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 Rongara - Panda Road in the State of Meghalaya, Government of India.

Rongara - Panda Road is a section of Ranikhor to Baghmara Project which is an important State Highway passing in Meghalaya and providing connectivity to Rongara (design ch 96.0) to Panda (design ch 112.3). Portion of project road 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 Rongara - Panda Road (Km 31.063) to 2-lane State Highway standards.

The proposed highway section for the project road is given in the drawings volume.

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	Improvement/widening to Two-laning of stretch from Km 96.0(Rongara) to Km 112.3 (Panda) of Ranikor – Baghmara project in the State of Meghalaya under SARDP-NE "Phase-A
• 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

Objective of the Assignment

The objective of the consultancy services is to prepare a detailed project report covering widening of existing highway to 2-lane standards, which shall, inter-alia, include construction of elevated road, bypasses/re-alignments, construction/reconstruction of bridges, Grade separators and cross drainage structures, retaining walls, breast walls, provision of road safety measures.

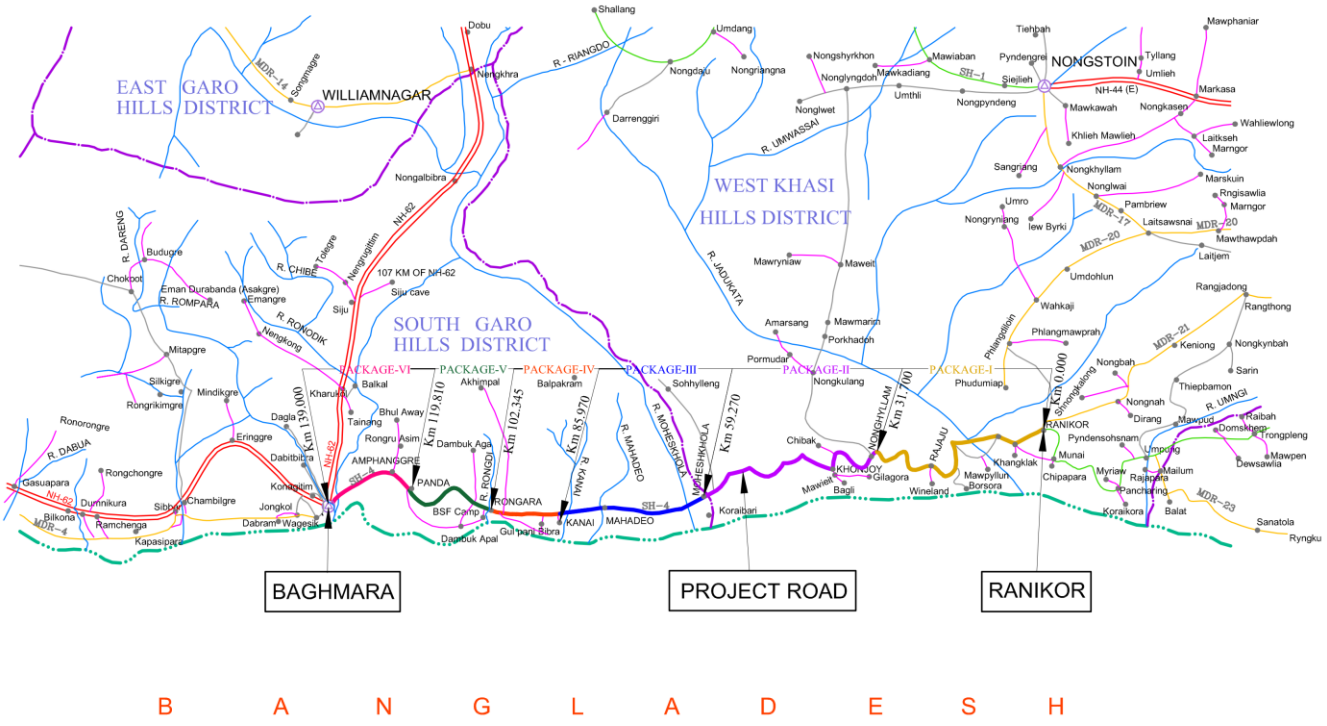
• Survey and Investigations
• Detailed Engineering Design, Drawings, Costing and Project Report
• Economics Analysis
• Contract Packaging and implementation schedule
• Computerized inventory and digitized map

We will demonstrate the efficacy of coordinated effort of the Department and the Consultant for achieving high quality project.

Project Road

The Project Road for the development is shown in the fig 1.1:

Fig 1.1 : Project Road



Scope of Services

These are specified in the TOR and are summarized as under:

- Traffic Survey and Assessment
- Material investigations
- Geo-technical investigations and sub-soil exploration
- Detailed Design of Road Works
- Detailed Design of bridges and structures
- Environmental and Social Studies
- Land Acquisition Plan
- Estimation of quantities and project cost
- Economic Analysis
- Contract Packaging and Implementation Schedules
- Submission of reports at 4-stages

Inception Report

Inception Report was submitted by Holtec Consulting Pvt. Ltd, Gurgaon vide their letter No 10558/7244 dated 29 June 2011.

Draft DPR

Draft DPR was submitted by Holtec Consulting Pvt Ltd, Gurgaon vide their letter No 10558/ dated 16 Dec 2011.

Project Road

The existing road, KM 96.0 to 119.810, starts at Village Rongara and terminates at Panda. It passes through villages and Built-up areas.

- **Start Point** :
  - Km 96.0(Rongara)
    `
  - Km of 102.345 (Survey Chainage) / 96.0 (Design Chainage)
- **End Point**
  - Km 112.3(Panda)
  - Km of 119.810(Survey Chainage) / 112.3 (Design Chainage)
- **Length Of Project Road**
  - Length as per existing chainage is 17.46 Km
  - Length as per Design chainage is 16.3 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 96.0 to 119.810)
  - SH 4 : South direction and across Meghalaya

- **Intersections / Junction Points**

  There are 11 junctions proposed along project road.

- **Towns and Villages**

  The Project Road connects the following villages and towns:

Sn.	Name of Habitation	Location (Km) (Designed Chainage
		From
1	Dambuka	109.573

- **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.

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 regarding.

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 four distinct parts.

PACKAGE V

Sn	Name of Work	Remarks (Rongara to Panda)
1	Strengthening, Widening and Regrading of Existing Single Lane Road to 2-lane	Existing Single -Lane Road (9.470 Kms)
2	New Construction. (includes curve improvements and realignment portions)	New 2-Lane Road (6.830 Kms)

Alignment Drawings

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

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

Detailed Topographical Survey has been carried out. The design of Plan & Profile is based on detailed survey data. These are placed in drawing Volume.

ROADWAY DESIGN

2-Lane

- Road is designed for Roadway width of 10m.
- Preliminary design is on the basis of the alignment survey. It will be fine tuned based on detailed topographical data and cross-sections.
- Preliminary alignment plans along with road profile of the proposed road are attached in the Volume IV (a) – Drawings: Road Works.
- Preliminary design follows the standards specified in IRC:SP:48 1998.
- Design Speed is : 40 Km/hr except some curve wherever 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 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 placed in Drawing Volume.

Design Factors

The roadway design factors are tabulated below

• Total road width	:	10 m
• Earthen Shoulder (Hill Side)	:	1x1.5
• Earthen Shoulder (Valley Side)	:	1x1.5
• Angle of Hill cutting	:	Average 60^{o}
• Average height of cutting	:	10.0 m
• Soil classification of hill cutting	:	Attached
• ROW	:	24.000/16.00 m
• Length	:	16.300 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:

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 PCU and CVPD of the count stations are tabulated below:

S. No	Traffic Count Location		PCU	CVPD
	Survey Chainage	Design Chainage		
1	Km 137.664	Km 129.385	1196	204

**As section from design km 80.5 to km 112.3 is a part of Ranikor to Baghmara, survey location was fixed near Baghmara.*

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

Three years of construction period is adopted.

CBR

S. no	Location	CBR value
1	Design Ch 96.0 to Ch 112.3	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 129.385

Project road is designed as Flexible pavement for 10MSA and 8% CBR as per IRC 37-2018 details are as under :

BC : 40 mm
WMM : 150 mm
CTSB : 200 mm

Shoulder : 2 x 1.50 metre

Pavement : **in 7m width**

- 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.

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.

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.

PRELIMINARY STUDY AND DESIGN OF BRIDGES

Summary of Bridges

Sn.	Type of Bridge	Retain	Widened	New Construction	Total No. of Bridges.
1	Major	0	0	1	1
2	Minor	1	0	0	1
	Total No. of Bridges	**1**	**0**	**1**	**2**

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, et., 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 are placed in Volume-II : Bridges and 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

The proposed Drains category wise are tabulated below:

Drain Type	Length in running (m)
Covered drain	1450
Unlined drain in HR Stretches	0
Lined drain	14693

JUNCTIONS/INTERSECTION

Junctions

14 minor Junctions on project road.

TRUCK LAYBYES

Proposed Truck Lay byes are as under :

Sn	Location (Designed Chainage)	Description
NIL		

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.

BUS BAYS / STOPS

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

GUARD RAILS/ METAL BEAM CRASH BARRIER

Pedestrian guardrail has been designed to control and guard pedestrian and road crossing movements' safety.

W-Beam Metal Crash Barrier have been designed for the major hazard locations e.g. on road sections where embankments height is more than 3m or in bridge approaches.

BREAST WALL/ RETAINING WALL

Toe wall are proposed on the outer edges of the roadway where the pond/river/nala edge are in existence and embankment heights is less then 2.5 meter and retaining wall are proposed where embankment ht more then 2.5 meter . Breast wall in 905m and retaining wall in 520m shall be provided.

TRAFFIC CONTROL DEVICES

Accident statistics is collected for the whole Road stretch and an improvement proposal is considered in the design. Some of the sharp curves are improved and at some of the locations precautionary boards are recommended

MARKING & SIGNAGES

Traffic sings and markings are important features of traffic control designs as they transmit visually vital information to drivers and ensure increased safety and efficiency in free flow of traffic. IRC standards IRC: 67-2012 for road signs and IRC: 35-1997 for road markings shall be followed. The road markings shall be applied to lane lines, road centerline, edge lines, continuity line, zebra crossing etc.

FACILITIES FOR PEDESTRIANS

Facilities for safe and unhindered movement of pedestrians and cyclists are proposed on the project highway wherever it passes through urban/built up area in accordance with the provisions contained in IRC: 103

LAND ACQUISITION PLAN

Description	Qty./Status
Total Land Required	39.32 Ha
Land Available	9.29 Ha
Land to be acquired	30.03 Ha

UTILITIES SHIFTING ; RELOCATION

The utility estimate has been received from authority and is as per the table below

Type of Utility	Amount(Rs.)	Amount(Cr.)
PHED	5478443.5	0.55
Electrical	6827257.9	0.68
Total	**12305701.35**	**1.23**

COST ESTIMATE

As per preliminary cost estimate, construction cost of Package-5 is 89.51 cr (5.49cr. Per Km). The Abstract of project cost is presented in Table below

Table : Cost Estimates

S.No	Item of Work	Amount (Rs)	Amount (Cr.)	Cost (Crores)/Km
1	Site Clearance	5818287	0.58	0.04
2	Earth work	263709537	26.37	1.62
3	Bases and sub Bases (Non Bituminous)	187172077	18.72	1.15
4	Bituminous Works	81109013	8.11	0.50
5	Protection Works Rwalls / Bwalls/ Toe Walls	127950404	12.80	0.78
6	Culverts	124209411	12.42	0.76
7	Bridges	74617322	7.46	0.46
8	Major Junctions and Minor Junctions	13245980	1.32	0.08
9	Drains	40220642	4.02	0.25
10	Traffic Signs and marking	39133084	3.91	0.24
11	Cost of Bus stops/bays	4048388	0.40	0.02
A	**Construction Cost (1 to 11)** (Rates adopted from current June'2018 SOR for Garo Hills District, Meghalaya are inclusive of GST @ 12%)	**961234144.7**	**96.12**	
	Cost of GST @ 12% to be deducted from A	102989372.7	10.30	
B	**Construction Cost (Excluding GST)**	**858244772.1**	**85.82**	**5.27**
	Cost Inflation for the year 2020-21 @ 4.3% based on WPI on B	36904525.2	3.69	
C	**Estimated Civil Cost/ Cost Put upto Tender**	**895149297.3**	**89.51**	**5.49**
	Addition of GST @12% of C	107417915.7	**10.74**	
	Contingencies at 2.8% of C	25064180.32	2.51	
	Agency charges @ 3% of C	26854478.91	2.69	
	O&M cost for Ist five years after construction @ 2.5% of C	22378732.43	2.24	
	Supervision @ 3% of C	26854478.92	2.69	
	Price Escalation @ 2.5% per year for 0.5 year of C	22378732.43	2.24	
D	**Project Cost**	**1126097816**	**112.61**	**6.91**
1	Cost of land and property acquisition	330412053.6	33.04	
2	Cost of Utility Shifting (PHE and Electrical)	12305701.35	1.23	
E	**Total Non Civil Cost (1+2)**	**342717755**	**34.27**	**2.10**
F	**TOTAL PROJECT COST (D+E)**	**1468815571**	**146.88**	**9.01**

Conclusion and Recommendation

1. As per traffic projection, 2 Lane with earthen shoulders has been proposed for the project road
2. Total Construction cost for the project road is Rs.89.51 crores for the year 2020-21.