99	6.33	3.80	10.13	10.13	10.13	8.86	100.00	
	20	12	20	10	3	8	10	6	0	89	
Percentage	22.47	13.48	22.47	11.24	3.37	8.99	11.24	6.74	0.00	100.00	
	20	15	18	10	4	10	10	10	10	107	West Garo Hills
Percentage	18.69	14.02	16.82	9.35	3.74	9.35	9.35	9.35	9.35	100.00	
	20	11	20	8	3	8	9	6	10	95	
Percentage	21.05	11.58	21.05	8.42	3.16	8.42	9.47	6.32	10.53	100.00	
	20	10	20	8	2	9	10	6	10	95	
Percentage	21.05	10.53	21.05	8.42	2.11	9.47	10.53	6.32	10.53	100.00	
	5	3	7	3	3	2	3	3	5	34	
Percentage	14.71	8.82	20.59	8.82	8.82	5.88	8.82	8.82	14.71	100.00	
	15	12	17	7	4	9	9	8	8	89	
Percentage	16.85	13.48	19.10	7.87	4.49	10.11	10.11	8.99	8.99	100.00	
	16	12	15	7	4	6	8	7	8	83	
Percentage	19.28	14.46	18.07	8.43	4.82	7.23	9.64	8.43	9.64	100.00	
	4	4	5	2	2	2	4	4	6	33	
Percentage	12.12	12.12	15.15	6.06	6.06	6.06	12.12	12.12	18.18	100.00	
Average	19.29	12.13	17.70	8.3933765	4.41	8.38	10.30	9.06	10.34	100.00	
	19	14	19	9	4	10	9	9	9	102	
Percentage	18.63	13.73	18.63	8.82	3.92	9.80	8.82	8.82	8.82	100.00	
	12	10	10	5	2	5	6	6	6	62	East Garo Hills
Percentage	19.35	16.13	16.13	8.06	3.23	8.06	9.68	9.68	9.68	100.00	
	15	10	14	5	3	6	7	6	8	74	
Percentage	20.27	13.51	18.92	6.76	4.05	8.11	9.46	8.11	10.81	100.00	

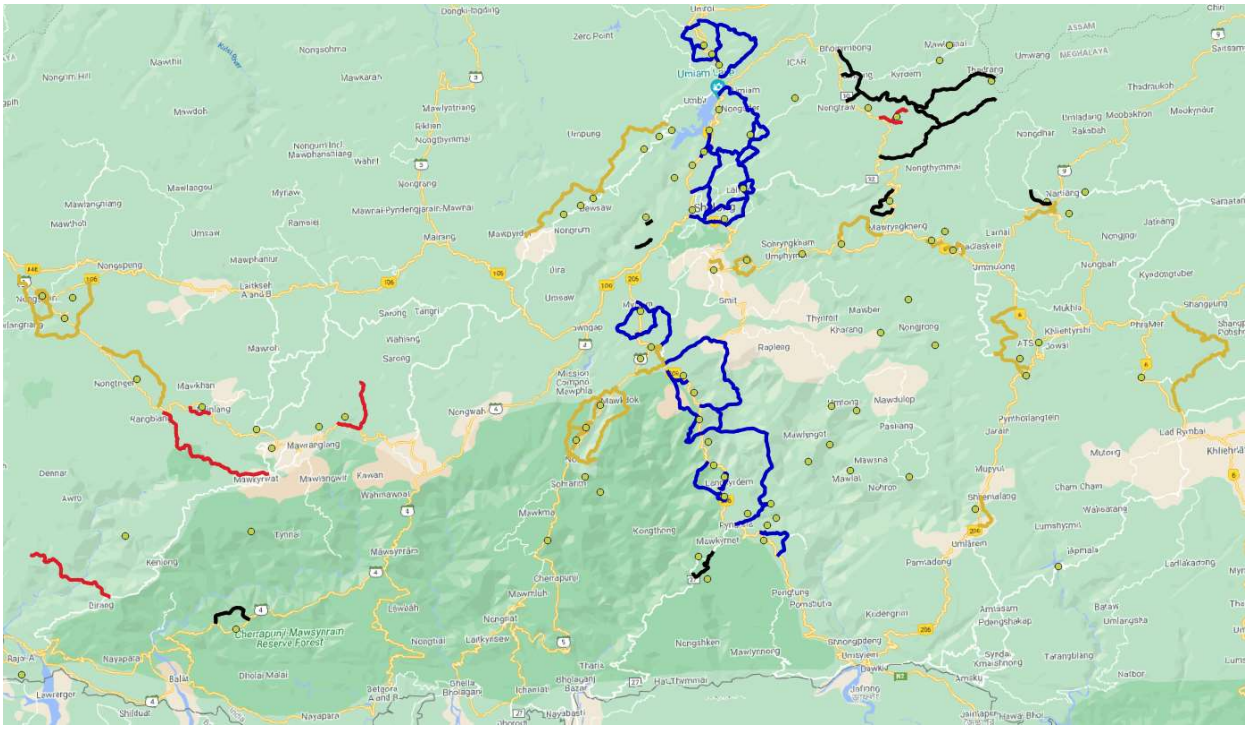
	10	6	7	4	3	3	4	4	3	44	
Percentage	22.73	13.64	15.91	9.09	6.82	6.82	9.09	9.09	6.82	100	
	6	8	9	7	3	7	6	0	0	46	
Percentage	13.04	17.39	19.57	15.22	6.52	15.22	13.04	0.00	0.00	100	
Average	18.80	14.88	17.83	9.59	4.91	9.60	10.02	7.14	7.23	100.00	
	15	12	15	10	3	8	8	8	7	86	
Percentage	17.44	13.95	17.44	11.63	3.49	9.30	9.30	9.30	8.14	100.00	
	17	10	16	5	3	9	9	6	7	82	SWKH
Percentage	20.73	12.20	19.51	6.10	3.66	10.98	10.98	7.32	8.54	100.00	
Average	19.09	13.07	18.48	8.86	3.57	10.14	10.14	8.31	8.34	100.00	
	5	3	5	5	2	3	5	3	4	35	
Percentage	14.29	8.57	14.29	14.29	5.71	8.57	14.29	8.57	11.43	100.00	
	10	10	5	5	2	5	0	0	8	45	
Percentage	22.2	22.2	11.1	11.1	4.4	11.1	0.0	0.0	17.8	100.0	
	0	0	5	0	0	5	5	0	5	20	
Percentage	0	0	25	0	0	25	25	0	25	100	SWGH
	10	4	4	3	2	3	2	4	5	37	
Percentage	27.03	10.81	10.81	8.11	5.41	8.11	5.41	10.81	13.51	100.00	
Average	15.88	10.40	15.30	8.3762334	3.89	13.20	11.17	4.85	16.93	100.00	
	18	12	15	9	4	0	0	0	7	65	
Percentage	27.69	18.46	23.08	13.85	6.15	0.00	0.00	0.00	10.77	100.00	
	18	12	15	9	4	0	0	0	7	65	
Percentage	27.69	18.46	23.08	13.85	6.15	0.00	0.00	0.00	10.77	100.00	
	15	10	10	3	2	5	6	6	7	64	
Percentage	23.44	15.63	15.63	4.69	3.13	7.81	9.38	9.38	10.94	100.00	
	12	10	10	8	2	5	5	6	7	65	
Percentage	18.46	15.38	15.38	12.31	3.08	7.69	7.69	9.23	10.77	100.00	East Khasi Hills
	20	12	15	5	5	10	10	10	8	95	
Percentage	21.05	12.63	15.79	5.26	5.26	10.53	10.53	10.53	8.42	100.00	
	15	15	12	10	5	10	10	8	8	93	
Percentage	16.13	16.13	12.90	10.75	5.38	10.75	10.75	8.60	8.60	100.00	
	13	10	13	9	4	7	6	7	5	74	
Percentage	17.57	13.51	17.57	12.16	5.41	9.46	8.11	9.46	6.76	100.00	
	12	9	14	10	3	6	7	6	7	74	

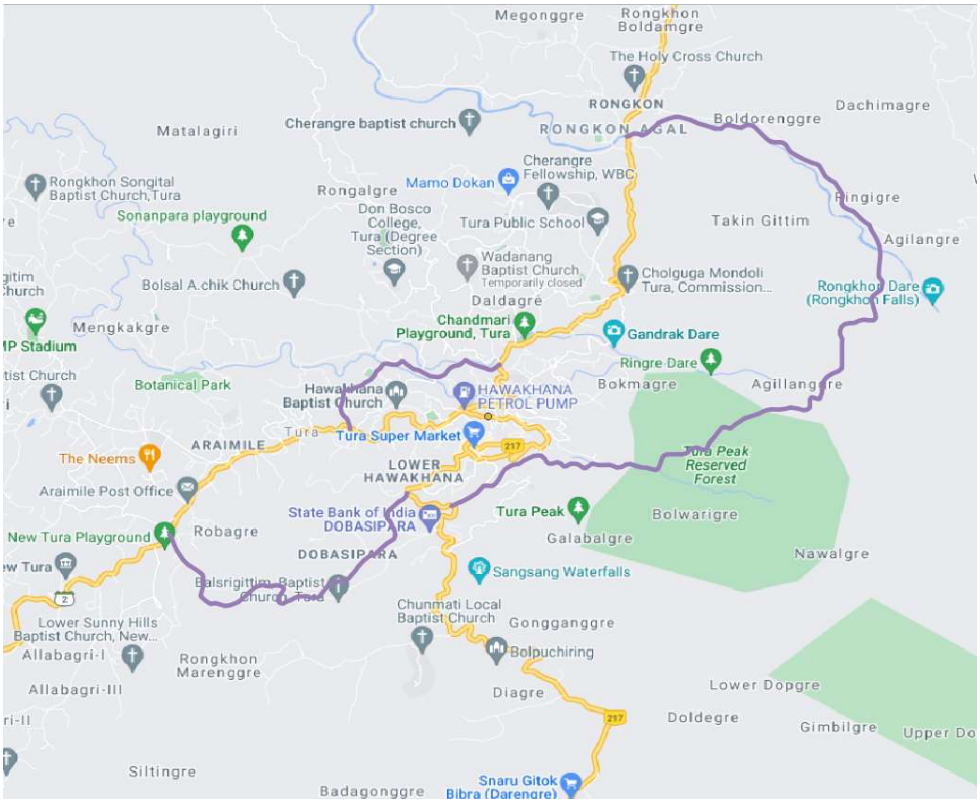
Percentage	16.22	12.16	18.92	13.51	4.05	8.11	9.46	8.11	9.46	100.00	
	15	12	17	8	3	8	7	8	8	86	
Percentage	17.44	13.95	19.77	9.30	3.49	9.30	8.14	9.30	9.30	100.00	
	19	14	18	10	4	10	8	6	9	98	
Percentage	19.39	14.29	18.37	10.20	4.08	10.20	8.16	6.12	9.18	100.00	
	12	10	15	5	3	7	9	5	6	72	
Percentage	16.67	13.89	20.83	6.94	4.17	9.72	12.50	6.94	8.33	100.00	
	15	12	15	5	3	7	9	5	6	77	
Percentage	19.48	15.58	19.48	6.49	3.90	9.09	11.69	6.49	7.79	100.00	
	15	12	15	5	3	7	9	5	6	77	
Percentage	19.48	15.58	19.48	6.49	3.90	9.09	11.69	6.49	7.79	100.00	
	12	6	17	7	4	5	5	5	6	67	
Percentage	17.91	8.96	25.37	10.45	5.97	7.46	7.46	7.46	8.96	100.00	
	12	10	15	6	3	9	6	5	7	73	
Percentage	16.44	13.70	20.55	8.22	4.11	12.33	8.22	6.85	9.59	100.00	
	15	15	15	8	6	6	5	7	7	84	
Percentage	17.86	17.86	17.86	9.52	7.14	7.14	5.95	8.33	8.33	100.00	
	12	10	15	5	3	6	6	7	7	71	
Percentage	16.90	14.08	21.13	7.04	4.23	8.45	8.45	9.86	9.86	100.00	
	15	10	15	5	3	6	6	7	7	74	
Percentage	20.27	13.51	20.27	6.76	4.05	8.11	8.11	9.46	9.46	100.00	
Average	19.45	14.65	19.19	9.32	4.65	8.07	8.13	7.37	9.17	100.00	
	15	10	20	2	3	2	5	3	8	68	Ribhoi
Percentage	22.06	14.71	29.41	2.94	4.41	2.94	7.35	4.41	11.76	100.00	
	2	1	20	0	1	0	1	3	10	38	
Percentage	5.26	2.63	52.63	0.00	2.63	0.00	2.63	7.89	26.32	100.00	
Average	13.66	8.67	41.02	1.47	3.52	1.47	4.99	6.15	19.04	100.00	
	20	15	20	0	5	10	10	10	10	100	West Jaintia Hills
Percentage	20	15	20	0	5	10	10	10	10	100	
	15	12	15	0	4	8	8	8	8	78	
Percentage	19.23	15.38	19.23	0.00	5.13	10.26	10.26	10.26	10.26	100.00	
	20	15	20	0	5	10	10	10	10	100	
Percentage	20	15	20	0	5	10	10	10	10	100	
	20	15	20	0	5	10	10	10	10	100	
Percentage	20	15	20	0	5	10	10	10	10	100	

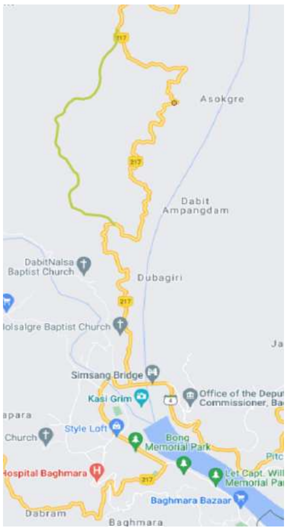
	20	15	20	0	5	10	10	10	10	100	
Percentage	20	15	20	0	5	10	10	10	10	100	
	15	12	15	0	4	8	8	8	8	78	
Percentage	19.23	15.38	19.23	0.00	5.13	10.26	10.26	10.26	10.26	100.00	
	20	12	19	9	4	9	8	9	10	100	
Percentage	20	12	19	9	4	9	8	9	10	100	
	15	12	15	8	4	8	9	7	7	85	
Percentage	17.65	14.12	17.65	9.41	4.71	9.41	10.59	8.24	8.24	100.00	
	20	15	20	0	5	10	10	10	10	100	
Percentage	20	15	20	0	5	10	10	10	10	100	
	15	10	15	10	5	10	10	10	5	90	
Percentage	16.67	11.11	16.67	11.11	5.56	11.11	11.11	11.11	5.56	100.00	
	10	10	10	10	5	10	10	10	10	85	
Percentage	11.76	11.76	11.76	11.76	5.88	11.76	11.76	11.76	11.76	100.00	
	20	10	20	0	5	10	10	5	5	85	
Percentage	23.53	11.76	23.53	0.00	5.88	11.76	11.76	5.88	5.88	100.00	
Average	19.01	13.88	18.92	3.44	5.11	10.30	10.31	9.71	9.33	100.00	
	20	15	20	10	0	10	10	10	10	105	East Jaintia Hills
Percentage	19.05	14.29	19.05	9.52	0.00	9.52	9.52	9.52	9.52	100.00	
	20	15	20	10	0	10	10	10	10	105	
Percentage	19.05	14.29	19.05	9.52	0.00	9.52	9.52	9.52	9.52	100.00	
	20	15	20	10	0	10	10	10	10	105	
Percentage	19.05	14.29	19.05	9.52	0.00	9.52	9.52	9.52	9.52	100.00	
	20	15	15	10	0	10	0	10	10	90	
Percentage	22.22	16.67	16.67	11.11	0.00	11.11	0.00	11.11	11.11	100.00	
	20	15	20	10	5	10	7	10	10	107	
Percentage	18.69	14.02	18.69	9.35	4.67	9.35	6.54	9.35	9.35	100.00	
	18	10	15	10	3	10	10	8	10	94	
Percentage	19.15	10.64	15.96	10.64	3.19	10.64	10.64	8.51	10.64	100.00	
Average	19.53	14.03	18.08	9.94	1.31	9.94	7.63	9.59	9.94	100.00	

Annexure 6

Landslide mitigation routes:




Megonggre
Rongkhon Boldamgre
The Holy Cross Church
RONGKON
Dachimagre
Matalagiri
Cherangre baptist church
RONGKON AGAL
Boldorenggre
Cherangre Fellowship, WBC
Rongkhon Songital Baptist Church,Tura
Rongalgre
Mamo Dokan
Pingigre
Sonanpara playground
Don Bosco College, Tura (Degree Section)
Tura Public School
Takin Gittim
Agilangre
Wadanang Baptist Church
Temporarily closed
Bolsal A·chik Church
Cholguga Mondoli Tura, Commission...
Rongkhon Dare (Rongkhon Falls)
Daldagre
Mengkakgre
Chandmari Playground, Tura
Gandrak Dare
Ringre Dare
Botanical Park
Hawakhana Baptist Church
HAWAKHANA PETROL PUMP
Bokmagre
Agillangre
Tura
Tura Super Market
ARAIMILE
The Neems
Tura Peak Reserved Forest
LOWER HAWAKHANA
Araimile Post Office
State Bank of India DOBASIPARA
Tura Peak
Bolwarigre
New Tura Playground
Robagre
Galabalgre
DOBASIPARA
Nawalgre
Sangsang Waterfalls
Balsrigittim Baptist Church
Chunmati Local Baptist Church
Gongganggre
Lower Sunny Hills Baptist Church, New...
Allabagri-I
Bolpuchiring
Rongkhon Marenggre
Allabagri-III
Diagre
Lower Dopgre
Doldegre
Gimbilgre
Siltingre
Badagonggre
Snaru Gitok Bibra (Darengre)

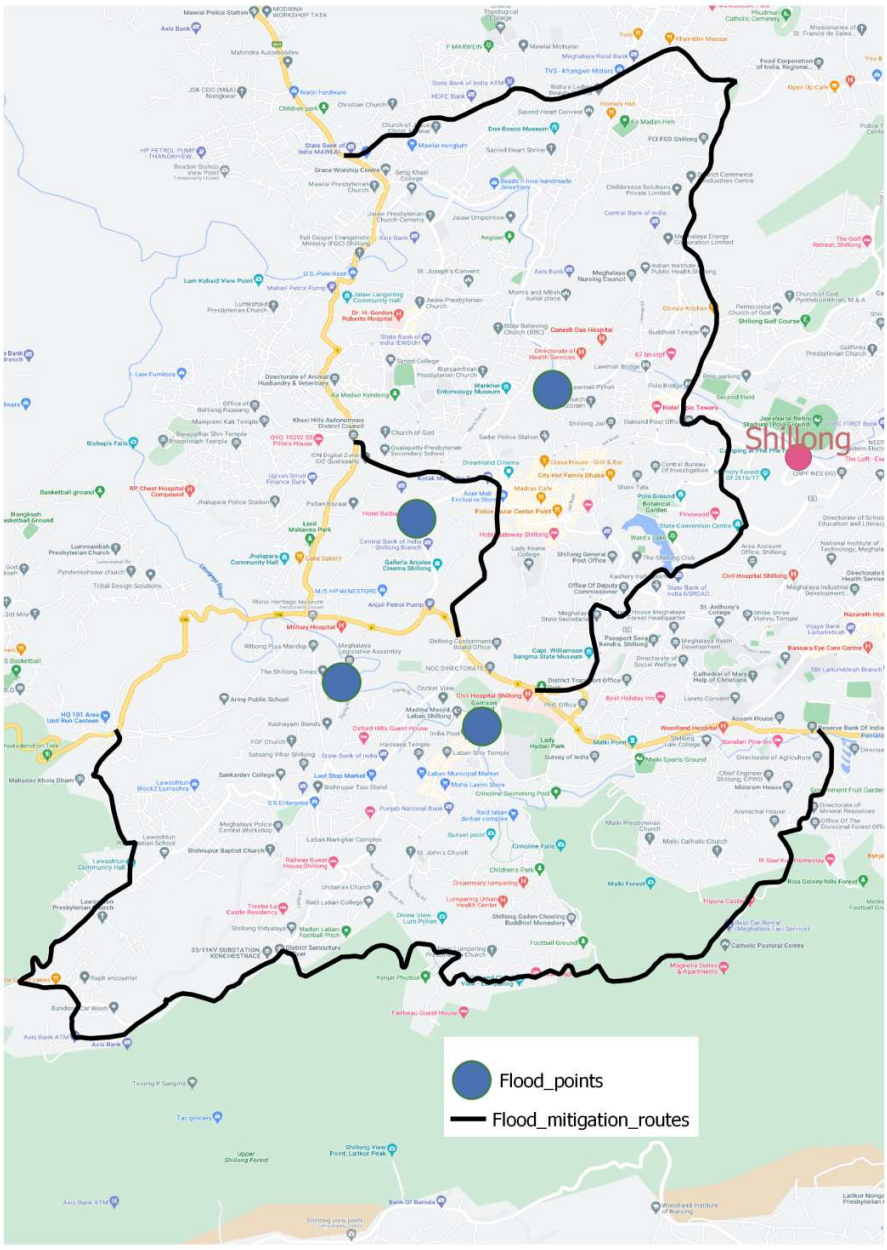


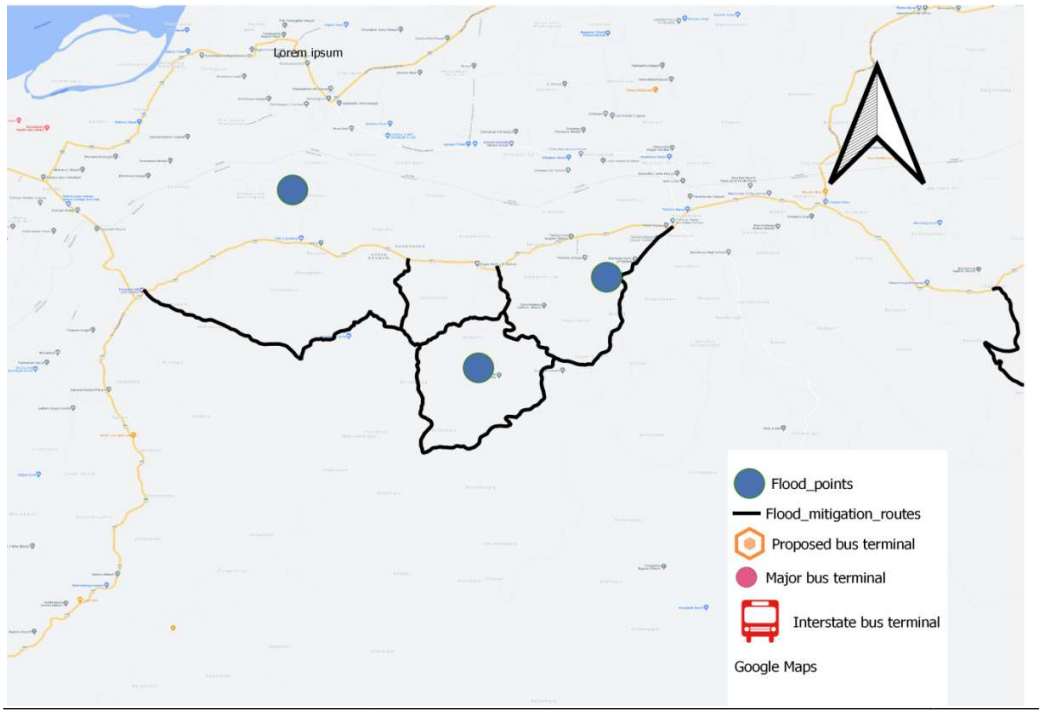
Asokgre
Dabit Ampangdam
DabitNalsa Baptist Church
Dubagiri
Simsang Bridge
Kasi Grim
Style Loft
Bong Memorial Park
Hospital Baghmara
Baghmara Bazaar
Baghmara
Dabram

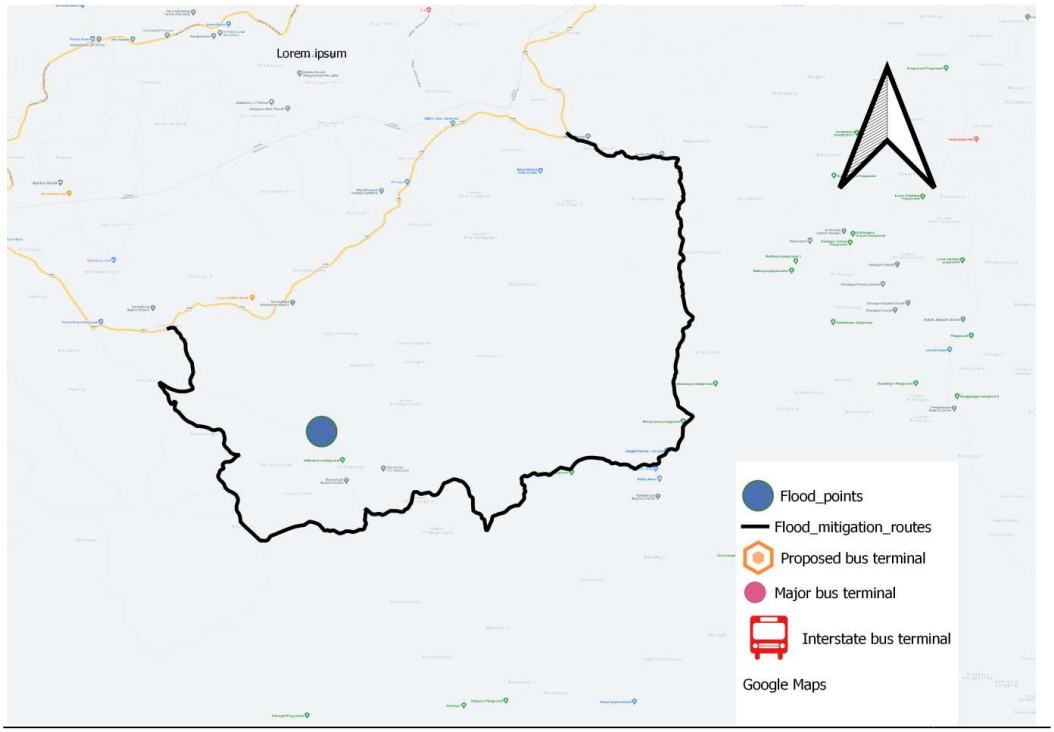
Jengjal
Marakapara
Wanbokgre
Babadamgre
Rongram
Chidekgre
Rangmalgre
Pongrenggre Reserved Forest
Balsipara
Rongalgre
Daldagre
Okkapara
Adegre
Dinigre
Nokrek National Park
Salmanpara
Dimagre
Bolmapara
Chandpara
Mandagiri
Dalugaon
Barengapara
Baghmara
Arapara
Kapasipara
Sibbari
Mayagachi
Emangiri
Siju

Annexure 7

Flood mitigation routes

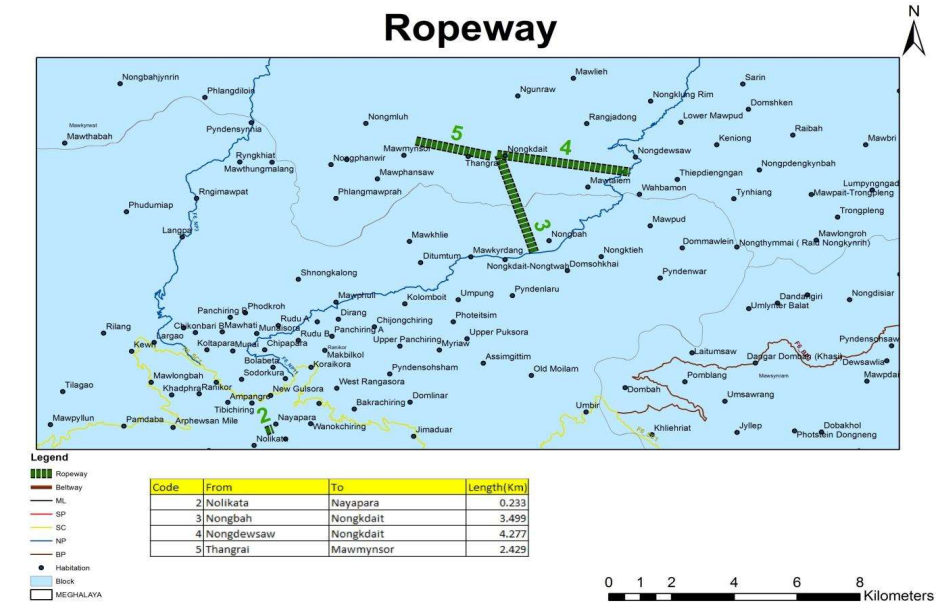



Lorem ipsum
Flood_points
Flood_mitigation_routes
Proposed bus terminal
Major bus terminal
Interstate bus terminal
Google Maps

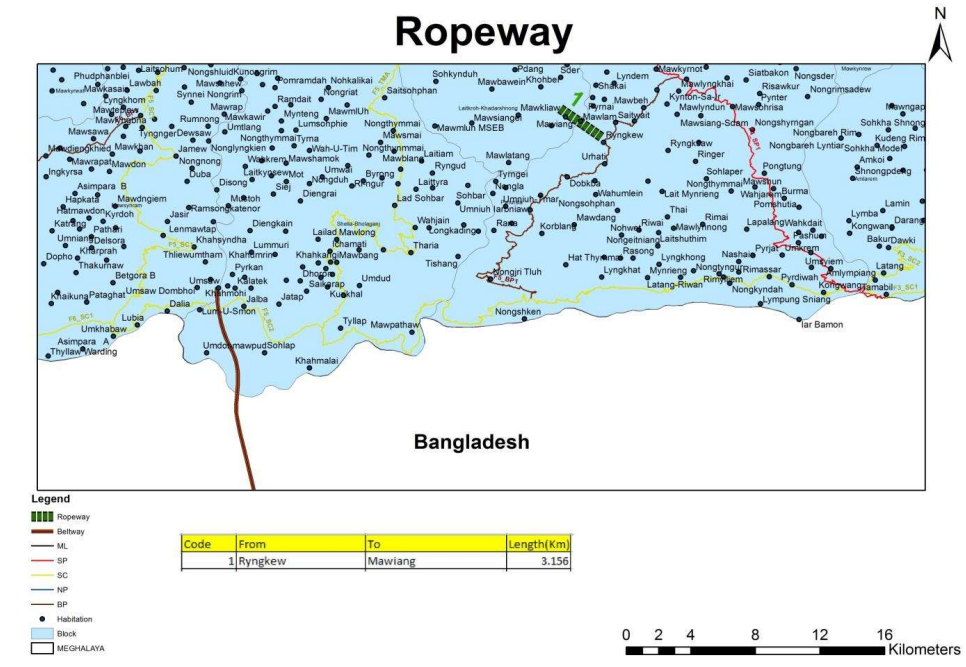

Lorem ipsum
Flood_points
Flood_mitigation_routes
Proposed bus terminal
Major bus terminal
Interstate bus terminal
Google Maps

Annexure 8

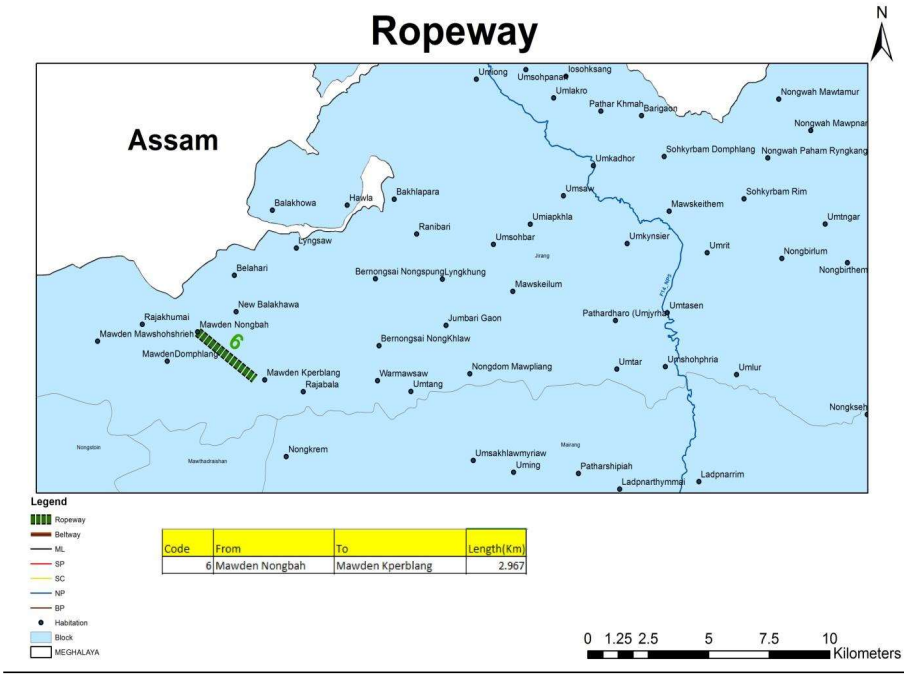
Ropeway maps

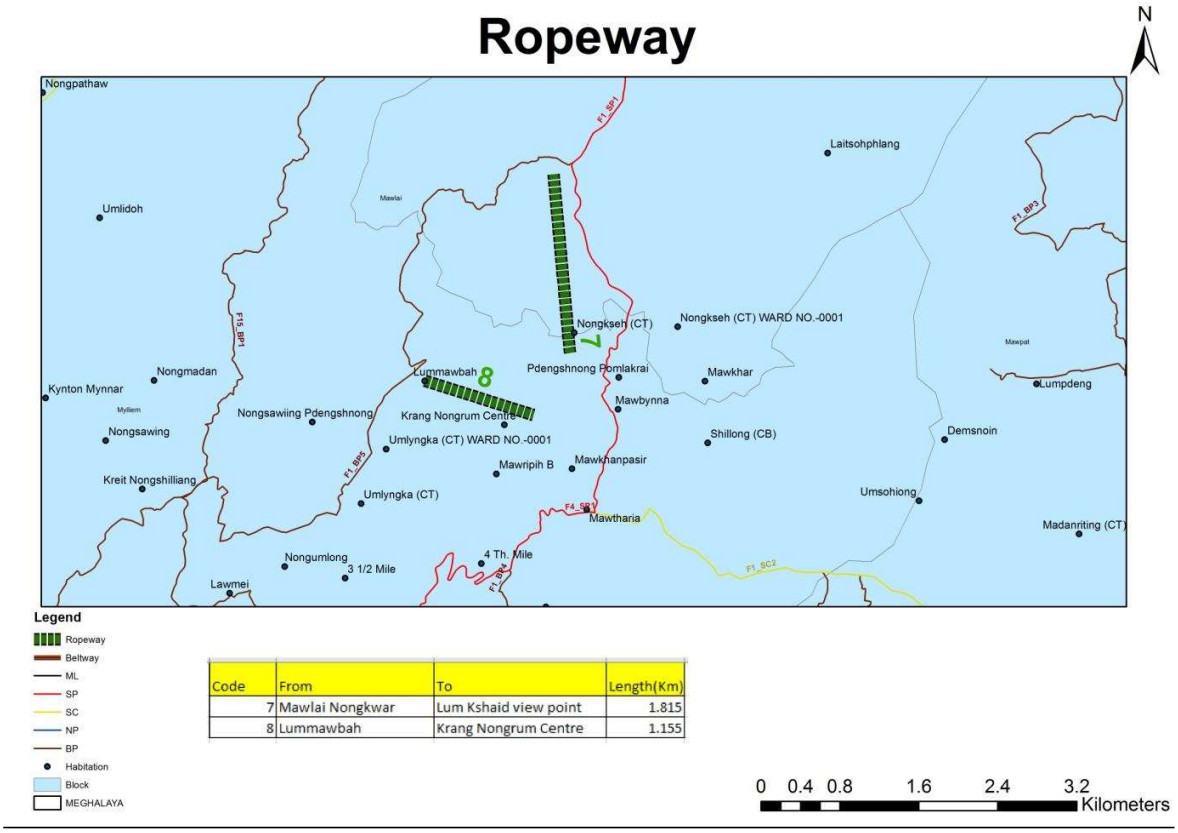


Code	From	To	Length(Km)
2	Nolikata	Nayapara	0.233
3	Nongbah	Nongkdait	3.499
4	Nongdewsaw	Nongkdait	4.277
5	Thangrai	Mawmynsor	2.429



Code	From	To	Length(Km)
1	Ryngkew	Mawiang	3.156


Ropeway
N
Assam
Umiong
Umsohpanah
Iosohksang
Umlakro
Pathar Khmah
Barigaon
Nongwah Mawtamur
Nongwah Mawpnar
Umkadhor
Sohkyrbam Domphlang
Nongwah Paham Ryngkang
Balakhowa
Hawla
Bakhlapara
Umsaw
Sohkyrbam Rim
Mawskeithem
Umtngar
Ranibari
Umiapkhla
Lyngsaw
Umsohbar
Umkynsier
Umrit
Nongbirlum
Nongbirthem
Belahari
Bernongsai NongspungLyngkhung
Mawskeilum
New Balakhawa
Rajakhumai
Mawden Nongbah
Jumbari Gaon
Pathardharo (Umjymai)
Umtasen
Mawden Mawshohshrieh
6
Bernongsai NongKhlaw
MawdenDomphlang
Mawden Kperblang
Warmawsaw
Nongdom Mawpliang
Umtar
Umshohphria
Umlur
Rajabala
Umtang
Nongkseh
Nongkrem
Umsakhlawmyriaw
Umiing
Patharshipiah
Ladpnarrim
Ladpnarthymmai
Legend
Ropeway
Beltway
ML
SP
SC
NP
BP
Habitation
Block
MEGHALAYA
Code
From
To
Length(Km)
6
Mawden Nongbah
Mawden Kperblang
2.967
0 1.25 2.5 5 7.5 10
Kilometers


Ropeway
N
Nongpathaw
Laitsohphlang
Umlidoh
Mawlai
Nongkseh (CT)
7
Nongkseh (CT) WARD NO.-0001
Nongmadan
Lummawbah
8
Pdengshnong Pomlakrai
Mawkhar
Kynton Mynnar
Mawbynna
Lumpdeng
Nongsawiing Pdengshnong
Krang Nongrum Centre
Nongsawing
Umlyngka (CT) WARD NO.-0001
Shillong (CB)
Demsnoin
Mawripih B
Mawkhanpasir
Kreit Nongshilliang
Umlyngka (CT)
Umsohiong
Mawtharia
Madanriting (CT)
Nongumlong
3 1/2 Mile
4 Th. Mile
Lawmei
Legend
Ropeway
Beltway
ML
SP
SC
NP
BP
Habitation
Block
MEGHALAYA
Code
From
To
Length(Km)
7
Mawlai Nongkwar
Lum Kshaid view point
1.815
8
Lummawbah
Krang Nongrum Centre
1.155
0 0.4 0.8 1.6 2.4 3.2
Kilometers

Annexure 9

Summary of Rough Estimate:

Abstract Summary Of Rough Estimate (Integrated Transport Network Development)

Name of Road	Description	Item Cost (Rs in Crores)	Remarks
Umpung - Khadphra (MBGM) (Length = 21.00 Kms)-	Earthwork	₹ 6.18	**State Highway (SH) Carriageway width proposed to 5.50m with 12 m formation width.**
	Sub base /base course	₹ 6.10	
	Bituminous Work	₹ 28.84	
	Construction of RCC Bridges 7 Nos.	₹ 20.79	
	H.P Culverts	₹ 5.16	
	Earthen Shoulder	₹ 0.10	
	Side drain	₹ 0.32	
	carriage loading and unloading	₹ 5.50	
	Road appurtenances	₹ 0.38	
	Sub-Total =	₹ 73.37	
	Add 2% +3% +7.50%	₹ 9.17	
		₹ 82.54	
	Say (Grand Total)	**₹ 82.54**	

(Rupees Eighty Two Crores Fity Four Lakhs) only.

The road is proposed for widening and upgradation to intermediate lane i.e 5.5m with formation width of 12.00m. The rough cost estimate amounting to Rs 82.54 Crores has been framed on the basis of the Schedule of Rates for Roads,

	Proposed Road Formation = 12.00 m										
	EARTHWORK										
	Av. Qty For E/W	=	21000.00	x	4.00	x	3.00	=	252000.00	m^3	
1/3.5	(iii) Excavation in Soil using Hydraulic Excavator and Tippers with disposal upto 1000 m.										
						@	20 %	=	50400.00	m^3	
				@	₹ 105.00	$/m^3$				=	₹ 5,292,000.00
2/3.8	(iii) Excavation in Soil using Hydraulic Excavator and Tippers with disposal upto 1000 m.										
						@	40 %	=	100800.00	m^3	
				@	₹ 156.00	$/m^3$				=	₹ 15,724,800.00
3/3.9	(i) Excavation in Hard Rock (requiring blasting) with disposal upto 1000 m.										
						@	30 %	=	75600.00	m^3	
				@	₹ 401.00	$/m^3$				=	₹ 30,315,600.00
	(iii) Excavation in Hard Rock (Controlled blasting).										
						@	10 %	=	25200.00	m^3	
				@	₹ 415.00	$/m^3$				=	₹ 10,458,000.00
4	**Proposal 7 Nos RCC Bridge**										
	Br. No 17/1	37.50	Rm								
	Br. No 18/1	6.37	Rm								
	Br. No 24/1	10.37	Rm								
	Br. No 25/1	7.5	Rm								

		0									
	Br. No 25/2	8.90	Rm								
	Br. No 26/1	8.50	Rm								
	Br. No 26/2	24.75	Rm								
	Total =	103.89	Rm								
				@	₹ 2,000,000.00			/ Rm		=	₹ 207,780,000.00
5/4.1	(B) By Plant Mix Method Construction of granular sub-base by providing well graded material, mixing in mechanical mix plant at OMC carriage of mixed material to work site upto a lead of 1000 m, spreading in uniform layers with motor grader on prepared surface and compacting with smooth wheel roller to achieve the desired density, complete as per Technical Specification Clause 401.										
	(II) For Grading- II Material										
	Area for Pavement =		21000.00	x	5.50			=	115500.00	m^2	
	Add 5% for curves in S/Elevation			@	5%			=	5775.00	m^2	
						Total		=	121275.00	m^2	
	Quantity	=	121275.00	x	0.125			=	15159.38	m^3	
				@	₹ 4,028.00	/m^3				=	₹ 61,061,962.50
6/4.9	**Wet Mix Macadam**										

	Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the material with water at OMC in mechanical mixer (Pug Mill), carriage of mixed material by tipper to site, laying in uniform layers in sub-base/base course on a well prepared sub-base and compacting with smooth wheel roller of 80-100 kN weight to achieve the desired density including lighting, barricading and maintenance of diversion, etc. as per Tables 400.11 & 400.12 and Technical Specification Clause 406.									
	Qty. (Two Layers) =		121275.00	x	0.15	x	2	=	36382.50	m^3	
				@	₹ 4,876.00	$/m^3$				=	₹ 177,401,070.00
7/5.1	**Prime coat**										
	(ii)Providing and applying primer coat with bitumen emulsion(SS-1) on prepared surface of granular base including clearing of road surface and spraying primer at the rate of 0.90-1.20 kg/sqm using mechanical means.									
	II. Medium Porosity									
	Qty.							=	1212750.00	m^2	
				@	₹ 71.00	$/m^2$				=	₹ 8,610,525.00
8/5.3	**Tack coat**										
	(ii)Providing and applying tack coat with with penetration grade bitumen (S-90) using bitumen pressure distributor at the specified rate of 0.50kg/sqm on the prepared WBM surface not primed, cleaned with hydraulic broom as per Technical Specification Clause 503.									
	Qty.							=	1212750.00	m^2	
				@	₹ 30.00	$/m^2$				=	₹ 3,638,250.00
9/5.4	**Bituminous Macadam**										

	(A). Providing and laying bituminous macadam with hot mix plant using crushed aggregates of grading as per table 500.4 premixed with bituminous binder, etc, transported to site upto a lead of 1000m laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled etc.										
	For Grading I (40 mm nominal size)										
	Quantity	=	121275.00	x	0.050			=	6063.75	m^3	
				@	₹ 9,849.00	$/m^3$				=	₹ 59,721,873.75
10/5.5	**SDBC**										
	Providing and laying semi dense bituminous concrete with with hot mixed plant using crushed aggregates of specified grading as per Table 500.14 (MORTH&H Specification) premixed with bituminous binder transporting to site upto a lead of 1000m,etc.										
	WITHOUT ANTI-STRIPPING AGENT										
	For Grading I (10 mm nominal size)										
	Quantity	=	121275.00	x	0.025			=	3031.88	m^3	
				@	₹ 12,872.00	$/m^3$				=	₹ 39,026,295.00
11/3.14	Construction of Earthen shoulders Construction of sub-grade and earthen shoulders with approved material obtained from borrow pits with all lifts and leads, etc. and compacting to meet requirement of Table 300.2 with lead upto 1000m…. (For earthen shoulders)										
	Av. Qty.	=	2100000.00	x	0.60	x	0.125	=	1575.00	m^3	
				@	₹ 627.00	$/m^3$				=	₹ 987,525.00

12/3.19	(II) Surface Drains in Ordinary Rock (A) Construction of unlined surface drains of average cross-sectional area 0.40 sqm in oridnary rock to specified lines, grades, levels and dimensions as per Technical Specification Clause 307. Excavated material to be used in embankment at site.										
	Av. Qty.	=	21000.00	x	1			=	21000.00	Rm	
				@	₹ 154.00	/m				=	₹ 3,234,000.00
13/-	**Hume Pipe NP4**							=	60	Nos.	
								@	₹ 860,000.00	Each	₹ 51,600,000.00
	Carriage + Loading and unloading							=			₹ 55,000,000.00
	Road Appurtenances		150000	x	25			=			₹ 3,750,000.00
									Total	=	₹ 733,601,901.25
					Add	2% + 3% + 7.5%				=	₹ 91,700,237.66
									GRAND TOTAL	=	₹ 825,302,138.91
									Say	=	**₹ 825,400,000.00**
	(Rupees Eighty Two Crores Fifty Four Lakhs) only.										

Annexure 10

World Bank Comments:

Comments and Observations:	**Comments /Feedback by CRRI**	**Action Taken by CRRI**
1. Firstly, there are lots of quality concerns especially related spellings, grammatical errors, and incomplete sentences which require serious editing to improve readability. Second – the report is basically a synthesis of data and information available in public domain – loosely put together. CRRI is requested to take a structured approach for developing the ITNDP which should be agreed upfront with the GoM and the Bank.	Revised structured report will be submitted once you agree to our feedback. All grammatical error and sentence check will be carried out.	Revised structure eis submitted in Phase 1 report
2. **As-Is Scenario and learning from the past** - Though inception report rightly covers some of the aspects of State transport network demands and provides as as-is scenario of transport network of the State as well as the ongoing work and future investments those that have been announced. The strategic planning should however look into the learning from the past as well. Especially the gaps in institutional capacity, implementation and operational capabilities, as well as coordination requirements, which could be at all levels, local, State, and national. Further, it should also include all existing / ongoing future plans coming up under various schemes/ programs of the central as well as state government.	We will incorporate this suggestion in our future work including various schemes and programs of national and state government. Currently States receives funding from Central Road Fund (C.R.F) Border Area Development Programme (BADP),Inter State Connectivity (I.S.C), N.L.C.P.R. projects are funded by the Ministry of DONER, North Eastern Council (NEC), North East Special Infrastructure Development Scheme (NESIDS), North East Road Sector Development Scheme (NERSDS) and the North Eastern Council (NEC) Ministry of Housing & Urban Affairs, Central Public Works Department, Ministry of external affairs The ASIDE Scheme and Export Development Fund for North East Region (EDF-NER). The funding is coming in fragmented manner from different sources. These funds are allocated as per objective and mission of their departments. Notwithstanding for PMGSY, there is no unified database or plan that can identify the gaps which can supplements and fulfill the strategic need of state of Meghalaya. For example there is no traffic data base at state level, there is no past data of road condition and inventory, or there is no roughness/condition database at state level or central level which can help in development of integrated transport network of the state. Also at intuitional level or departmental level there is very little manpower that is trained and their skilled capacity meets to plan, priorities and allocate the different schemes. There is lack of planner and modeler, coordinators who can foresee the vision of state as a whole. There is PMGSY Central funding Scheme, District Rural Road Plan has been made basis for fund allocation for connecting population up to 250. But for SH/NH/ or other population below 250 there is no such plan which is ready made tools for engineer to decide the witch project they should be implementing. Similar problem is with border roads with	Recommendation is given in section 6.5

	450 km length in Meghalaya. Also there are many Industry are developed without proper approach roads to Industry. Similar problem exists with connectivity to Agriculture, Mines and tourist. At the same time there is no single window scheme where the issue can be resolved at Institutional level. Such gaps in institution need further proper integrated transportation plan, capacity building and educational and intuitional training in this direction.	
3. Climate Compatibility and Environmental Sustainability – All strategic plans look full proofed on paper but may not withstand all weather if they are not climate compatible and environmentally sustainable. The inception report is absolutely silent on these aspects. Since Meghalaya is highly susceptible to intense and continuous rainfall, which often triggers landslides and mudslides, it is important to see how the current and proposed network are climate proofed. Additionally, as the State is rich in biodiversity, approximately 80% being covered with forest and trees, it is highly important to weigh and justify any additional construction against environmental parameters and not just on time savings and economic cost. Considerations geographical terrain and vulnerability to climate events of high rainfall, cloud burst, precipitation etc., transport network should considering building redundancies in the system to ensure all-round connectivity through alternative routes.	Climate Compatibility and Environmental Sustainability is very much important in terms of Meghalaya as it larger forest cover, land slide, high precipitation, earthquake prone zone. Maps and Data on this aspect are being collected and there will be addition on this section. In ITNDP a routes maps and transportation supply infrastructure such as helipad requirements, are being prepared considering building redundancy in system to ensure all round network. The road inventory and condition survey will include climate vulnerability and environmentally sensitive parameters, Considering environmental sensitivity, the proposed solution emphasize on improving existing SH, MDR, and rural roads within their existing right-of-way by improving drainage, climate vulnerable locations, pavements, road safety and promoting bio-engineering and environment friendly construction. Hill cutting is to be exercised in small and isolated sections with adequate mitigation measures. Also these parameters are included in Road inventory and condition survey format to assess the significance of the climate and environmental sustainability. A suitable environmental friendly cold mix technology, road from waste material, landslide treatment etc will also suggested as policy paradigm in traditional road construction. Apart from that very limited amount of hill cutting and filling is ensured by just following the existing alignment, limited capacity augmentation, is being made only in special case. All this steps will be helpful in achieving the climate and environmental sustainability.	Refer section 4.4.8 Also reccondation given in Chapter 6
4. Objectives – Further, transport is a derived demand and thus a transport network is to be created to meet the trade flows of the state. In case of Meghalaya it assumes importance as Meghalaya is the land gateway state between India and Bangladesh (specifically in context of trade with North Eastern States). This objective seems to have gone amiss in the very first paragraph of the Executive Summary.	The study do emphasize on international connectivity in addition to national and state level. It will include important routes for border trade between Meghalaya and Bangladesh, by border haat connectivity in addition to international routes like BBIN corridors connecting Bangladesh with India and Bhutan and Nepal via Meghalaya Suggested objectives in TOR has been already included as task 6.1 a. (i) all the transport infrastructure, roads, bridges, tracks, and footpath and footbridges, airport, railways waterways, including those providing international/regional, national, and local connectivity to both existing and planned network by	

a. The list of objectives needs to be properly framed. Currently, the sentences have been jumbled up. It is also advised to include the following in the objectives: i. Integrated development of transport network ii. Opportunities for greening and sustainable ways of freight Transport iii. Improving agro-logistics and supply value chain through integrated transport infrastructure iv. Inter-modal connectivity and continuity of network v. Institutional development – both in terms of capability and capacity for all modes of transportation b. Though the report starts with "Integrated Transport" the summary misses out on both "integration and other modes of transport" c. The ES lists various needs of the state – without any justification of the same. It's not clear how these interventions have been arrived at or justified?	national and state governments as well as border crossings;(ii) cities, towns, villages, habitations, (iii) markets including local markets and border haats; (iv) tourist centers, (v) industries including MSMEs, (Warehouses with their functionality); (vi) mining areas, (vii) agriculture areas, other centers of economic activities which require transport connectivity;(viii)Administrative boundaries International, State/District/Block. ii. and iii. *Kindly note, this study is for network development, while freight transport will be an important basis for network development. Same way agro-logistics and supply chains and intermodal connectivity will be considered while developing ITNDP* *iv: Intermodal connectivity and continuity are being identified by stakeholder workshop, building database, and using the frame-based concept for analysis based on major traffic flow. 16 frame has been created in Meghalaya.* *v.* **This is not clear – the study is essentially about network planning and not on institutions.** b. b. Air , water, bus routes are marked and rail are marked in Figure 5.9. Efficient working of air, rail, waterways, and international corridors will be considered while developing ITNDP. However, being a hilly state, road transport is the most prominent mode, very little scope for rail, waterways, and air transport, ITNDP will account for various plans of the Government for these modes of transport. c. All the needs mentioned in Executive Summary(ES) is based on availble data and detailed from main chapters. The chapter reference could be being mentioned in revised ES if required.	
5. State's Vision – While the report starts with an opening sentence of addressing State's vision, however, later it misses out to address the same. Firstly, the demand for transport network and or services against each sectors/ region should be established, thereafter in the basis of demand the network plans should be developed. The focus should however remain on green growth. Thus, selecting the mode of transport and its economics should be justified. Please note that the Chapter 2 repeats State's vision many times – without stating what the vision is. May help to get some	Kindly note Meghalaya has a Vision of becoming high income state by 2030 by capitalizing its potential for high value tourism and agriculture and horticulture in addition to small scale industries- Enterprise Development, mining, improvement of border haat and land custom station,. The transport network will be developed considering these demands in addition to the connectivity needs of under-served populations living in small and scattered locations in difficult hilly terrain: The study will consider (i) Enhancemnets in international connectivty by indetfying gaps and potential opportnites to reduce travel costs and intermodel perfromance – especifically considering the GOI and GOM efforts as per Act East Policy and HIRA (highway, Internet, Rail, and Air Port Model-upgradation of airport) (ii) Core network of SH and MDR to connect tourst locations agricurture markets (national and inetnational) and industries (iii) Rural Roads (PMGSY) to connect villages upto	Demand for transport network is established in Chapter 4.0. Network need is analyzed in Chapter 5 with plan . EV , cold mix technology, suggested in 4.10,

clarity over here. The Plan should integrate, align and reflect the state growth vision and existing/ upcoming strategies/ plans/ programs to become high income Meghalaya.	500/250 populatations (iv) Local roads and paths (to provide last mile connectivty) to populations below 250 (v) Important ropeways (for toursims and agriculture) (vi) Waterways havng toursim potential and can be modified in the international connectivty *The state export vision and opportunity is given in Annexure 11 in the Sheet*	
6. Transport Network – The report focuses mainly on the missing links of the network, connectivity between districts, regions and international borders. While it states the need for 'a growth-oriented transport network to achieve the state's Vision', but remains silent on what are the growth areas, what are the transport demand in those sectors/ regions, what are the major markets in the State that demand improve connectivity – such as:	We will consider this comment in our further work. Transports are derived demand due to agriculture, tourism, and mining, and horticulture, industrial and commercial activity. All the different sectors have been identified and mapped. Not only agriculture but all stated sectors are not able to reach their potential due to lack of road connectivity and its transportation facility. A separate tourist circuit, agriculture, mining circuit, and commercial circuits are being developed which will be incorporated in the Phase1 report. Main growth areas are cities/Town, tourism, and agriculture. Identification of missing gaps was considered an important aspect to develop corridors for interconnecting growth centers. It will also include the local issues.	Refer Section 4.5, 2, 4.6, 4.7 Market centre is identified in Section.
Daranggir Banana Market in Assam - Majority of the produce marketed through this very market comes from the foot hills of East Garo hills district of Meghalaya and the neighboring villages. Many publicly available literatures suggest that the market has not been able to attain its potential due to challenges in transportation.https://www.zizira.com/blogs/people-and-process/meghalaya-farmers-market	All this local issue will be further discussed with stakeholder and solution will be proposed.	The linking I shown in Figure 4.5
https://apeda.gov.in/apedawebsite/Announcements/APEDA_NER_Final_Project_Report_Compr.pdf - This report provides a comprehensive view of NER agriculture potential and transport linkages	All this local issue with agriculture constraints will be further discussed with stakeholder and solution will be proposed.	Agriculture potential market centre is identified in 4.5.2
https://mofpi.nic.in/sites/default/files/action_plan_for_development_of_value_chain_of_lakadong_turmeric_in_meghalaya_.pdf - This report discusses the logistic needs of Lakadong Turmeric from Meghalaya. It suggests ropeways as solution to move produces.	All this local issue will be further discussed with stakeholder and solution will be proposed.	Rope is identified and that will be proposed in Phase 2 report.

Ginger production and logistic issues in Meghalaya		
The report assess multi sectoral requirements including transport network required for improving agriculture productivity and income	All these issue will be further discussed with stakeholder and solution will be proposed.	
ITNDP should also cover first and last-mile connectivity plans of the network.	ITNDP is covering up to Integration of Local roads, paths, and small bridges for connecting small habitations and opening agricultural areas, tourist centers, industries, and mining areas and integrating with MDR/SH/NH/Asian Highway. This will be dealt in Phase 3 where it ensures last mile connectivity.	This will be dealt in Phase 3 where it ensures last mile connectivity.
The Plan would need to be drafted considering the current condition of the network- its asset life/ maintenance conditions and further rehabilitations/ upgradation and maintenance plans under works.	It will be, we are including a very comprehensive road inventory and condition surveys.	
The final ITNDP should cover all transport sub-sectors including the multi-modal integration of the network beyond the road sector.	Yes it will done integration of all transport mode (air, railway, water, bus, taxi (shared), bike and other .	Refer section 4.9
7. Additional Comments on Chapter 4:		
a. The figure presented as Fig 4.1 is not of Meghalaya and does not bear correlation with the para detailing the challenges and strength of the state in particular and north east in general	 Figure 4.1 is revised please see. The para will be revised.	
b. Many assertions are made on poverty, deficiency diseases etc. which may need substantiation with data.	Data can be referred to http://www.megplanning.gov.in/circular/Draft%20Meghalaya%20Vision%20Document%202020-21%20to%202024-25.pdf http://megplanning.gov.in/report/vision2030/vision2030.pdf	Phase report 1 covers all this aspect.
c. The biggest challenge identified is seclusion due to partition!!! Well this would indeed reflect poorly on the solutions arrived at – don't know where it is heading	● The idea was to highlight the development of missing link to increase the efficiency, which was not possible due to partition of country and state which could be major generator of traffic demand if not isolated.. To improve the regional cooperation NITI Ayog and Act East Policy has suggested important steps in this direction. ● NITI@75 recommended to provide 'North-East Road Network Connectivity Project Phase I': improve infrastructure in Meghalaya and Mizoram and	Phase 1 report structure changed.

	enhance connectivity with inter-state roads and international.. ● Other initiative such as Act East Policy is closely connected with its long-term vision of developing its Northeastern region (NER) which is considered as a gateway to Southeast Asia. It will have significant strategic and political dimensions. Maritime security is an important aspect of India's Act East policy. The policy supports connectivity programmers for promoting regional cooperation and integration between India, Bangladesh, Maynmanar and other ASEAN countries for their economic and strategic interests converge in the Indo-Pacific and provide a great opportunity for mutual cooperation. https://www.orfonline.org/expert-speak/indias-act-east-policy-and-regional-cooperation-61375/	
d. The language is so warped difficult to understand!	The section will be revised	Language checked and revised in Phase 1
e. Some mention of Japanese investment in Bangladesh is done – with Bangladesh to be treated as associate degree integral!!!! Have no clue what it means – but its essential to be sensitive of political economy of the region.	The idea was to further tap the investment made in Bangladesh by providing a value-added supply chain by Meghalaya for example setting a hub for automobile parts and assembly in Bangladesh and tap the investment benefits of Japanese companies.	
f. The rail road and airways facilities are listed without identifying routes of movement or capacity utilization – If its meant to be abstract then well accepted indicator of road density and rail density can be used.	Railways: There is only 1.2 km rail line in Mendipathar. 108 km length of railway has been proposed from Byrnihat to Shillong. Railway Ministry's plan for linking all State capitals with railway tracks by 2023. The Khasi Students' Union (KSU) and other organisations have been opposing plans to connecting Meghalaya, specifically the western half leading to Shillong, with railways. Their contention has been that it would be difficult to check the inflow of "unwanted outsiders" by train unlike in vehicles on the highways. Toy train Shillong-Sohra railway link would provide new opportunities for the state and the people who would utilize the railway for high-end tourism destination and as separate facility for farmers. This will also provide a kind of train ride for couples enjoying their honeymoon or others celebrating their anniversary in the midst of beauty and nature, Provision of parcel trains and rapid transportation of goods will further bolster the efficiency of supply chains during the lockdown, will help in movement of essential items. Roads: Road are the only major facilities to provide the transportation of goods and passenger. The road density of the state is only 47.8 Km/ 100 sq. km against the national average of 170. Even amongst the NE states, Meghalaya's road density is on the lower side of the spectrum. Several of the challenges faced by the State stem from a severe geographical disadvantage. The State is landlocked, far away from well-developed markets, has a hilly terrain with very severe slopes on the Southern side, and experiences heavy torrential rainfall. Due to our	Railway proposal and their length is given in Chapter 4.9.6

	hostile terrain and extreme climatic condition, maintenance of roads is very high. There is a 27% gap in the maintenance cost of these roads. The annual maintenance cost of SPT bridges inadequate budgeted. State strategy is to leverage central resources. Currently they are neither efficient and neither interconnected. There are many missing links and lack of infrastructure. Air: The domestic aircraft movements at all Indian airports put together have been forecasted to grow at the rate of 4.0% up to 2017-18 and at the rate of 8% for the period 2018-19 to 2022-23. (both international and domestic) have been forecasted to grow at the rate of 4.2% and 7.6% for the period 2013-14 to 2017-18 and 2018-19 to 2022-23 respectively. There is only one Airport at Shillong. The growth rate needs expansion in future. The present 6,000 ft runway can be extended to about 8,000 feet to facilitate the operation of narrow-body jet aircraft like Boeing 737 and Airbus A320. However, this would require the cutting of clusters of hillocks that would come in the way of approaching aircraft after the runway was extended. The cost of this obstacle removal is ₹ 8,000 Crores. Cost is a major constraint. https://www.aai.aero/en/content/airport-policy There is no facility for any airlift support in case of medical emergency.	
g. The report then starts following the urban rural area identification – may be for the purpose of calculating economic transactions – the base of core road network model. However, the chapter ends abruptly without really giving a sense of purpose for the listing of economic resources.	Additional paragraph will be added for listing the economic resources.	Phase 1 report is revised.
8. Chapter 5		
a. The chapter does not list whether the challenges are faced by government or private sector. It doesn't even list whether its related to road transportation or multimodal.	The challenges are faced by both government and private sector. Many sectors such as agriculture, industry, mining etc are dealt by both govt and pvt .Since road density is scare, road transportation is major contributors. Other mode air, aril, water is not significant currently; however they have potential to be further developed and strengthen specially for tourism and medical emergency purpose. Water transport can play significant role as alternative to road for mining purpose.	
b. It abruptly then moves once again to listing various road routes – wasn't clear of the purpose	Will be revisited	
c. The report once again moves abruptly to listing possibility of water transport.	Will be revisited	Phase report structure is changed .
9. Cities, Urban Transport and Congestions – The inception reports identifies both	Current study only cover upto bypass which will be further connecting to main arteries(NH,SH, MDR) to decongest the city. Other ancillary (parking space, public bus service,	

growing traffic in the important cities/ towns of the State as well as to-and-fro movement between cities in the neighbouring States. However, it is not clear how the study will consider the needs of the urban centres, not just the bypass, but also ancillary needs such as parking space, public bus services, footpaths, etc.	foot path etc.), CRRI could do if scope of the work is extended with enough resources.	
10. Land as well as inland water transportation routes through Bangladesh to Kolkata and *getting access to Chittagong port (through Tripura)* – The State in its vision document identifies these two connectivity routes as major hurdles to economic development of the State. While this may not be within the scope of work for the current TA, however, it is recommended to reflect on the State's preparedness for the same. If there is anything that State can do to mobilise the plan forward.	Meghalaya seeks to access the Chittagong and Mongla ports and reestablish direct road and rail links between cities of India and Bangladesh to enhance bilateral economic ties and people-to-people contact. The SOP allows transshipment of goods from Chittagong and Mongla on four road, rail, and water routes to Agartala (Tripura) via Akhaura; Dawki (Meghalaya) via Tamabil; Sutarkandi (Assam) via Sheila; and Srimantpur (Tripura) via Bibirbazar. During the trial, the cargo destined for the north-east India was transported from Chittagong to Agartala by road. It will also augment development and improve trade since the facility is likely to reduce time and distance substantially, making trade viable. A trial can be started by Govt. of Meghalaya. This can be discussed with state. https://opinion.bdnews24.com/2016/02/16/opportunities-for-meghalaya-bangladesh-ties/. https://www.orfonline.org/research/bangladesh-new-boost-to-maritime-connectivity-with-india/	
11. iTEAM 1917 - The Department of Agriculture, Government of Meghalaya, with the motto of "Connecting farmers to markets', launched the project 1917iTEAMS (Integrated Technology Enabled Agri Management System) in December 2017. The project which is based on Information Communication Technology (ICT) aims to cater to the needs of the farmers with just a phone call away as mobile telephony is the technology of choice for people from all walks of life today. https://1917iteams.in/about-us/ . The team is likely to have transportation and logistics demands from various production hotspots of Meghalaya	This development is very nascent stage but useful. The further discussion is going with team.	There is no issue of transportation as per current demand.
12. Potential of Waterways in Meghalaya - https://mdoner.gov.in/contentimages/files/Identification_of_Pote	OK, We will plan a meeting with states	Consultant is appointed by MIDFC in this regard. And some potential is given

ntial_Waterways_in_NER.pdf. This report provides a comprehensive view on potential waterways of Meghalaya. The consultant must discuss the same with the State authorities to find their interest and possibilities of development.		section 4.9.4 and 6.3.5
13. River Ropeways – To see if there is need for river ropeways as completed in Assam on River Brahmaputra.	India's "longest" river ropeway has been opened! Recently, the state government of Assam has inaugurated a 1.8 km ropeway across the river Brahmaputra and described it as the country's longest river ropeway. Every day, many people commute between the capital city of Guwahati and North Guwahati town, where IIT Guwahati is situated. The newly inaugurated ropeway cuts journey time between the two banks to around eight minutes, according to an IE report. Between the two banks, the current travel options are by ferry (half an hour or more, depending on the season and current) or by road through a bridge that generally takes more than an hour in the traffic. The CEO of the Guwahati Metropolitan Development Authority was quoted in the report saying that on the ropeway, one-way travel will take around nine to ten minutes. So if a person can complete a round trip between Guwahati and North Guwahati in just 20 minutes, it will be highly beneficial. According to Doley, the ropeway can be used by tourists to visit North Guwahati and spend quality time on that side. On that side, hospitality services will also be developed. Therefore, the newly launched ropeway is expected to be an overall boost for the city's tourism, he said. According to the report, the new river ropeway, linking Kachari Ghat in Guwahati to Dol Govinda Temple on the northern bank, passed the well-known Umananda temple on a small island. One-way Ticket INR 60. https://www.financialexpress.com/infrastructure/indias-longest-river-ropeway-over-brahmaputra-inaugurated-in-assam-know-why-it-is-special/2064950/ Possibility of such facility at Dhubari(Assam)_Phulbari(Meghalaya) can be explored.	No such proposal has been made, however it will be further explored in Phase 2.
14. Structured Stakeholder Consultations – CRRI should conduct structured stakeholder consultations by identifying the relevant stakeholder departments and organisations including C&RD Department, Ministry of Doner, North-East Council, Ministry of Civil Aviation and Airport Authority of India, Ministry of Shipping, Inland Waterways Authority, MoRTH / MoHUA for Ropeways etc.	CRRI will conduct a stakeholder meeting once the COVID situation is normalized.	Already conducted meeting one to one and meeting organized by PWD. Further consultation will be done in Phase 2 program.

15. E-Mobility – The planning should also explore possibility of introducing E-mobility in the growing cities and town in the State, such that the pristine hills can be saved from pollution as well as reduce the dependency on transport fuels which are procured at high cost from outside the State. Charging requirements are often less at the hills as travel distances are always less as compare to widespread cities and metros.	National Electric Mobility Mission Plan (NEMMP) and Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) We do agree that Meghalaya aspires to promote eco-friendly tourism. E-mobility is a step forward for the state in ensuring sustainable development. The plan to build a robust infrastructure for EVs that includes adequate power availability, a network of charging points, and a favorable power tariff. Among the state goals is the need to balance the power demand of utilities, bring operational efficiency and increase savings for transport utility and the transport sector in general. This will encourage new apartments, Petrol pumps, high-rise buildings, and technology parks to make provision for EV charging infrastructure. Right coordination among three pillars of EV industry viz. urban planning, transportation and power sectors is required CRRI can do the detailed study if the scope of the work is extended with enough resources.	Mentioned Table 5.11 and charging infrastructure identified for Shillong and Tura

Annexure 11

Meghalaya Export Vision and opportunity:

Meghalaya primarily exports mineral and horticultural products to Bangladesh, which constitute almost 90 percent of the total exports from the NER. Coal and limestone, two major mineral products found in the southern belt of Meghalaya, are exported through the LCSs at Dawki, Borsora, Mahendraganj, Baghmara, Gasuapara, Dalu, and Mankachar (Assam). There exists a complementarily between the resource base of the hills of Meghalaya and the nearby plains of Bangladesh. A cement factory at Chhatak in Bangladesh, for instance, fully depends on Meghalaya for limestone. Likewise, the tea gardens, jute mills, and brick manufacturing units in Bangladesh largely depend on coal mining in Meghalaya.
(http://megplanning.gov.in/report/vision2030/chapter7.pdf)
The journey time analysis's conducted between Dhaka and Thimpu via Meghalaya. The time saving has been taken as one of the parameters for a land gateway between India and Bangladesh. The border town of Dalu in Garo hills can be the first preferred nearest international border to the Northeast's business Hub, Guwahati. One can travel by road from Guwahati to Tura in four hours and Tura to Dalu in around two hours. From the border in Bangladesh's Naltabari in Nakugaon, it is three hours by road to the capital city, Dhaka. So one can travel from Guwahati to Dhaka in approximately 10 hours- this is possible and very much doable. The exports of ginger, oranges, etc. can also be encouraged from Dalu. Imports of plastic products, cement, refined oil, mosquito nets, etc., take place from this border town. new customs port area proposed by India in the border area of Gowainghatupazila of Sylhet can further increase the traffic,

The proposed link from Meghalaya to Hilli in west Bengal Apart could be an alternative for Chicken neck from that there is a lot of strategic significance of its due to movement. Dhaka Shillong Bus route has a lot of potential for serving tourist demand. Tamabil border imports boulder, coal, and limestone. Bangladesh's easy access to Meghalaya can be a big boon to tourism in Meghalaya.

Upgrading the existing border haats and adding new ones with basic facilities on either side of the international border will help flourish border trade to sell local produce and generate self-employment among the local population. The promotion of free trade will enhance trade and economic cooperation and bilateral trade where each economy produces goods by utilizing their strength in their field as well as the other country's technology thus opening their markets to each other.

The presence of several Land Custom Stations (LCS) in Meghalaya would augment the supply of raw materials for industries in Bangladesh. The necessity of connecting all LCS with railway network and discussed the matter with the center.

The Meghalaya government also intends to open inland waterways with Bangladesh to facilitate the movement of goods such as coal, limestone, and boulders. The use of Bangladesh's riverine routes could hugely benefit Assam and Meghalaya by making transportation of goods much easier. The Karimganj-Ashuganj river route is generally preferred, and both sides felt the necessity for upgrading the navigability of the Kushiara river to increase bilateral trade. In addition to this, the state government has identified three common rivers for developing commercial ties with Bangladesh. The three rivers include: the Kynshi in West Khasi Hills district, Simsang in South Garo Hills, and Jingrinam in West Khasi Hills

A new National Highway 127B connecting North Bengal with Garo Hills in the western region of Meghalaya bordering Assam across the Brahmaputra could emerge as a “trade corridor between Bhutan, Nepal, North East India, and Bangladesh”.
Overall there is the prospect of making Shillong a tourist and educational destination for the people of Bangladesh which will have derived demand that needs transportation network either created or upgraded. https://opinion.bdnews24.com/2016/02/16/opportunities-for-meghalaya-bangladesh-ties/
https://www.sentinelassam.com/editorial/time-for-drastic-measures-536921?infinitescroll=1

Annexure 12

RANKING

1 International Connectivity Roads

Weightage	10.39	14.49	20.60	18.06	7.22	3.76	8.59	8.99	7.91
	Possibility in terms of cost of construction (Total Cost in Lakhs)	**Connectivity (No. of villages connected, Total population covered) (TOTAL)**	**Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/small /micro industries),) (IN NUMBERS)**	**Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (IN NUMBERS)**	**Missing Links (Missing links connectivity) (0-10)**	**Capacity Constraints (Volume/Capacity,) (0-5)**	**Time Saving (Condition of roads from traffic and inventory data,) (0-10)**	**Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)**	**Pre-Feasibility width/Curve visual (Availabe carriage way) (0-10)**
SP1/F-1	910.5	17832	16	0	1.47	3.5	1.5	5.0	6.2
SP1/F-4	158000	21364	22	1	6.38	4.9	9.2	9.2	8.5
SP1/F-16	51733	28862	13	1	1.47	3.5	1.5	5.0	6.2
SP-1/F-11	54420	9625	8	0	8.39	4.4	8.4	10.3	9.1
SP-1/F-8	69101	5421	11	1	8.39	4.4	8.4	10.3	9.1
SP-2/F-10	31900	4417	3	0	8.39	4.4	8.4	10.3	9.1
SP-1/F-9	43500	9427	6	0	8.39	4.4	8.4	10.3	9.1
SP-3/F-10	13200	20490	2	2	8.39	4.4	8.4	10.3	9.1
SP-4/F-10	11791	3713	0	0	8.39	4.4	8.4	10.3	9.1
NP-1/F-10	21600	6898	3	0	8.39	4.4	8.4	10.3	9.1
SC-2/F-09	18200	5274	0	0	8.39	4.4	8.4	10.3	9.1
SC-3/F-09	13000	4669	3	0	8.38	3.9	13.2	11.2	4.8
SC-4/F-09	2395	33648	9	0	8.38	3.9	13.2	11.2	4.8
SC-5/F-09	200	16735	2	1	8.38	3.9	13.2	11.2	4.8

Road Number(SP/SC/SNP /BP)	Possibility in terms of cost of construction (0-10)	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/small /micro industries) ,) (0-20)	Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity,) (0-5)	Time Saving (Condition of roads from traffic and inventory data,) (0-10)	Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)	Pre-Feasibility width/Curve visual (Available carriage way) (0-10)
SP1/F-1	0.00	0.29	0.45	0.00	0.05	0.22	0.04	0.14	0.21
SP1/F-4	0.79	0.35	0.62	0.35	0.22	0.31	0.27	0.25	0.29
SP1/F-16	0.26	0.47	0.37	0.35	0.05	0.22	0.04	0.14	0.21
SP-1/F-11	0.27	0.16	0.23	0.00	0.29	0.28	0.24	0.28	0.31
SP-1/F-8	0.35	0.09	0.31	0.35	0.29	0.28	0.24	0.28	0.31
SP-2/F-10	0.16	0.07	0.08	0.00	0.29	0.28	0.24	0.28	0.31
SP-1/F-9	0.22	0.15	0.17	0.00	0.29	0.28	0.24	0.28	0.31
SP-3/F-10	0.07	0.33	0.06	0.71	0.29	0.28	0.24	0.28	0.31
SP-4/F-10	0.06	0.06	0.00	0.00	0.29	0.28	0.24	0.28	0.31
NP-1/F-10	0.11	0.11	0.08	0.00	0.29	0.28	0.24	0.28	0.31
SC-2/F-09	0.09	0.09	0.00	0.00	0.29	0.28	0.24	0.28	0.31
SC-3/F-09	0.07	0.08	0.08	0.00	0.29	0.25	0.39	0.30	0.16
SC-4/F-09	0.01	0.55	0.25	0.00	0.29	0.25	0.39	0.30	0.16
SC-5/F-09	0.00	0.27	0.06	0.35	0.29	0.25	0.39	0.30	0.16

Road Number (SP/SC/SNP/BP)	Possibility in terms of cost of construction (price /cost)	Connectivity (No. of villages connected, Total population covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/small /micro industries),) (0-20)	Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume /Capacity,) (0-5)	Time Saving (Condition of roads from traffic and inventory data,) (0-10)	Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)	Pre-Feasibility width/Curve visual (Available carriageway) (0-10)	Si+	Si-	Pi	RANK	ROAD NUMBER (SP/SC/ NP/BP)
SP1/F-1	0.05	4.20	9.34	0.00	0.37	0.84	0.37	1.22	1.65	16.08	9.91	0.38	5	SP1/F-1
SP1/F-4	8.25	5.03	12.84	6.38	1.61	1.16	2.30	2.25	2.28	6.65	17.23	0.72	1	SP1/F-4
SP1/F-16	2.70	6.80	7.59	6.38	0.37	0.84	0.37	1.22	1.65	10.41	11.85	0.53	2	SP1/F-16
SP-1/F-11	2.84	2.27	4.67	0.00	2.12	1.05	2.10	2.51	2.42	16.72	6.32	0.27	8	SP-1/F-11
SP-1/F-8	3.61	1.28	6.42	6.38	2.12	1.05	2.10	2.51	2.42	11.58	10.16	0.47	4	SP-1/F-8
SP-2/F-10	1.67	1.04	1.75	0.00	2.12	1.05	2.10	2.51	2.42	19.04	3.75	0.16	11	SP-2/F-10
SP-1/F-9	2.27	2.22	3.50	0.00	2.12	1.05	2.10	2.51	2.42	17.52	5.23	0.23	9	SP-1/F-9
SP-3/F-10	0.69	4.83	1.17	12.77	2.12	1.05	2.10	2.51	2.42	14.05	13.74	0.49	3	SP-3/F-10
SP-4/F-10	0.62	0.87	0.00	0.00	2.12	1.05	2.10	2.51	2.42	20.53	2.95	0.13	14	SP-4/F-10
NP-1/F-10	1.13	1.63	1.75	0.00	2.12	1.05	2.10	2.51	2.42	19.07	3.63	0.16	12	NP-1/F-10
SC-2/F-09	0.95	1.24	0.00	0.00	2.12	1.05	2.10	2.51	2.42	20.30	3.05	0.13	13	SC-2/F-09
SC-3/F-09	0.68	1.10	1.75	0.00	2.11	0.93	3.31	2.72	1.30	19.45	4.19	0.18	10	SC-3/F-09
SC-4/F-09	0.13	7.93	5.25	0.00	2.11	0.93	3.31	2.72	1.30	17.04	9.56	0.36	6	SC-4/F-09
SC-5/F-09	0.01	3.94	1.17	6.38	2.11	0.93	3.31	2.72	1.30	15.98	8.10	0.34	7	SC-5/F-09

V+	8.25	6.80	12.84	12.77	2.12	1.16	2.30	2.52	2.43
V-	0.05	0.874	0	0	0.37	0.83	0.36	1.22	1.65

2 National Connectivity

	weightage	10.39	14.49	20.60	18.06	7.22	3.76	8.59	8.99	7.91
SI NO	**Road Number(SP/SC/SNP/BP)**	**Possibility in terms of cost of construction (Total Cost in Lakhs)**	**Connectivity (No. of villages connected, Total population on covered) (0-15)**	**Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/ small /micro industries),) (0-20)**	**Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)**	**Missing Links (Missing links connectivity) (0-10)**	**Capacity Constraints (Volume/Capacity,) (0-5)**	**Time Saving (Condition of roads from traffic and inventory data,) (0-10)**	**Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)**	**Pre-Feasibility width/Curve visual (Available carriage way) (0-10)**
1	**SC1/F-1**	10000.00	13045.00	6.00	1.00	1.47	3.52	1.47	4.99	6.15
2	**SC2/F-1**	74385.00	35001.00	20.00	0.00	6.38	4.88	9.18	9.22	8.54
3	**SC3/F-2**	9352.50	5677.00	6.00	0.00	9.94	1.31	9.94	7.63	9.59
4	**SC4/F-2**	2000.00	8357.00	6.00	1.00	3.44	5.11	10.30	10.31	9.71
5	**SC1/F-3**	11265.00	4651.00	2.00	1.00	6.69	3.21	10.12	8.97	9.65
6	**SC2/F-3**	17400.00	19491.00	22.00	1.00	6.38	4.88	9.18	9.22	8.54
7	**SC3/F-3**	162400.00	12840.00	22.00	1.00	6.69	3.21	10.12	8.97	9.65
8	**SC1/F-5**	116623.50	21883.00	20.00	1.00	9.32	4.65	8.07	8.13	7.37
9	**SC2/F-5**	12098.75	6657.00	7.00	1.00	6.38	4.88	9.18	9.22	8.54
10	**TMA1/F-5**	3000.00	22383.00	16.00	0.00	9.32	4.65	8.07	8.13	7.37
11	**SC1/F-6**	11070.00	9125.00	10.00	1.00	9.09	4.11	9.10	9.13	7.84

12	**SC2/F-6**	102370.00	9206.00	8.00	0.00	8.86	3.57	10.14	10.14	8.31
13	**SC3/F-6**	11750.00	12844.00	9.00	0.00	8.86	3.57	10.14	10.14	8.31
14	**SC1/F-7**	92920.00	6017.00	9.00	1.00	7.61	3.44	9.35	10.38	9.02
15	**SC2/F-7**	5000.00	37419.00	13.00	0.00	9.08	4.58	9.11	9.52	8.07
16	**SC1/F-8**	92800.00	6873.00	8.00	1.00	7.37	3.86	8.47	10.46	9.39
17	**SC2/F-8**	115943.00	7461.00	11.00	0.00	7.97	4.11	9.08	10.32	8.43
18	**SC1/F-9**	250.00	3932.00	1.00	1.00	8.38	3.89	13.20	11.17	4.85
19	**SC3/F-9**	35786.00	10789.00	3.00	0.00	8.38	4.15	10.79	10.74	6.95
20	**SC-1/F-11**	1764.00	18384.00	0.00	1.00	8.39	4.41	8.38	10.30	9.06
21	**SC-2/F-11**	118047.00	7071.00	8.00	1.00	8.39	4.41	8.38	10.30	9.06
22	**SC1/F-12**	89900.00	14383.00	11.00	1.00	7.34	3.66	7.90	8.26	6.65
23	**SC-2/F-12**	89900.00	7983.00	19.00	0.00	8.39	4.41	8.38	10.30	9.06
24	**SC3/F-12**	10800.00	7370.00	3.00	1.00	7.34	3.66	7.90	8.26	6.65
25	**SC1/F-13**	184436.00	3936.00	4.00	1.00	8.58	4.25	8.61	9.02	9.00
26	**SC2/F-15**	46139.00	7304.00	0.00	0.00	6.46	4.14	6.05	7.38	7.51
27	**SC1/F-16**	5800.00	8929.00	2.00	1.00	1.47	3.52	1.47	4.99	6.15
28	**NP5/F-11**	5500.00	2941.00	0.00	1.00	5.08	2.41	6.19	6.50	6.15
29	**NP5/F-13**	1105.00	6098.00	4.00	1.00	7.51	3.41	8.31	8.55	7.82
30	**NP5/F-14**	6662.32	22838.00	5.00	1.00	5.02	3.89	5.04	7.00	7.58

S. NO	Road Number(SP/SC/SNP/BP)	Possibility in terms of cost of construction (0-10)	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/ small /micro industries),) (0-20)	Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity,) (0-5)	Time Saving (Condition of roads from traffic and inventory data,) (0-10)	Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)	Pre-Feasibility width/Curve visual (Available carriage way) (0-10)
1	**SC1/F-1**	0.03	0.16	0.10	0.22	0.04	0.16	0.03	0.10	0.14
2	**SC2/F-1**	0.19	0.43	0.34	0.00	0.16	0.22	0.19	0.19	0.19
3	**SC3/F-2**	0.02	0.07	0.10	0.00	0.24	0.06	0.21	0.15	0.22
4	**SC4/F-2**	0.01	0.10	0.10	0.22	0.08	0.23	0.22	0.21	0.22
5	**SC1/F-3**	0.03	0.06	0.03	0.22	0.16	0.15	0.21	0.18	0.22
6	**SC2/F-3**	0.04	0.24	0.37	0.22	0.16	0.22	0.19	0.19	0.19
7	**SC3/F-3**	0.41	0.16	0.37	0.22	0.16	0.15	0.21	0.18	0.22
8	**SC1/F-5**	0.30	0.27	0.34	0.22	0.23	0.21	0.17	0.16	0.17
9	**SC2/F-5**	0.03	0.08	0.12	0.22	0.16	0.22	0.19	0.19	0.19
10	**TMA1/F-5**	0.01	0.28	0.27	0.00	0.23	0.21	0.17	0.16	0.17
11	**SC1/F-6**	0.03	0.11	0.17	0.22	0.22	0.19	0.19	0.18	0.18
12	**SC2/F-6**	0.26	0.11	0.14	0.00	0.22	0.16	0.21	0.20	0.19
13	**SC3/F-6**	0.03	0.16	0.15	0.00	0.22	0.16	0.21	0.20	0.19
14	**SC1/F-7**	0.24	0.07	0.15	0.22	0.19	0.16	0.20	0.21	0.20
15	**SC2/F-7**	0.01	0.46	0.22	0.00	0.22	0.21	0.19	0.19	0.18
16	**SC1/F-8**	0.24	0.09	0.14	0.22	0.18	0.18	0.18	0.21	0.21
17	**SC2/F-8**	0.29	0.09	0.19	0.00	0.19	0.19	0.19	0.21	0.19
18	**SC1/F-9**	0.00	0.05	0.02	0.22	0.20	0.18	0.28	0.23	0.11
19	**SC3/F-9**	0.09	0.13	0.05	0.00	0.20	0.19	0.23	0.22	0.16
20	**SC-1/F-11**	0.00	0.23	0.00	0.22	0.20	0.20	0.18	0.21	0.20

21	**SC-2/F-11**	0.30	0.09	0.14	0.22	0.20	0.20	0.18	0.21	0.20
22	**SC1/F-12**	0.23	0.18	0.19	0.22	0.18	0.17	0.17	0.17	0.15
23	**SC-2/F-12**	0.23	0.10	0.32	0.00	0.20	0.20	0.18	0.21	0.20
24	**SC3/F-12**	0.03	0.09	0.05	0.22	0.18	0.17	0.17	0.17	0.15
25	**SC1/F-13**	0.47	0.05	0.07	0.22	0.21	0.19	0.18	0.18	0.20
26	**SC2/F-15**	0.12	0.09	0.00	0.00	0.16	0.19	0.13	0.15	0.17
27	**SC1/F-16**	0.01	0.11	0.03	0.22	0.04	0.16	0.03	0.10	0.14
28	**NP5/F-11**	0.01	0.04	0.00	0.22	0.12	0.11	0.13	0.13	0.14
29	**NP5/F-13**	0.00	0.08	0.07	0.22	0.18	0.16	0.17	0.17	0.18
30	**NP5/F-14**	0.02	0.28	0.08	0.22	0.12	0.18	0.11	0.14	0.17

S I. No	Road Number (SP/SC/SNP/BP)	**Possibility in terms of cost of construction (price/cost)**	**Connectivity (No. of villages connected, Total population covered) (0-15)**	**Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/small /micro industries),) (0-20)**	**Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)**	**Missing Links (Missing links connectivity) (0-10)**	**Capacity Constraints (Volume /Capacity,) (0-5)**	**Time Saving (Condition of roads from traffic and inventory data ,) (0-10)**	**Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)**	**Pre-Feasibility width/Curve visual (Availabe carriageway) (0-10)**	**Si+**	**Si-**	**Pi**	**RANK**	Road Number (SP/SC/SNP/BP)
1	**SC1/F-1**	0.26	2.34	2.09	4.04	0.26	0.60	0.26	0.90	1.09	8.93	4.92	0.36	20	**SC1/F-1**
2	**SC2/F-1**	1.96	6.28	6.97	0.00	1.12	0.84	1.65	1.67	1.52	5.15	9.46	0.65	3	**SC2/F-1**
3	**SC3/F-2**	0.25	1.02	2.09	0.00	1.75	0.22	1.79	1.38	1.71	10.12	3.19	0.24	28	**SC3/F-2**
4	**SC4/F-2**	0.05	1.50	2.09	4.04	0.61	0.88	1.85	1.87	1.73	9.11	5.13	0.36	17	**SC4/F-2**
5	**SC1/F-3**	0.30	0.83	0.70	4.04	1.18	0.55	1.82	1.62	1.72	10.24	4.65	0.31	25	**SC1/F-3**
6	**SC2/F-3**	0.46	3.50	7.67	4.04	1.12	0.84	1.65	1.67	1.52	5.55	9.39	0.63	4	**SC2/F-3**
7	**SC3/F-3**	4.28	2.30	7.67	4.04	1.18	0.55	1.82	1.62	1.72	4.55	10.06	0.69	2	**SC3/F-3**

8	**SC1/F-5**	3.07	3.93	6.97	4.04	1.64	0.80	1.45	1.47	1.31	3.58	9.49	0.73	1	**SC1/F-5**
9	**SC2/F-5**	0.32	1.19	2.44	4.04	1.12	0.84	1.65	1.67	1.52	8.92	5.18	0.37	16	**SC2/F-5**
10	**TMA1/F-5**	0.08	4.02	5.58	0.00	1.64	0.80	1.45	1.47	1.31	7.22	6.89	0.49	8	**TMA1/F-5**
11	**SC1/F-6**	0.29	1.64	3.49	4.04	1.60	0.71	1.64	1.65	1.39	8.06	5.88	0.42	13	**SC1/F-6**
12	**SC2/F-6**	2.70	1.65	2.79	0.00	1.56	0.61	1.82	1.84	1.48	8.42	4.67	0.36	18	**SC2/F-6**
13	**SC3/F-6**	0.31	2.30	3.14	0.00	1.56	0.61	1.82	1.84	1.48	8.80	4.31	0.33	21	**SC3/F-6**
14	**SC1/F-7**	2.45	1.08	3.14	4.04	1.34	0.59	1.68	1.88	1.60	7.67	6.10	0.44	10	**SC1/F-7**
15	**SC2/F-7**	0.13	6.71	4.53	0.00	1.60	0.79	1.64	1.72	1.43	7.02	7.99	0.53	5	**SC2/F-7**
16	**SC1/F-8**	2.45	1.23	2.79	4.04	1.30	0.66	1.52	1.90	1.67	7.79	5.92	0.43	12	**SC1/F-8**
17	**SC2/F-8**	3.06	1.34	3.83	0.00	1.40	0.71	1.63	1.87	1.50	8.00	5.42	0.40	15	**SC2/F-8**
18	**SC1/F-9**	0.01	0.71	0.35	4.04	1.47	0.67	2.37	2.02	0.86	10.68	4.88	0.31	24	**SC1/F-9**
19	**SC3/F-9**	0.94	1.94	1.05	0.00	1.48	0.71	1.94	1.94	1.24	9.94	3.12	0.24	29	**SC3/F-9**
20	**SC-1/F-11**	0.05	3.30	0.00	4.04	1.48	0.76	1.51	1.87	1.61	9.72	5.37	0.36	19	**SC-1/F-11**
21	**SC-2/F-11**	3.11	1.27	2.79	4.04	1.48	0.76	1.51	1.87	1.61	7.58	6.25	0.45	9	**SC-2/F-11**
22	**SC1/F-12**	2.37	2.58	3.83	4.04	1.29	0.63	1.42	1.50	1.18	6.30	6.62	0.51	6	**SC1/F-12**
23	**SC-2/F-12**	2.37	1.43	6.62	0.00	1.48	0.76	1.51	1.87	1.61	7.24	7.42	0.51	7	**SC-2/F-12**
24	**SC3/F-12**	0.28	1.32	1.05	4.04	1.29	0.63	1.42	1.50	1.18	9.78	4.60	0.32	23	**SC3/F-12**
25	**SC1/F-13**	4.86	0.71	1.39	4.04	1.51	0.73	1.55	1.63	1.60	8.74	6.81	0.44	11	**SC1/F-13**
26	**SC2/F-15**	1.22	1.31	0.00	0.00	1.14	0.71	1.09	1.34	1.33	10.97	2.04	0.16	30	**SC2/F-15**
27	**SC1/F-16**	0.15	1.60	0.70	4.04	0.26	0.60	0.26	0.90	1.09	10.26	4.26	0.29	26	**SC1/F-16**
28	**NP5/F-11**	0.14	0.53	0.00	4.04	0.89	0.41	1.11	1.18	1.09	11.09	4.20	0.27	27	**NP5/F-11**
29	**NP5/F-13**	0.03	1.09	1.39	4.04	1.32	0.59	1.50	1.55	1.39	9.78	4.69	0.32	22	**NP5/F-13**
30	**NP5/F-14**	0.18	4.10	1.74	4.04	0.88	0.67	0.91	1.27	1.35	8.22	5.79	0.41	14	**NP5/F-14**

V+	4.86	6.71	7.67	4.04	1.75	0.88	2.37	2.02	1.73
V-	0.01	0.53	0.00	0.00	0.26	0.22	0.26	0.90	0.86

3 By-Pass

	weightage	10.39	14.49	20.60	18.06	7.22	3.76	8.59	8.99	7.91

SI NO	Road Number(SP/SC/SNP/BP)	Possibility in terms of cost of construction (Total Cost in Lakhs)	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/ small /micro industries),) (0-20)	Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity,) (0-5)	Time Saving (Condition of roads from traffic and inventory data,) (0-10)	Local Demand (Potential source of safety Hazards, Border Area, Border Hat, Any other Significance) (0-10)	Pre-Feasibility width/Curve visual (Available carriage way) (0-10)
1	**BP1/F-1**	5332	14059	2	1	2.46	4.31	5.88	7.65	7.93
2	**BP2/F-1**	73805	15342	6	0	1.47	3.52	1.47	4.99	6.15
3	**BP3/F-1**	1905	15351	4	0	9.32	4.65	8.07	8.13	7.37
4	**BP4/F-1**	2425.71	12234	4	0	9.32	4.65	8.07	8.13	7.37
5	**BP5/F-1**		12752	2	0	9.32	4.65	8.07	8.13	7.37
6	**BP1/F-2**	3000	8775	2	0	3.44	5.11	10.30	10.31	9.71
7	**BP1/F-3**	1722	1914	6	1	3.44	5.11	10.30	10.31	9.71
8	**BP2/F-3**	4841.25	9623	4	0	9.94	1.31	9.94	7.63	9.59
9	**BP1/F-4**	351	13376	2	0	9.32	4.65	8.07	8.13	7.37
10	**BP1/F-5**		4657	4	0	9.32	4.65	8.07	8.13	7.37
11	**BP1/F-6**	640	3879	4	0	8.72	3.91	9.37	9.58	8.65
12	**BP2/F-6**	4240	7895	1	0	8.95	4.45	8.34	8.57	8.18
13	**BP3/F-6**	5091	5856	2	0	9.32	4.65	8.07	8.13	7.37
14	**BP2/F-7**	5000	2080	4	0	7.47	3.78	8.58	9.82	9.36
15	**BP1/F-8**	14880	6544	1	0	7.37	3.86	8.47	10.46	9.39
16	**BP2/F-8**	2080	311	0	0	6.36	3.32	8.55	10.63	9.73
17	**BP-1/F-10**	787.5	1771	1	0	8.39	4.41	8.38	10.30	9.06
18	**BP1/F-12**	315	24613	2	0	9.59	4.91	9.60	10.02	7.14
19	**BP2/F-12**	1100	0	2	0	5.08	2.41	6.19	6.50	6.15
20	**BP3/F-12**		4166	12	0	9.59	4.91	9.60	10.02	7.14

21	**BP1/F-14**	11.25	704	1	0	8.58	4.25	8.61	9.02	9.00
22	**BP2/F-14**	13.45	532	1	0	8.58	4.25	8.61	9.02	9.00
23	**BP1/F-15**	2142.8571	4532	4	0	9.32	4.65	8.07	8.13	7.37
24	**BP1/F-16**	195.545	18669	1	0	1.47	3.52	1.47	4.99	6.15

SI.No	**Road Number (SP/SC/SNP/BP)**	**Possibility in terms of cost of construction (0-10)**	**Connectivity (No. of villages connected, Total population on covered) (0-15)**	**Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more commercial crops, industries (medium/small /micro industries),) (0-20)**	**Coverage (Connecting International routes, roads in border areas Connecting National Highway, State Highways/ inter-district roads connecting number of village roads including PMGSY roads,) (0-20)**	**Missing Links (Missing links connectivity) (0-10)**	**Capacity Constraints (Volume/Capacity,) (0-5)**	**Time Saving (Condition of roads from traffic and inventory data,) (0-10)**	**Local Demand (Potential source of safety Hazards, Border Area , Border Hat, Any other Significance) (0-10)**	**Pre-Feasibility width/Curve visual (Availabe carriageway) (0-10)**
1	**BP1/F-1**	0.07	0.28	0.11	0.71	0.06	0.21	0.15	0.18	0.20
2	**BP2/F-1**	0.97	0.31	0.32	0.00	0.04	0.17	0.04	0.12	0.15
3	**BP3/F-1**	0.02	0.31	0.21	0.00	0.24	0.22	0.20	0.19	0.18
4	**BP4/F-1**	0.03	0.24	0.21	0.00	0.24	0.22	0.20	0.19	0.18
5	**BP5/F-1**	0.00	0.25	0.11	0.00	0.24	0.22	0.20	0.19	0.18
6	**BP1/F-2**	0.04	0.18	0.11	0.00	0.09	0.25	0.26	0.24	0.24
7	**BP1/F-3**	0.02	0.04	0.32	0.71	0.09	0.25	0.26	0.24	0.24
8	**BP2/F-3**	0.06	0.19	0.21	0.00	0.26	0.06	0.25	0.18	0.24
9	**BP1/F-4**	0.00	0.27	0.11	0.00	0.24	0.22	0.20	0.19	0.18
10	**BP1/F-5**	0.00	0.09	0.21	0.00	0.24	0.22	0.20	0.19	0.18

11	**BP1/F-6**	0.01	0.08	0.21	0.00	0.23	0.19	0.23	0.22	0.22
12	**BP2/F-6**	0.06	0.16	0.05	0.00	0.23	0.21	0.21	0.20	0.20
13	**BP3/F-6**	0.07	0.12	0.11	0.00	0.24	0.22	0.20	0.19	0.18
14	**BP2/F-7**	0.07	0.04	0.21	0.00	0.19	0.18	0.21	0.23	0.23
15	**BP1/F-8**	0.20	0.13	0.05	0.00	0.19	0.19	0.21	0.24	0.24
16	**BP2/F-8**	0.03	0.01	0.00	0.00	0.17	0.16	0.21	0.25	0.24
17	**BP-1/F-10**	0.01	0.04	0.05	0.00	0.22	0.21	0.21	0.24	0.23
18	**BP1/F-12**	0.00	0.49	0.11	0.00	0.25	0.24	0.24	0.23	0.18
19	**BP2/F-12**	0.01	0.00	0.11	0.00	0.13	0.12	0.15	0.15	0.15
20	**BP3/F-12**	0.00	0.08	0.63	0.00	0.25	0.24	0.24	0.23	0.18
21	**BP1/F-14**	0.00	0.01	0.05	0.00	0.22	0.20	0.21	0.21	0.23
22	**BP2/F-14**	0.00	0.01	0.05	0.00	0.22	0.20	0.21	0.21	0.23
23	**BP1/F-15**	0.03	0.09	0.21	0.00	0.24	0.22	0.20	0.19	0.18
24	**BP1/F-16**	0.00	0.37	0.05	0.00	0.04	0.17	0.04	0.12	0.15

SI.NO	Road Number(SP/SC/SNP/BP)	Possibility in terms of cost of construction (price/cost)	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers, agriculture producing centers with more	Coverage (Connecting International routes, roads	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity.) (0-5)	Time Saving (Condition of roads from traffic and inventory	Local Demand (Potential source of safety Hazards	Pre-Feasibility width/Curve visual (Availabe carriageway)	Si+	Si-	Pi	RANK	Road Number(SP/SC/SNP/BP)
1	**BP1/F-1**	0.73	4.07	2.17	12.77	0.46	0.78	1.25	1.60	1.57	14.73	13.65	0.48	2	**BP1/F-1**
2	**BP2/F-1**	10.05	4.44	6.50	0.00	0.28	0.64	0.31	1.05	1.22	14.85	12.77	0.46	3	**BP2/F-1**
3	**BP3/F-1**	0.26	4.44	4.33	0.00	1.75	0.84	1.72	1.70	1.46	18.49	6.60	0.26	6	**BP3/F-1**
4	**BP4/F-1**	0.33	3.54	4.33	0.00	1.75	0.84	1.72	1.70	1.46	18.60	6.03	0.24	7	**BP4/F-1**
5	**BP5/F-1**	0.00	3.69	2.17	0.00	1.75	0.84	1.72	1.70	1.46	19.84	4.83	0.20	15	**BP5/F-1**
6	**BP1/F-2**	0.41	2.54	2.17	0.00	0.65	0.92	2.19	2.16	1.92	19.89	4.15	0.17	16	**BP1/F-2**
7	**BP1/F-3**	0.23	0.55	6.50	12.77	0.65	0.92	2.19	2.16	1.92	13.53	14.54	0.52	1	**BP1/F-3**
8	**BP2/F-3**	0.66	2.78	4.33	0.00	1.87	0.24	2.12	1.60	1.90	18.60	5.79	0.24	8	**BP2/F-3**
9	**BP1/F-4**	0.05	3.87	2.17	0.00	1.75	0.84	1.72	1.70	1.46	19.79	4.97	0.20	14	**BP1/F-4**
10	**BP1/F-5**	0.00	1.35	4.33	0.00	1.75	0.84	1.72	1.70	1.46	19.32	5.06	0.21	12	**BP1/F-5**
11	**BP1/F-6**	0.09	1.12	4.33	0.00	1.64	0.71	2.00	2.01	1.71	19.33	5.11	0.21	10	**BP1/F-6**
12	**BP2/F-6**	0.58	2.28	1.08	0.00	1.68	0.80	1.78	1.80	1.62	20.46	3.45	0.14	19	**BP2/F-6**
13	**BP3/F-6**	0.69	1.69	2.17	0.00	1.75	0.84	1.72	1.70	1.46	19.95	3.61	0.15	18	**BP3/F-6**
14	**BP2/F-7**	0.68	0.60	4.33	0.00	1.40	0.68	1.83	2.06	1.86	19.20	4.98	0.21	13	**BP2/F-7**
15	**BP1/F-8**	2.03	1.89	1.08	0.00	1.39	0.70	1.81	2.19	1.86	19.92	3.78	0.16	17	**BP1/F-8**
16	**BP2/F-8**	0.28	0.09	0.00	0.00	1.19	0.60	1.82	2.23	1.93	21.85	2.29	0.09	24	**BP2/F-8**
17	**BP-1/F-10**	0.11	0.51	1.08	0.00	1.58	0.80	1.79	2.16	1.80	21.16	2.68	0.11	20	**BP-1/F-10**
18	**BP1/F-12**	0.04	7.12	2.17	0.00	1.80	0.89	2.05	2.10	1.41	19.51	7.89	0.29	5	**BP1/F-12**
19	**BP2/F-12**	0.15	0.00	2.17	0.00	0.96	0.43	1.32	1.36	1.22	20.79	2.51	0.11	21	**BP2/F-12**
20	**BP3/F-12**	0.00	1.20	12.99	0.00	1.80	0.89	2.05	2.10	1.41	17.30	13.31	0.43	4	**BP3/F-12**
21	**BP1/F-14**	0.00	0.20	1.08	0.00	1.61	0.77	1.83	1.89	1.78	21.31	2.57	0.11	22	**BP1/F-14**
22	**BP2/F-14**	0.00	0.15	1.08	0.00	1.61	0.77	1.83	1.89	1.78	21.32	2.57	0.11	23	**BP2/F-14**
23	**BP1/F-15**	0.29	1.31	4.33	0.00	1.75	0.84	1.72	1.70	1.46	19.18	5.06	0.21	11	**BP1/F-15**
24	**BP1/F-16**	0.03	5.40	1.08	0.00	0.28	0.64	0.31	1.05	1.22	20.40	5.52	0.21	9	**BP1/F-16**

V+	10.05	7.12	12.99	12.77	1.87	0.92	2.19	2.23	1.93
V-	0.00	0.00	0.00	0.00	0.28	0.24	0.31	1.05	1.22

4 Other roads

SI.NO	Road Number(SP/SC/SNP/BP)	Possibility in terms of cost of construction (price/cost)	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers, agriculture producing	Coverage (Connecting International	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity,) (0-5)	Time Saving (Condition of roads from traffic	Local Demand (Potential source of safety Hazards, Border Area.	Pre-Feasibility width/Curve visual (Available carriageway) (0-10)
1	**NP4/F-1**	1058	3536	1	0	1.47	3.52	1.47	4.99	6.15
2	**NP1/F-6**	5746	1085	3	0	8.72	3.91	9.37	9.58	8.65
3	**NP3/F-6**	6170.8	5570	2	0	8.86	3.57	10.14	10.14	8.31
4	**NP9/F-6**	470	4040	3	0	8.72	3.91	9.37	9.58	8.65
5	**NP11/F-6**	16004	10819	6	0	8.86	3.57	10.14	10.14	8.31
6	**NP3/F-8**	832	2044	0	0	7.37	3.86	8.47	10.46	9.39
7	**NP6/F-8**	2770	3948	0	0	7.37	3.86	8.47	10.46	9.39
8	**NP1/F-12**	7600	3329	8	1	5.08	2.41	6.19	6.50	6.15
9	**NP5/F-12**	4100	1702	2	1	7.34	3.66	7.90	8.26	6.65
10	**NP9/F-13**	357.5	4468	5	0	9.59	4.91	9.60	10.02	7.14

SLNO	Road Number(SP/SC/SNP/BP)	Possibility in terms of cost of construction (price/cost)	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting Tourist centre, market centers,	Coverage (Connecting International routes, roads	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity,) (0-5)	Time Saving (Condition of roads from traffic	Local Demand (Potential source of safety Hazards, Border Area.	Pre-Feasibility width/Curve visual (Availabe carriageway) (0-10)
1	**NP4/F-1**	0.05	0.23	0.08	0.00	0.06	0.30	0.05	0.17	0.24
2	**NP1/F-6**	0.28	0.07	0.24	0.00	0.36	0.33	0.35	0.33	0.34
3	**NP3/F-6**	0.30	0.37	0.16	0.00	0.36	0.30	0.38	0.35	0.33
4	**NP9/F-6**	0.02	0.27	0.24	0.00	0.36	0.33	0.35	0.33	0.34
5	**NP11/F-6**	0.79	0.71	0.49	0.00	0.36	0.30	0.38	0.35	0.33
6	**NP3/F-8**	0.04	0.13	0.00	0.00	0.30	0.32	0.32	0.36	0.37
7	**NP6/F-8**	0.14	0.26	0.00	0.00	0.30	0.32	0.32	0.36	0.37
8	**NP1/F-12**	0.37	0.22	0.65	0.71	0.21	0.20	0.23	0.22	0.24
9	**NP5/F-12**	0.20	0.11	0.16	0.71	0.30	0.31	0.29	0.28	0.26
10	**NP9/F-13**	0.02	0.29	0.41	0.00	0.39	0.41	0.36	0.34	0.28

SI.NO	Road Number(SP/SC/SNP/BP)	Possibility in terms of cost of construction	Connectivity (No. of villages connected, Total population on covered) (0-15)	Economic Importance (Connecting	Coverage (Connecting International	Missing Links (Missing links connectivity) (0-10)	Capacity Constraints (Volume/Capacity,)	Time Saving (Condition of	Local Demand (Potential source	Pre-Feasibility width/Curve visual (Availabe carriageway)	Si+	Si-	Pi	RANK	Road Number(SP/SC/SNP/BP)
1	**NP4/F-1**	0.54	3.37	1.67	0.00	0.44	1.11	0.47	1.54	1.93	20.59	18.99	0.48	10	**NP4/F-1**
2	**NP1/F-6**	2.94	1.03	5.01	0.00	2.59	1.24	3.00	2.96	2.72	18.62	17.75	0.49	7	**NP1/F-6**
3	**NP3/F-6**	3.16	5.30	3.34	0.00	2.63	1.13	3.25	3.14	2.61	17.73	17.40	0.50	5	**NP3/F-6**
4	**NP9/F-6**	0.24	3.84	5.01	0.00	2.59	1.24	3.00	2.96	2.72	18.39	17.89	0.49	6	**NP9/F-6**
5	**NP11/F-6**	8.20	10.30	10.02	0.00	2.63	1.13	3.25	3.14	2.61	13.21	18.23	0.58	2	**NP11/F-6**
6	**NP3/F-8**	0.43	1.95	0.00	0.00	2.19	1.22	2.71	3.24	2.95	21.74	20.38	0.48	9	**NP3/F-8**
7	**NP6/F-8**	1.42	3.76	0.00	0.00	2.19	1.22	2.71	3.24	2.95	20.77	19.68	0.49	8	**NP6/F-8**
8	**NP1/F-12**	3.89	3.17	13.37	12.77	1.51	0.76	1.98	2.01	1.93	8.71	19.40	0.69	1	**NP1/F-12**
9	**NP5/F-12**	2.10	1.62	3.34	12.77	2.18	1.15	2.53	2.56	2.09	14.67	18.60	0.56	3	**NP5/F-12**
10	**NP9/F-13**	0.18	4.25	8.35	0.00	2.85	1.55	3.07	3.10	2.24	17.01	17.88	0.51	4	**NP9/F-13**

				V+	8.20	10.30	13.37	12.77	2.85	1.55	3.25	3.24	2.95		
				V-	0.18	1.03	0.00	0.00	0.44	0.76	0.47	1.54	1.93		