EXECUTIVE SUMMARY

BACKGROUND

Transport plays a vital role in the economic and social development of a country. The demand for inter-city freight transport in India is expected to double every 12 years while the demand for passenger transport is expected to double every eight or nine years. Since 1950, the system of State Highways has expanded over eight-fold. This rapid expansion of road network was made possible through speedy access to available resources for construction of single or intermediate lane state and district roads, with thin and structurally deficient pavements. As a result the arterial road system has become grossly congested with poor pavement condition. We are faced with many capacity related problems as traffic on arterial routes is growing at 10-12% per annum. With such high growth of traffic, congestion becomes inevitable and loss due to accidents also increases. Additional capacity has to be created by widening the roads to multi-lane standards and/or by strengthening the existing pavement crust. The Government of India aims at improving and developing the road infrastructure of the Ranikor-Nonghyllam-Maheshkhola-Baghmara Road in the State of Meghalaya, Government of India.

Ranikor-Nonghyllam-Maheshkhola-Baghmara Road is important State Highway passing in Meghalaya and providing connectivity Ranikor to Baghmara. Portion of Ranikor-Nonghyllam-Maheshkhola-Baghmara passes through the towns and the habited areas. With the fast development of the State, the land-use has added tremendous problems to the movement of traffic – passenger as well as freight services. Existing facility needs to be augmented to 2-Lane for fast movement of the traffic and ease and comfort to the commuters.

The Govt of India and in Govt of Meghalaya,(Public Works Department, Meghalaya) has decided to take up the development of the existing Ranikor-Nonghyllam-Maheshkhola-Baghmara Road for(Km 139) to 2-lane State Highway standards.

The Government of Meghalaya,Public Works Department, Meghalaya Government of India called for consultancy assignment for preparation of Detailed Project Report which should expressively give all the requirements for development of the project and its facilities as well as to assess the financial requirements in a clear and practicable manner. The consultancy assignment has been awarded to Holtec Consulting Private Limited, Gurgaon for preparation of Detailed Project Report for upgradation of the project Highway.

Salient Features of the Consultancy Assignment

• Name of the Project	Preparation of Detailed Project Report for Development of Ranikor – Nonghyllam – MaheshKhila – Baghmara road from 0 to 139 in Meghalaya to 2-Lane Standards.
• Name of Employer	Chief Engineer, Ministry of Road Transport and Highways and Chief Engineer (NH), Public Works Department, Meghalaya
• Name of Consultant	Holtec Consulting Private Limited, Gurgaon, Haryana
• Contract Award	Agreement dated. 18 February 2010
• Consultant's Services	Preparation of Detailed Project Report

Project Road

The existing road, KM 0 to 31.700, starts at Village Khadphra (Ranikor) and terminates at Nongjri. It passes through villages, Built-up areas as well as forest areas.

- **Start Point** :
  - Khadphra
    `
  - Km of Project Road 0.000
- **End Point**
  - Nongjri
  - Km of 31.700(Survey Chainage) / 30.000 (Design Chainage)
- **Length Of Project Road**
  - Length as per existing chainage is 31.700 Km
  - Length as per Design chainage is 33.250 Km
  - Road features of this report are based on the design chainages
  - Survey and Investigation data is based on existing chainages
- **Project Influence Area**
  - Project Road: SH 4 (from km 0.00 to 30)
  - SH 4 : South direction and across Meghalaya
- **Major Roads Connectivity:**
  - Shillong Road
  - Borsora Town
  - Nongkulang – Nongjiri Town
- **Major Intersections / Junction Points**
  - Junction of SH 4 at Starting of the project road with the road to Shillong Km 0.00
  - Junction of SH 4 with road to Borsora at Km 18.300
  - Junction of SH 4 with road to Nong Kulang at Km 27.760
- **Towns and Villages**

The Project Road connects the following villages and towns:

Sn.	Name of Habitation	Location (Km) (Designed Chainage
		From
1	Kadphra	0.000
2	Rajaju	16.900
3	Nonghyllam – Nongjiri	25.700 – 28.000

- **Terrain**
  - Hilly and steep mountainous terrain
- **Land Use**
  - Passes through hill forest area with some villages / towns en-route

Meteorological Features

The region experiences heavy rainfall.

The area is windy.

Weather experiences low temperature.

Road Geometrics

The elements of road geometrics of this road are poor.

It has sharp curves which need improvement.

It has number of stretches with steep gradients which require short re-alignment and/or relocation.

Rivers En route

The Project Road crosses many Streams / Rivers en-route. There are 28 major stream crossings (Major / Minor Bridges)

Condition of Existing Road

- Road width is of single lane standard
- Condition of the Road Pavement is Poor.
- Shoulders have been damaged or mostly washed away
- Retaining walls are in satisfactory condition but may get damaged during widening operation
- Breast walls will be relocated due to widening
- Drainage is unsatisfactory Road side drains are damaged, blocked, filed with debris, non-existing, etc
- CD structures are mostly choked or blocked (fully or partially)
- Many culverts are found to be having inadequate waterway.
- There are no major slide and sinking areas :
- Road safety structures are inadequate
- Road marking non-existing
- Sign boards are in inadequate number
- Crash barriers not existing
- Parapet walls are damaged

Alignment of Existing Road

Project road in general, follows the natural line of communication.

It provides connectivity to regional villages/towns.

The geometric standard of the project road is poor.

Horizontal alignment has curves which need improvement to bring to the National Highway Standard.

The vertical gradient is by and large within the specified standard. Some portions require regrading.

DESIGN PACKAGES

With the approval of PWD, Meghalya, the Road Project is divided into two packages:

Package-1 **:** Ranikor (Ch.0.000) to Nongjri (Ch. 30.000)

ALIGNMENT DESIGN

Alignment Plan

The proposed road will follow the existing alignment except the New construction due to Short Realignment / relocation, and curve improvement. The alignment is designed in a manner that the newly constructed structures are integrated in the Alignment Plan.

Alignment Concept Plan

The Concept Plan for development of the project is divided into three distinct parts.

PACKAGE I

Sn	Name of Work	Remarks (Chainage : Km 0.000 to Km 30.000)
1	Widening	11.90 km
2	New-Construction	5.58 km
3	Box-Cut	10.89 km
4	Built-up	4.88 km

Alignment Drawings

The Proposed Road will follow the existing alignment except the following due to up-gradation works:

- New construction due to Short Realignment / relocation and curve improvement
- Strengthening, widening and regarding

ROADWAY DESIGN

2-Lane

- Road is designed for Roadway width of 10.000 m
- Preliminary design is on the basis of the alignment survey. It will be fine tuned based on detailed topographical data and cross-sections.
- Preliminary design follows the standards specified in IRC:SP:48 1998.
- Design Speed is : Ruling : 60 Km/hr; Minimum : 30 Km/hr
- The speed and radius of curvature in village / town are modified lowered to avoid heavy cutting, relocation of settlement, environmental and social problems etc.
- Some stretches, particularly the village / towns will be amended to accommodate within the available space.
- Consequent to improvement of geometric some box-cut are incorporated.
- Space / hill face between the realignment closer to existing road, the space or features between the two will be knocked off

Design Categories

Roadway of 10.00 m consists of the following categories:

- Widening of Existing Single Lane Road to Double Lane.
- New construction at short realignment /relocation for geometric improvement.

Road Stretches

The road stretches are given in the Plan and Profile drawings.

The roadway design factors are tabulated below

• Total road width	:	10.000 m
• Earthen Shoulder hill side (including drain)	:	2 x 1.5 m
• Earthen Shoulder Valley side	:	2 x 1.5 m
• ROW	:	24.000 m
• Length	:	33.250 Km

TRAFFIC DESIGN

Homogeneous Sections

Homogenous sections are the sections of the project road having similar traffic and travel characteristics. Major intersections / settlements are also considered as nodes for identification for various homogenous sections. The project road was divided in to three homogeneous sections the details are tabulated below:

Homogenous Sections of the Project Road

Section	Stretch	Approximate Length (Km)
1	SH-4 Km 0.00 – Km 28.315	28.315
2	SH-4 Km 28.315 to Km 56.170	27.855
3	SH-4 Km 56.170 to Km 129.385	73.215

Classified Traffic Volume Count

In order to assess the variation of traffic levels and traffic composition over the week, traffic surveys were conducted continuously for one-week duration. The survey was carried out 24 hrs for one week. The traffic count was carried out at three count station. The details of traffic is as per table below:

Sl.No.	Type of Vehicle	Average Traffic (UP & DOWN)	Percentage (%)	Equivalency Factor	PCU
1	Two Wheeler	5	1.57	0.5	2.5
2	Three Wheeler	0	0	1	0
3	Car/Jeep/Taxi	143	43.82	1	143
4	Mini Bus	1	0.16	1.5	1.5
5	Bus (full)	11	3.3	3	33
6	Light Commercial Vehicle (LCV)	63	19.19	1.5	94.5
7	Two Axle Truck	104	31.85	3	312
	Total (1 to 7)	**327**	**100**		586.50
				Say (At 2011)	**590**
				At 2018 (assuming 7.5% growth)	**978.83**
				Say	**1000**

For pavement design the below mentioned factors were also considered :-

Traffic Growth Rate

Growth rate of 7.5% is adopted.

Traffic Design Life

Traffic Design Life of 15 years is adopted.

Construction Period

2.5 years of construction period is adopted.

CBR

S. no	Location	CBR value
1	Homogeneous Section I	8 %
2	Homogeneous Section II	8%
3	Homogeneous Section III1	8%

PAVEMENT DESIGN

Based on above factors the pavement design adopted for homogenous sectors is detailed below:

Design Proposal From Km 0.00 to Km 30.000

For Km 0.00 to Km 30.000 Flexible pavement comes as under :

BC	:	40 mm
BM	:	60mm
WMM	:	125 mm
CTSB	:	200 mm
Shoulder	:	2 x 1.50 metre
Pavement	**:**	**in 7m width**

Shoulders

- Keeping in view the Traffic Volume and its growth in 15 years, it is proposed to provide Earthen Shoulder 2 x 1.5 m
- Earthen Shoulder on Valley side includes crash barrier, parapet wall, etc.

- Earthen Shoulder on hill side includes road side drain.

Pavement Design

Flexible pavement for 20 MSA and 8% CBR has been proposed.

DESIGN OF CULVERTS

Existing Culverts

- The condition survey of existing culvert was carried out
- CD structures are mostly choked or blocked (fully or partially)
- Many culverts are found to be having inadequate waterway.
- The pipe culverts are constructed of NP-2 class

It is proposed to reconstruct the culverts providing adequate water way, providing inlet and outlet chutes wherever required.

New Culverts

At some locations it is observed that culverts have not been provided at the locations of natural water course. The valley side has been eroded due to non availability of culverts at such locations new culverts have been proposed.

The details are tabulated below:

PACKAGE I

Km 0.00 to Km 30.000					
S. no	**Type of Culvert**	**Size of Culvert**	**Reconstruction (Nos)**	**New Construction (Nos)**	**Total**
1	**SRHP**				
		1 x 1.0	121	39	**160**
		1 X 1.2	5	1	**6**
2	**DRHP**				
		2 x 1.0	9	2	**11**
		2 x 1.2	2	1	**3**
3	**RCC Box Culvert**				
		1 x 3	7	1	**8**
		1 x 4	5	2	**7**
		1x 6	4	1	**5**
	Total		**153**	**47**	**200**

PACKAGE I

PRELIMINARY STUDY AND DESIGN OF BRIDGES

Summary of Bridges

Sn.	Type of Bridge	Widening	Retention	New Construction/Reconstruction	Total No. of Bridges.
1	Minor	17	0	11	**28**
2	Major	0	1	0	**1**
	Total No. of Bridges	17	1	11	**29**

Bridge Packages

Package No.	Widening	Retention	Reconstruction / New Construction	Total
1	17	1	11	29

Category of Bridges

The Road Sector has higher requirement of Bridges and Drainage structures due to heavy rainfall, foothill location and hills / plain terrain. The bridges are (a) existing bridges (b) bridges recently constructed, (c) bridges with standards and specifications not matching to 2-lane highways, (d) new bridges and (e) rehabilitation of old bridges.

Study

Consultant have carried out our visual examination and evaluation of the data made available by the Client as well as data collected by local enquiry that the design parameter arrived at are appropriate.

Desk Study

We undertook a desk study of available data on topography, rainfall, top soil characteristic, vegetation cover, etc., so as to assess hydraulic parameters for all existing and proposed drainage provision.

General Study of Bridges

This includes the data based on general enquiry, visual inspection, analysis of available data, and historical background in order to make assessment of hydrological behavior and design parameters. The hydrological and hydraulic study has been carried out in accordance with IRC Special Publication No. 13 (Guidelines for the design of small bridges and culverts). IRC: 5-1998

(Standard Specification & Code of Practice for Road Bridges, Section 1: General Feature of design), etc.

Details of Proposals

Designed details contain the followings :

- Salient Features
- Typical Photographs
- Hydraulic study
- Preparation of Location Plan
- Preparation of General Arrangement Drawings (GAD)

Based on the above, the parameters have been identified for carrying out the study for aiming at the design parameter of the bridges.

DRAINAGE DESIGN

Inadequate drainage on a hill road causes softening of the sub-grade and renders it too weak to take the load of the moving traffic. Roadside drains are therefore necessary on a hill road.

In the existing road drainage is unsatisfactory road side drains are damaged, blocked, filled with debris, non-existing, etc

Following categories are adopted in the proposal

i) Rectangular RCC Covered Drains (for towns/ villages)
ii) Lined Drains (V-shaped) in soil and soft rock portions and Box cuts (both side).
iii) Unlined drain (V-Shaped) in hard rock portions

JUNCTIONS/INTERSECTION

Major Junctions

The road has three major Junctions.

Sn	Location	Type of Junction	Name of Road
1	Km 0.000 at Starting Point	Y	Mawkyrwat – Maheshkola – Shillong
2	Km 18.300	Y	Ranikhkor – Borsora - Maheshkola
3	Km 27.760	Y	Ranikor – Nong Kulang – Maheshkola

TRUCK LAYBYES

Proposed Truck Laybyes are as under :

Sn	Location (Designed Chainage)	Description
1	Km 26.900	Left Side

SLOPE PROTECTION WORKS

Requirement

- Hill road is formed mostly by cutting into the hill and thereby disturbing natural stability of slopes
- Water course along the slopes cause erosion affecting road stability
- Soil movement along slope tends to disturb the road formation. All these have to be effectively countered to obtain a stable road by provision of structures to act as retaining, restraining and protective structures
- Safety of traffic also needs structures to be provided on the road
- This is achieved by construction of
  - Retaining walls
  - Breast walls
  - Parapet walls
  - Railings
  - Edge stones
  - Toe walls
- Landslide Area: There is no major Landslide area / Sinking location on this road.

Summary of Slope Protection Works

- Package-I : Ranikor to Nongjri

S. No	Type of Structure	New Construction (m)
1	**Breast Wall**	
	2.50 m height (R.R)	920
	3.50 m height (R.R)	750
	4.50 m height (R.R)	300
	5.50 m height (R.R)	300
	Total	**2270**
2	**Retaining wall**	
	1.50 m height (R.R)	260
	2.50 m height (R.R)	510
	3.00 m height (R.R)	240
	4.00 m height (R.R)	750
	Total	**1760**

BUS BAYS / STOPS

3 Nos. Bus Bays / Stops have been proposed in Town / Village areas.

LAND ACQUISITION PLAN

Land Acquisition is required as per the table below:

Total Land Required	76.5 Ha
Land available	20.17 Ha
Land to be acquired	56.3 Ha

UTILITIES SHIFTING ; RELOCATION

Utility shifting has been done and an Estimate of Rs. 3.14 Crore has been proposed for the same as directed by RO.

COST ESTIMATE

BOQ and Cost Estimate has been worked out.

Schedules of Rates (2013-14) of PWD, Meghalaya has been used for cost estimate. However an escalation of 4.32% as per Wholesale Price Index (WPI) has been applied in Civil Construction Cost for the Year 2018-19.

Lead and lift has been added.

2.5 years construction period has been considered.

Rate analysis has been worked out.

Abstract / Summary of cost is as per the Table below:-

Bill No.	Item of Work	Amount (Rs)	Amount (Cr.)	Cost (Crores)/Km
1	Site Clearance	66739907	6.67	0.20
2	Earth work	491140856	49.11	1.48
3	Bases and sub Bases (Non Bituminous)	298696350	29.87	0.90
4	Bituminous Works	321694937	32.17	0.97
5	Protection Works Rwalls / Bwalls/ Toe Walls	263435323	26.34	0.79
6	Culverts	133646950	13.36	0.40
7	Bridges	294672222	29.47	0.89
8	Major Junctions and Minor Junctions	49972190	5.00	0.15
9	Drains	76905526	7.69	0.23

Bill No.	Item of Work	Amount (Rs)	Amount (Cr.)	Cost (Crores)/Km
10	Traffic Signs and marking	83988529	8.40	0.25
11	Truck laybyes	8607241	0.86	0.03
12	Cost of Bus stops/bays (5 Nos)	6680314	0.67	0.02
	Construction Cost	**2096180345**	**209.62**	**6.30**
	Cost inflation @ 4.32% as per WPI for FY 2018-19	90554990.91	9.06	
A	**Civil Cost Put Upto Tender**	**2186735336**	**218.67**	**6.58**
	Contingencies at 2.8% of A	61228589.41	6.12	
B	**Sub Total**	**2247963925**	**224.80**	**6.76**
	Agency charges @ 3% of B	67438917.76	6.74	
II	Supervision @ 3% of A	65602060.08	6.56	
III	Price adjustment @7.5% during construction period of 2.5years on	164005150.2	16.40	
IV	O&M cost for Ist five years after construction @ 2.5% on A (0.25% for 1st & 2nd yr, 0.5% for 3rd & 4th year and 1% for 5th year)	54668383.4	5.47	
	Project Cost	**2599678437**	**259.97**	**7.82**
1	Cost of land and property acquisition	431700000	43.17	
2	Cost of Utility Shifting (PHE and Electrical)	31430000	3.14	
	Total capital Cost of Project	**3062808437**	**306.28**	**9.21**

Recommendations and Conclusions

Strengthening, widening and improvement of the project road to 2-lane standard specification will not pose any major issue and is recommended for acceptance.