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# CHAPTER 0.0:

# EXECUTIVE SUMMARY

## 0.1 Background

National Highways and Infrastructure Development Corporation (NHIDCL) has proposed the feasibility study, preparation of DPR & providing pre-construction services for up-gradation of selected road stretches/corridors to two lane with paved shoulder NH configuration under BHARATMALA Project and National Highways connectivity to Backward areas/Religious/Tourist places of the country in the state of Tripura.
Under this scheme, the consultancy work is awarded to M/s. Technocrats Advisory Services Pvt. Ltd. in association with Vaishnavi Infratech Services Pvt. Ltd. for preparation of Detailed Project Report of **Teliamura - Sabroom section (NH-208).**

The existing length of project road is 132.882 Km and design length (after geometric improvements) is 107.654 km (excluding 1.24km length for widening of NH-208 overlapped with NH-8 from Khowai chowmuhani to south pulinpur).

## 0.2 Consultancy Services

The consultancy services are to be provided in three stages as brought out below.

Stage 1: Inception Report (IR) & Quality Assurance Plan (QAP)

Stage 2: Feasibility Report

Stage 3: Detailed Project Report (DPR)

- **Stage – 1** i.e. Inception Report & Quality Assurance Plan has been submitted,
- **Stage – 2** i.e. Feasibility Report (Draft & Final) has been submitted,
- **Stage – 3** i.e. Detailed Project Report (Draft) has been submitted,

*Detailed Project Report (Final) is described as below –*

- Main Report
- Annexure to Main Report
- Design Report (Pavement & Bridge)
- Material Report
- Environmental Assessment Report including Environmental Management Plan (EMP) & Resettlement Action Plan (RAP)
- Technical Specifications

- Rate Analysis
- Cost Estimates
- Bill of Quantities
- Drawing Volume
- Civil work contract agreement
- Project Clearances

## 0.3 Objectives

The main objective of the consultancy service is to establish the technical, economical, and financial viability of the project and prepare detailed project reports for **Teliamura-Sabroom section.**

The viability of the project shall be established taking into account the requirements with regard to proposed alignment of Project road based on highway design, pavement design, provision of service/Slip roads wherever necessary, type of intersections, rehabilitation and widening of existing and/or construction of new bridges and structures, road safety features, quantities of various items of works and cost estimates and economic analysis.

## 0.4 Scope of Services

The Consultant is required to suggest alternative alignments (minimum 3 nos.) for proposed Bypasses, As far as possible, existing road having adequate ROW shall be include in the alignment. The widening / improvement work to 2 lane with paved shoulder shall be within the existing right of way avoiding land acquisition, except for locations having inadequate width and where provisions of short alignment corrections, improvement of intersections are considered necessary and practicable and cost effective. However, new alignment should also be considered, wherever improvement to 2 lane of the existing road is not possible. The Consultant shall furnish land acquisition details as per revenue records/maps for further processing.

The general scope of services is given in the sections that follow. However, the entire scope of services would, inter-alia, include the items mentioned in the Letter of Invitation and the TOR. The Consultant will also make suitable proposals for widening/ improvement of the existing road to 2 lanes etc. and strengthening of the carriageways, as required at the appropriate time to maintain the level of service over the design period.

All ready to implement 'good for construction' drawings shall be prepared.

Environmental Impact Assessment, Environmental Management Plan and Rehabilitation and Resettlement Studies shall be carried out by the Consultant meeting the requirements of MoEF / other statutory bodies.

Wherever required, consultant will liaise with concerned authorities and arrange all clarifications. Approval of all drawings including GAD and detail engineering drawings will be got done by the consultant from the Railways. However, if Railways require proof checking of the drawings prepared by the consultants, the same will be got done by NHIDCL. Consultant will also obtain 'No Objection Certificate 'from Ministry of Environment and Forest and also incorporate the estimates for shifting of utilities of all types involved from concerned local authorities in the DPR. Consultant is also required

to prepare all Land Acquisition papers (i.e. all necessary schedules as per L.A. act) for acquisition of land either under NH Act or State Act.

The Consultant shall prepare and submit the cost estimate and bid documents at Feasibility report stage

Consultant shall obtain all types of necessary clearances required for implementation of the project on the ground from the concerned agencies. The client shall provide the necessary supporting letters and any official fees as per the demand note issued by such concerned agencies from whom the clearances are being sought to enable implementation.

## 0.5 Key Professional Staff

**Table 0.1 – Key Professional staff**

| S. No. | Position | Name |
|---|---|---|
| 1 | Team Leader | **Mr. Babban Ram** |
| 2 | Geo-Technical and Pavement Expert | **Mr. Brijesh Mishra** |
| 3 | Environmental Specialist | **Mrs. Meena Bhaduri** |
| 4 | Traffic cum Safety Expert | **Mr. Salil Pathak** |
| 5 | Hill Road / Tunnel Expert | **Mr. P.K Dubey** |
| 6 | Revenue / Survey Expert | **Mr. Mahaveer Singh** |
| 7 | Bridge Design Engineer | **Mr. D.P. Singh** |
| 8 | Contract Specialist | **Mr. Vir Bahadur Singh** |

## 0.6 Project Alignment Description

- As per contract agreement, the Project alignment starts from Ompi chowmuhani (T-Junction with NH-08 at Teliamura) passes through Twidu, Sonacherra, Amarpur, Nutan Bazar, Karbook, Ailmara, Khedacherri, Ropaichari and ends at Harina (T-Junction with NH-08 near km 132.882). Sabroom is 8.1 km away from Harina junction.
- The Project road runs parallel to International border (India – Bangladesh) in some of its length.
- **The length of project road in first 2.4 km passes through Teliamura town, a heavy congestion of traffic / buildings exist at this section. To avoid these congestions, a bypass of 1.3 km is proposed for Teliamura town. This bypass starts at NH-08 (at South Pulinpur, 1.24 km from Khowai chowmuhani towards Agartala) and merges at existing km 2+600 of Project road.**
- The existing length of project road is 132.882 km
- The design length (after geometrical improvement) is 108.894 km (including 1.24km length for widening of NH-208 overlapped with NH-8 from Khowai chowmuhani to south pulinpur).
- Existing lane of Project road is maximum single lane with poor riding quality of PMGSY category.

**The Proposals for improvement of Project road is as under –**

a) **Widening of existing road (NH-208 overlapped with NH-8) from two lane to two lane with paved shoulder, Length 1.24 km (from khowai chowmuhani to south pulinpur),**

b) **Widening of existing road & new construction as two lane with paved shoulder from south pulinpur to Harina (junction with NH-8), length 107.654 km**

- **This Chapter describes the details of Package IV (from design km 72.000 to km 107.654, design length – 35.654 km)**

**The Project Road alignment shown in figure below-**

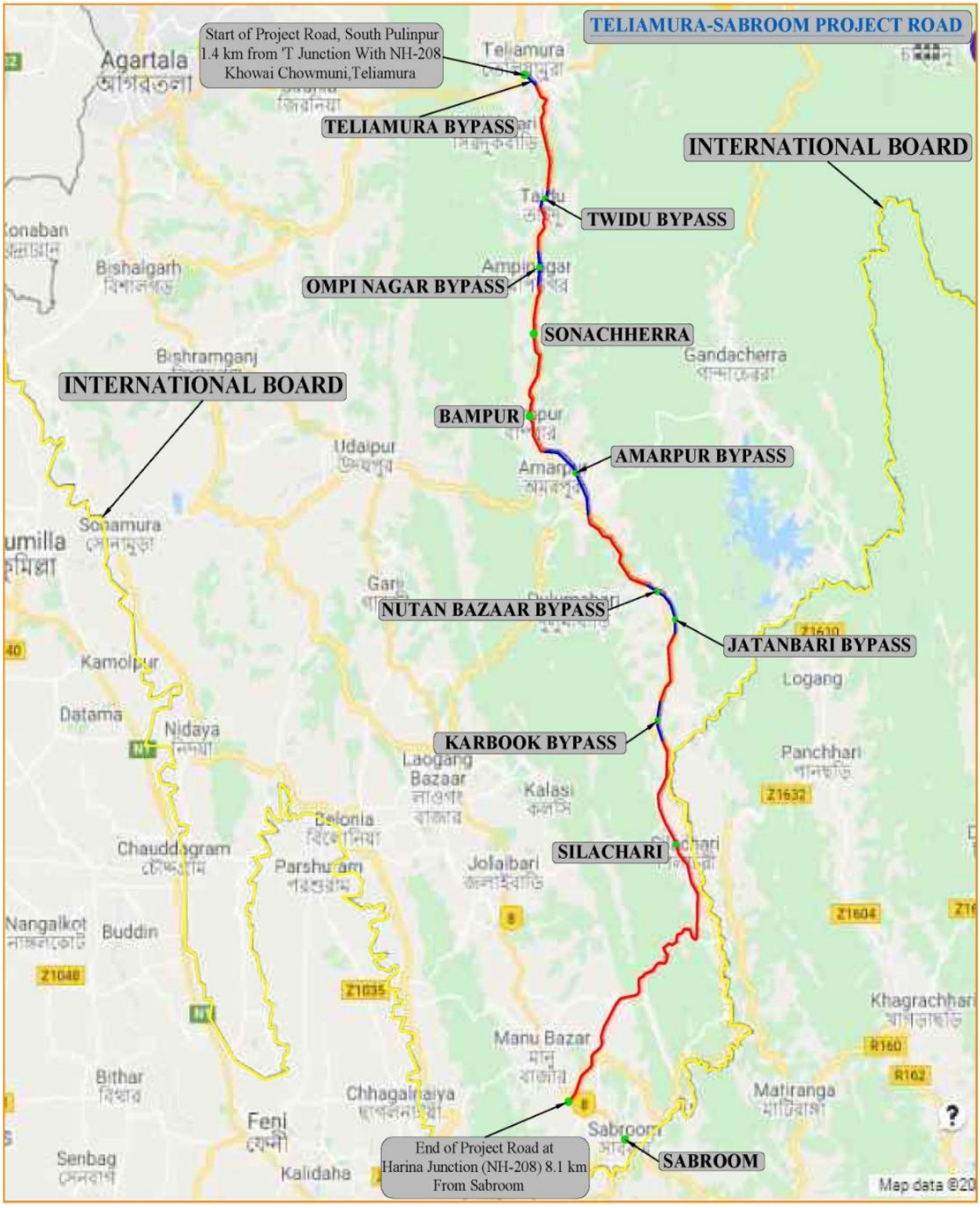



**Figure 0.1– Proposed Alignment of Project Road**

## 0.7 Right of Way (ROW)

There is no marking of existing RoW at ground along the Project road, the details of existing RoW is not available with PWD also, however, as per visual inspection and local people enquire, it is found the available land is only 8-10m.

The proposed RoW has been considered 20-80m for entire road stretch and details are presented below:

**Table 0.2:- Details of Proposed RoW**

| Sl. No. | Chainage | | Length (m) | Total PROW (m) |
|---|---|---|---|---|
| | From | To | | |
| 1 | 72000 | 77520 | 5520 | 30 |
| 2 | 77520 | 78560 | 1040 | 45 |
| 3 | 78560 | 85700 | 7140 | 30 |
| 4 | 85700 | 87110 | 1410 | 70 |
| 5 | 87110 | 87500 | 390 | 70 |
| 6 | 87500 | 87750 | 250 | 70 |
| 7 | 87750 | 88130 | 380 | 30 |
| 8 | 88130 | 88335 | 205 | 45 |
| 9 | 88335 | 89500 | 1165 | 30 |
| 10 | 89500 | 90000 | 500 | 80 |
| 11 | 90000 | 92100 | 2100 | 80 |
| 12 | 92100 | 96000 | 3900 | 60 |
| 13 | 96000 | 99715 | 3715 | 30 |
| 14 | 99715 | 99955 | 240 | 40 |
| 15 | 99955 | 106385 | 6430 | 30 |
| 16 | 106385 | 107654 | 1269 | 20 |

## 0.8 Abutting Land Use Pattern

Project road passing maximum in rolling terrain. Approx in 20% of total length, it passes through mountainous terrain also (From km 84+500 to km 96+500).
Built-up and partially built-up are existing along the both side of Project road.

The land use pattern in chart view is shown below –

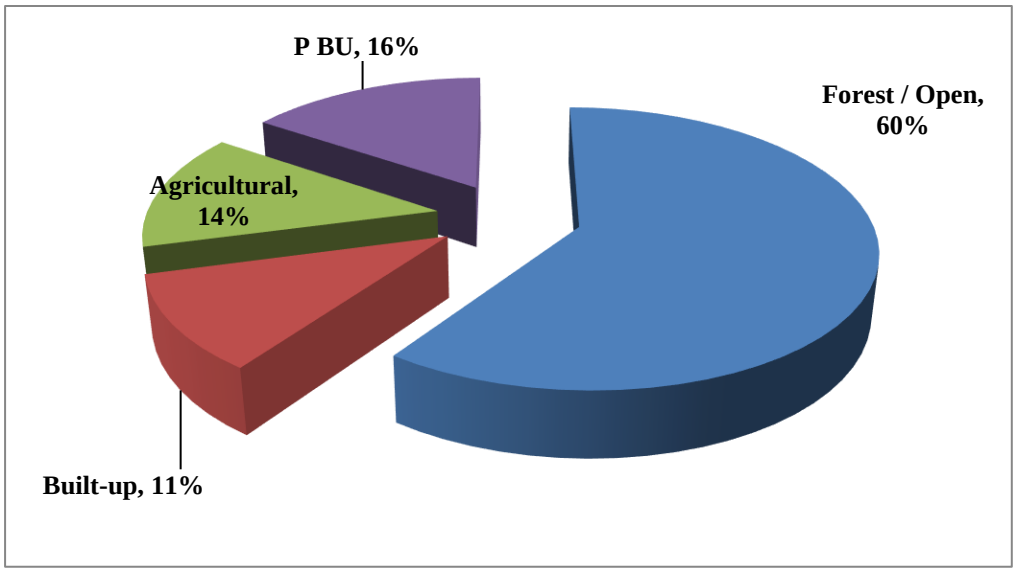



**Fig 0.2 Land Use Pattern**

**Table 0.3 :- Details of Land**

| Sl. No. | Design Chainage (Km) | | Length (Km) | Terrain | Remarks |
|---|---|---|---|---|---|
| 1 | 72.00 | 84.50 | 12.50 | Rolling | |
| 2 | 84.50 | 96.50 | 12.00 | Hilly | |
| 3 | 96.50 | 107.65 | 11.15 | Rolling | |

## 0.9 Terrain

Terrain is plain, rolling and mountainous.

## 0.10 Carriageway

The carriageway of the Project highway as per data collected at the time of reconnaissance survey is as shown below –

**Table 0.4 :-Carriageway Width**

| Sl. No. | Chainage (km) | | Carriage way width (m) | Remarks |
|---|---|---|---|---|
| | From | To | | |
| 1 | 85+600 | 103+000 | 3.5 – 4 | |
| 2 | 103+000 | 132+882 | 3.5 - 4 | |

## 0.11 Design Standards

Following design standards have been adopted as per Indian Roads Congress (IRC) guidelines, contained in IRC: 73, IRC: 86, IRC: 38, IRC 58-2011 and IRC: SP: 23 and is given in Table0.5.

**Table 0.5- Design Parameters**

| Item | Plain / Rolling / Mountainous Terrain | Reference |
|---|---|---|
| Design Speed (kmph) | Ruling -100 Kmph (Plain) / 60kmph (Hill)<br>Min.- 80 kmph (Plain) / 40kmph (Hill) | Table 2.1 |
| Sight distance (minimum) | 180 m | Table 2.6 |
| Proposed Land width (ROW) | 20-80 m (refer table 0.2 of Executive Summary) | |
| Lane configuration | 2-lane with paved shoulders | |
| Formation width | **In Open area**<br>7.0 m of carriageway + 1.5 m Paved shoulder + 1.0 m earthen shoulder<br>**In Built-up area**<br>7.0 m of carriageway + 2.5 m Paved shoulder + 1.75 m RCC drain | Refer MoRT&H circular dated 17.07.2020 |
| Edge strip | .25m Raised median | |
| | .5m Depressed Median | |
| Camber/cross fall | 2.5 % | Table 2.7 |

<table>
<tr><th>Item</th><th>Plain / Rolling / Mountainous Terrain</th><th>Reference</th></tr>
<tr><td>Shoulders</td><td>2.5 % for paved shoulder and 3.0 % for earthen shoulder</td><td>Clause 2.8.2</td></tr>
<tr><td>Side Slope</td><td>1 (V): 2 (H) Fill (Fill height upto 3.0 m)<br>1 (V): 1.5 (H) Fill (Fill height 3 m to 6.0 m)<br>1 (V): 0.5 (H) Cut</td><td></td></tr>
<tr><td>Maximum super-elevation</td><td>7.0 %</td><td></td></tr>
<tr><td>Radii of horizontal curves in plain/hilly terrain (m)</td><td><table><tr><th></th><th>Plain</th><th>Hilly</th></tr><tr><td>Ruling Min</td><td>400 m</td><td>150m</td></tr><tr><td>Absolute Min</td><td>250 m</td><td>75m</td></tr></table></td><td>Table 2.5</td></tr>
<tr><td>Drains</td><td>“Rectangular “shape on - either side where warranted depending on Site Condition & U-shaped Drain in hill sections.</td><td></td></tr>
</table>

## 0.12 Survey & Investigation

### 0.12.1 Traffic Surveys

Traffic surveys have been conducted at three locations in entire project road length (Teliamura – Harina).

**Table 0.6: Traffic count survey locations**

| Sl. No. | Homogenous Section | Location | Remarks to Capture |
|---|---|---|---|
| 1 | Section I :: Km 0 to Km 45.0 (Teliamura – Amarpur section) | Km 42.300 (near Rangamati) | Traffic coming from Agartala, Manu bazar & moving towards Amarpur, Harina, Sabroometc (both ways) |
| 2 | Section II :: Km 45.0 to Km 88.00 (Amarpur – Ailmara section) | Km 88.000 (near Ailmara) | Traffic coming from Agartala, Manu bazar, Amarpur& moving towards Harina, Sabroom also to Agartala via Harina (both ways) |
| 3 | Section III :: Km 88.0 to Km 133.00 (Ailmara – Harina section) | Km 132.800 (near Harina) | Traffic coming from Agartala, Manu bazar, Amarpur& moving towards Harina, Sabroom also to Agartala via Harina (both ways) Inclusion of local traffic. |

### 0.12.2 Growth Rate

The Adopted Traffic Growth rate is taken an average of 5% for all type of vehicles.

### 0.12.3 AADT, CVPD & Projected Traffic

**Table 0.7- Commercial Vehicle Per day**

| Sl. No. | Location | AADT | PCU | CVPD | Remarks |
|---|---|---|---|---|---|
| 1 | Km 42.30 (near Rangamati) | 1579 | 1583 | 302 | |
| 2 | Km 88.00 (near Ailmara) | 246 | 225 | 35 | |
| 3 | Km 132.80 (near Harina) | 251 | 241 | 45 | |

**Projected traffic on the project road is given below:**

**Table 0.8- Projected traffic**

| Year | Likely traffic on the Project road | | | |
|---|---|---|---|---|
| | PCU at km 42.30(Near Rangamati) | PCU at km 88.00 (Near Ailmara) | PCU at km 132.80 (Near Harina) | Requirement of |
| 2017 | 1583 | 224 | 241 | 2 Lane |
| 2020 | 2162 | 299 | 334 | |
| 2025 | 2750 | 368 | 423 | |
| 2030 | 3500 | 451 | 532 | |
| 2035 | 4457 | 559 | 666 | |
| 2040 | 5673 | 696 | 854 | |

As per the projected traffic & MoRT&H circular dated 26th May 2016, requirement for four lane is not qualifying upto year 2040 (For Plain terrain = 10000 PCU per day, for Rolling terrain = 8500 PCU per day & for Mountainous terrain = 6000 PCU per day), However, considering the connectivity of Project road with adjacent towns / NH-08 & development of backward areas/ Religious / Tourist Places, it is proposed to develop the project road as two lane with paved shoulder facility.

### 0.12.4 Axle load survey

Though CVPD (as per above table) on all three locations are found very less (302, 35 & 45), so the Axle load survey could not carried out and the default values of VDF as per table 4.2 of IRC -37:2018 is considered 1.5 for km 88 & 132.800 and value adopted as 3.9 for km 42.300.

### 0.12.5 Testing of soil from existing embankment

The soil samples from various locations on the existing embankment have been collected and subjected to laboratory testing for determination of various engineering properties. The CBR is found an average of 8%.

**Table 0.9: - Existing Pavement Crust**

| *Chainage (Km)* | *Position of Pit* | *Pavement Composition* | | | *Total (mm)* |
|---|---|---|---|---|---|
| | | *Bitumen Layer* | *Brick Soling* | *Sub base Course* | |
| | | *(mm)* | *(mm)* | *(mm)* | |
| 85+000 | LHS | 45 | 165 | - | 210 |
| 85+500 | LHS | 35 | 195 | - | 230 |
| 86+000 | RHS | 45 | 165 | - | 210 |
| 86+500 | LHS | 40 | 180 | - | 220 |
| 87+000 | RHS | 35 | 195 | - | 230 |
| 87+500 | LHS | 40 | 215 | - | 255 |
| 88+000 | RHS | 35 | 275 | - | 310 |
| 88+500 | LHS | 35 | 245 | - | 280 |
| 89+000 | LHS | 50 | 255 | - | 305 |
| 89+500 | RHS | 40 | 150 | - | 190 |
| 90+000 | LHS | 40 | 150 | - | 190 |
| 90+500 | RHS | 40 | 180 | - | 220 |
| 91+000 | LHS | 50 | 180 | - | 230 |
| 91+500 | RHS | 40 | 165 | - | 205 |
| 92+000 | LHS | 35 | 200 | - | 235 |
| 92+500 | LHS | 40 | 240 | - | 280 |
| 93+000 | RHS | 45 | 180 | - | 225 |
| 93+500 | LHS | 50 | 170 | - | 220 |
| 94+000 | RHS | 30 | 240 | - | 270 |
| 94+500 | LHS | 45 | 250 | - | 295 |
| 95+000 | RHS | 40 | 195 | - | 235 |
| 95+500 | LHS | 45 | 265 | - | 310 |
| 96+000 | LHS | 50 | 205 | - | 255 |
| 96+500 | RHS | 50 | 215 | - | 265 |
| 97+000 | LHS | 40 | 155 | - | 195 |
| 97+500 | RHS | 50 | 210 | - | 260 |
| 98+000 | LHS | 35 | 200 | - | 235 |
| 98+500 | RHS | 40 | 265 | - | 305 |
| 99+000 | LHS | 35 | 245 | - | 280 |
| 99+500 | LHS | 40 | 255 | - | 295 |
| 100+000 | RHS | 50 | 245 | - | 295 |
| 100+500 | LHS | 40 | 210 | - | 250 |
| 101+000 | RHS | 40 | 210 | - | 250 |
| 101+500 | LHS | 50 | 235 | - | 285 |

| *Chainage (Km)* | *Position of Pit* | *Pavement Composition* | | | *Total (mm)* |
|---|---|---|---|---|---|
| | | *Bitumen Layer* | *Brick Soling* | *Sub base Course* | |
| | | *(mm)* | *(mm)* | *(mm)* | |
| 102+000 | RHS | 30 | 210 | - | 240 |
| 102+500 | LHS | 30 | 245 | - | 275 |
| 103+000 | LHS | 45 | 215 | - | 260 |
| 103+500 | RHS | 50 | 245 | - | 295 |
| 104+000 | LHS | 35 | 260 | - | 295 |
| 104+500 | RHS | 35 | 280 | - | 315 |
| 105+000 | LHS | 45 | 195 | - | 240 |
| 105+500 | RHS | 45 | 220 | - | 265 |
| 106+000 | LHS | 35 | 180 | - | 215 |
| 106+500 | LHS | 35 | 250 | - | 285 |
| 107+000 | RHS | 35 | 275 | - | 310 |
| 107+500 | LHS | 35 | 170 | - | 205 |
| 108+000 | RHS | 40 | 165 | - | 205 |
| 108+500 | LHS | 45 | 195 | - | 240 |
| 109+000 | RHS | 40 | 165 | - | 205 |
| 109+500 | LHS | 45 | 180 | - | 225 |
| 110+000 | LHS | 35 | 195 | - | 230 |
| 110+500 | RHS | 40 | 215 | - | 255 |
| 111+000 | LHS | 45 | 275 | - | 320 |
| 111+500 | RHS | 45 | 245 | - | 290 |
| 112+000 | LHS | 45 | 255 | - | 300 |
| 112+500 | RHS | 40 | 150 | - | 190 |
| 113+000 | LHS | 30 | 150 | - | 180 |
| 113+500 | LHS | 45 | 180 | - | 225 |
| 114+000 | RHS | 45 | 180 | - | 225 |
| 114+500 | LHS | 30 | 165 | - | 195 |
| 115+000 | RHS | 35 | 200 | - | 235 |
| 115+500 | LHS | 35 | 240 | - | 275 |
| 116+000 | RHS | 35 | 180 | - | 215 |
| 116+500 | LHS | 40 | 170 | - | 210 |
| 117+000 | LHS | 40 | 240 | - | 280 |
| 117+500 | RHS | 40 | 250 | - | 290 |
| 118+000 | LHS | 30 | 195 | - | 225 |
| 118+500 | RHS | 35 | 265 | - | 300 |
| 119+000 | LHS | 40 | 205 | - | 245 |

| *Chainage (Km)* | *Position of Pit* | *Pavement Composition* | | | *Total (mm)* |
|---|---|---|---|---|---|
| | | *Bitumen Layer* | *Brick Soling* | *Sub base Course* | |
| | | *(mm)* | *(mm)* | *(mm)* | |
| 119+500 | RHS | 35 | 215 | - | 250 |
| 120+000 | LHS | 40 | 155 | - | 195 |
| 120+500 | LHS | 45 | 210 | - | 255 |
| 121+000 | RHS | 40 | 200 | - | 240 |
| 121+500 | LHS | 45 | 265 | - | 310 |
| 122+000 | RHS | 35 | 245 | - | 280 |
| 122+500 | LHS | 45 | 255 | - | 300 |
| 123+000 | RHS | 40 | 245 | - | 285 |
| 123+500 | LHS | 35 | 210 | - | 245 |
| 124+000 | LHS | 40 | 210 | - | 250 |
| 124+500 | RHS | 35 | 175 | - | 210 |
| 125+000 | LHS | 35 | 180 | - | 215 |
| 125+500 | RHS | 50 | 155 | - | 205 |
| 126+000 | LHS | 40 | 160 | - | 200 |
| 126+500 | RHS | 40 | 165 | - | 205 |
| 127+000 | LHS | 40 | 195 | - | 235 |
| 127+500 | LHS | 50 | 250 | - | 300 |
| 128+000 | RHS | 40 | 265 | - | 305 |
| 128+500 | LHS | 35 | 255 | - | 290 |
| 129+000 | RHS | 40 | 245 | - | 285 |
| 129+500 | LHS | 45 | 200 | - | 245 |
| 130+000 | RHS | 50 | 240 | - | 290 |
| 130+500 | LHS | 30 | 225 | - | 255 |
| 131+000 | LHS | 45 | 215 | - | 260 |
| 131+500 | RHS | 40 | 150 | - | 190 |
| 132+000 | LHS | 45 | 200 | - | 245 |
| 132+500 | RHS | 50 | 170 | - | 220 |
| 132+800 | LHS | 50 | 180 | - | 230 |

## 0.12.6 CBR Test Results of soil samples

NORTH EAST SOIL TESTING (NEST)

Regd. Office : Ujan Abhoynagar,
Opp. Post Office, Agartala ,
West Tripura, PIN – 799005 ,

ISO 9001:2008 Certified

Issue Date : 25.03.17
Issued To : TASPL
Sample Deposited by : Representative
Sample Description : Soil

Job No. : B 5533
Date of Sample received : 20.02.17
Page :3.of..3....

Location: - Teliamura - Sabroom Section

| Sl.No. | Chainage No. (Km) | MDD (g/cc) | OMC (%) | Unsoaked CBR (%) | Soaked CBR (%) | Swelling Index (%) |
|---|---|---|---|---|---|---|
| 01 | 10.00 | 1.756 | 15.71 | 15.43 | 7.54 | 3.86 |
| 02 | 20.00 | 1.878 | 11.55 | 18.86 | 8.14 | 2.65 |
| 03 | 30.00 | 1.782 | 15.26 | 16.52 | 7.86 | 3.79 |
| 04 | 55.00 | 1.794 | 14.78 | 17.47 | 7.98 | 3.79 |
| 05 | 65.00 | 1.802 | 13.92 | 18.58 | 8.04 | 2.98 |
| 06 | 75.00 | 1.816 | 14.11 | 18.61 | 8.12 | 2.78 |
| 07 | 95.00 | 1.823 | 13.75 | 17.94 | 7.96 | 2.71 |
| 08 | 105.00 | 1.787 | 15.78 | 16.76 | 7.89 | 3.73 |
| 09 | 115.00 | 1.796 | 14.74 | 17.33 | 7.85 | 3.81 |
| 10 | Borrow Area Near Km 44.00 | 1.778 | 15.55 | 17.27 | 8.43 | 3.77 |
| 11 | Borrow Area Near Km 82.00 | 1.800 | 13.76 | 17.78 | 8.16 | 3.02 |

Prepared by
25/03/17
B. Tech (Civil)
Quality Manager,
North East Soil Testing,
Agartala-799005

(1) This test report pertains only to the sample tested. (2) This test report is valid at the time of and under the conditions specified here in. (3) Any correction invalidates this test report. This test report should not be published in part or in full by any body without written permission from 'NEST'. (4) Samples will be destroyed after 90 days from the date of reporting unless otherwise specified. (5) This report not to be reproduced wholly or in part & can not be used as an evidence in the court of Law & should not be used in any advertising media without our special permission in writing.

## 0.13 Material survey

**Aggregate** quarry for structure works and road works is identified at Silchar (Assam) which is Approx 300km away from Teliamura.

**Sand** source has been located from Local River with average lead of 20 km.

**Borrow earth** can be obtained from number of locations along the project road.

**Cement** for concrete works may purchase from local vendors of different grades of OPC & PPC.

**Steel** for concrete work may also use from local suppliers.

**Bitumen** supply is considered from Guwahati depot (For packed bitumen) with lead of approx. 510Km. the rate of bitumen has been provided at Agartala with price of Rs 42000/- per MT + 18% GST, at Teliamura site it will be Rs 41000/- per MT +18% GST (a quotation is shown here)

**Swastik Petrochem**
Factory: Vill. Bheleuguri,
Samaguri, Nagaon, Assam – 782003
Mob.: +91-98120-39009
e-mail: petro.swastik@gmail.com

Ref:- SP/Q-108/2020-21 Dated: 06.01.2020

To,
M/s.Technocraft Advisory Services Pvt Ltd,
Ghaziabad,

Plant at :-Teliamura Tripura

**Sub.: Offer for Sale of Bitumen VG-30 and Bitumen VG-40 (Packed in Drums)**

Dear Sir,

This is with reference to your requirement of Bitumen and telephonic conversation had with you. We are pleased to offer our competitive rates for sale of Bitumen VG-30 and Bitumen VG-40 (Packed in Drums) as under:-

| Sr. No. | Description | Quantity | Rates (in Rs.) |
|---|---|---|---|
| 1 | Bitumen VG-30 (Packed in Drums) HS Code : 27132000 | 1000 M.T. (Approx) | 41000/- per M.T. + 18% GST |
| 2 | Bitumen VG-40 (Packed in Drums) HS Code : 27132000 | 1000 M.T. (Approx) | 42000/- per M.T. + 18% GST |

Note:-

1. These rates are F.O.R at Agartala.
2. Payment 100% advance before dispatch of Material.
3. GST @18% will be charged.
4. This offer is valid for 7 days.

Thanking you,
**For Swastik Petrochem**

**Amit Monga**
**Mob. No : 80530-52130**

## 0.14 Geotechnical Investigations

Geotechnical investigations have been completed and the results shown in other volume "Material Report".

## 0.15 Development Proposals

### 0.15.1 Pavement Design

Considering a growth rate of 5 % and VDF as 1.5 & 3.9 obtained from the IRC, design of pavement as per IRC 37 -2018 for a design life of minimum 15 years.

Accordingly design traffic has been worked out as 20MSA (as per 5.4.1 (i) of Two lane manual, IRC SP: 73: 2018) and considering sub-grade construction with soil of CBR not less than 8%,
The Pavement compositions for Project road as per IRC 37-2018 is as under:

a) Bituminous concrete (BC) - 40mm,
b) Bituminous stabilized material - 100mm,
c) Cement treated sub base - 200mm &
d) Subgrade - 500mm

## 0.15.2 Typical Cross Section and Widening Scheme

i) **Roadway width -**

a. **For Plain areas -** Roadway width of 12.00 (7.0+2x1.5+2x1.0) is proposed for sections with 2 lane plus paved shoulders of 1.50m and unpaved shoulder of 1.00m on either side in plain areas and,

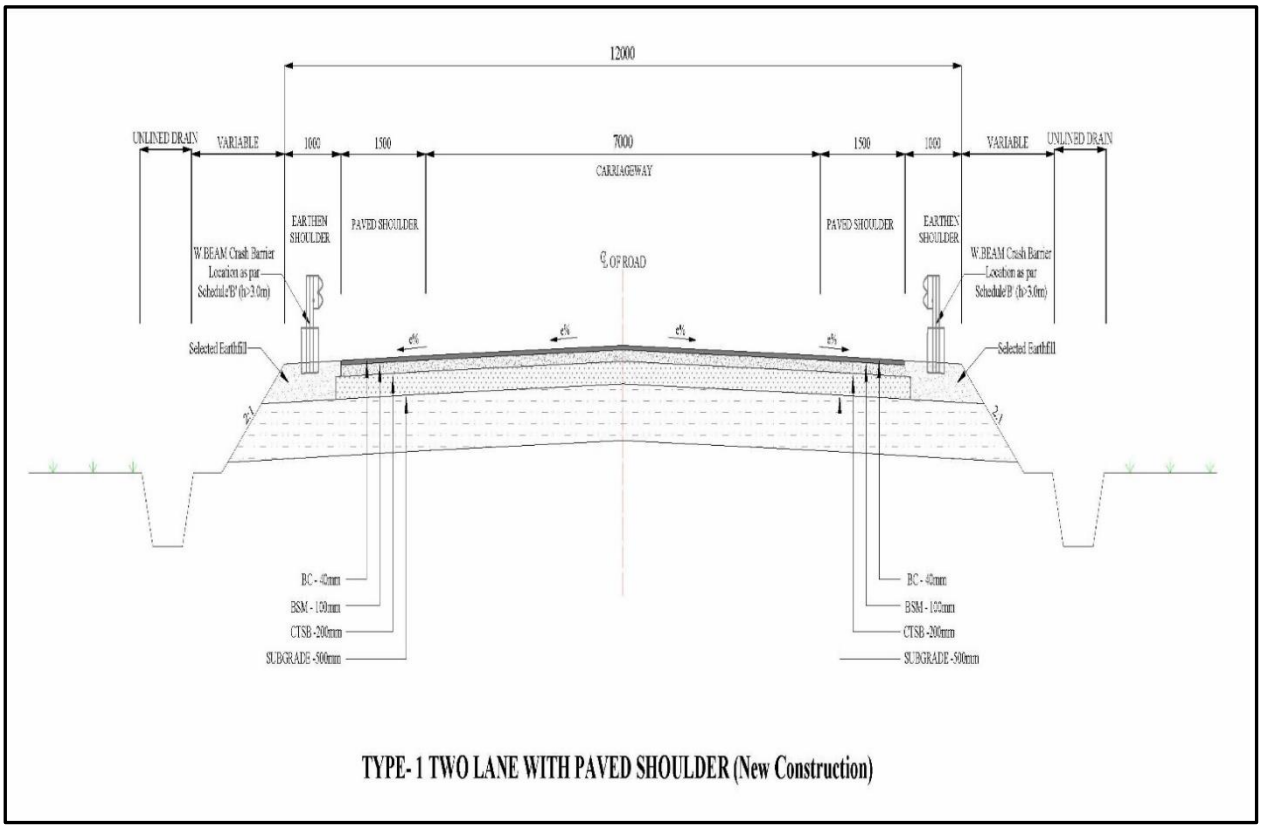
b. **For Built-up areas -** Roadway width of 12.00 (7.0+2x2.5 paved shoulder) + (2x1.75 drain) is proposed for sections with 2 lane plus paved shoulders of 1.50m and RCC covered drain of 1m wide on either side of Road way,

c. **For Hilly areas -** Roadway width of 10.00 (7.0+2x1.5) is proposed for sections with 2 lane plus paved shoulders of 1.50m (as per attached cross sections),

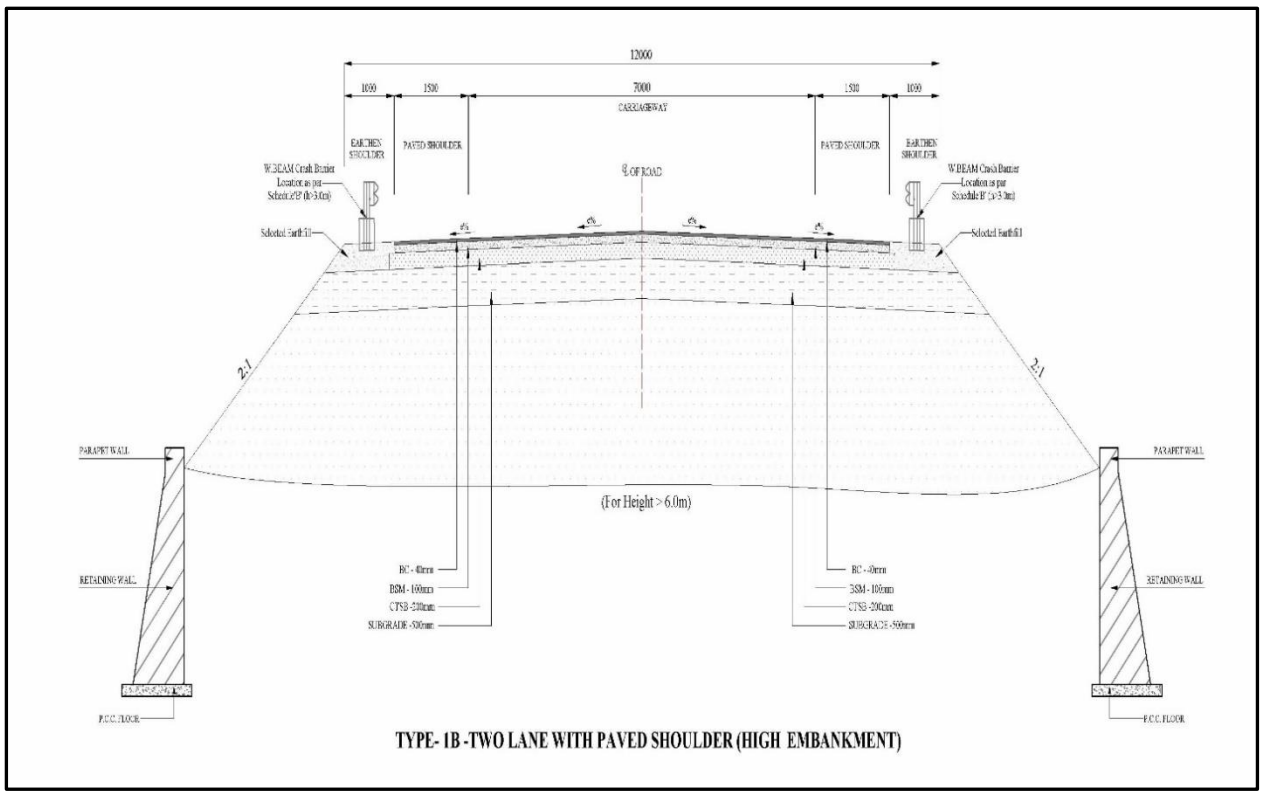
ii) **Carriageway Width -** Two Lane Carriage way (3.5m for each lane) is proposed,

iii) **Shoulders -** Unpaved shoulders of 1.0 wide and paved shoulder of 1.50m are proposed on either side of the Carriage way.

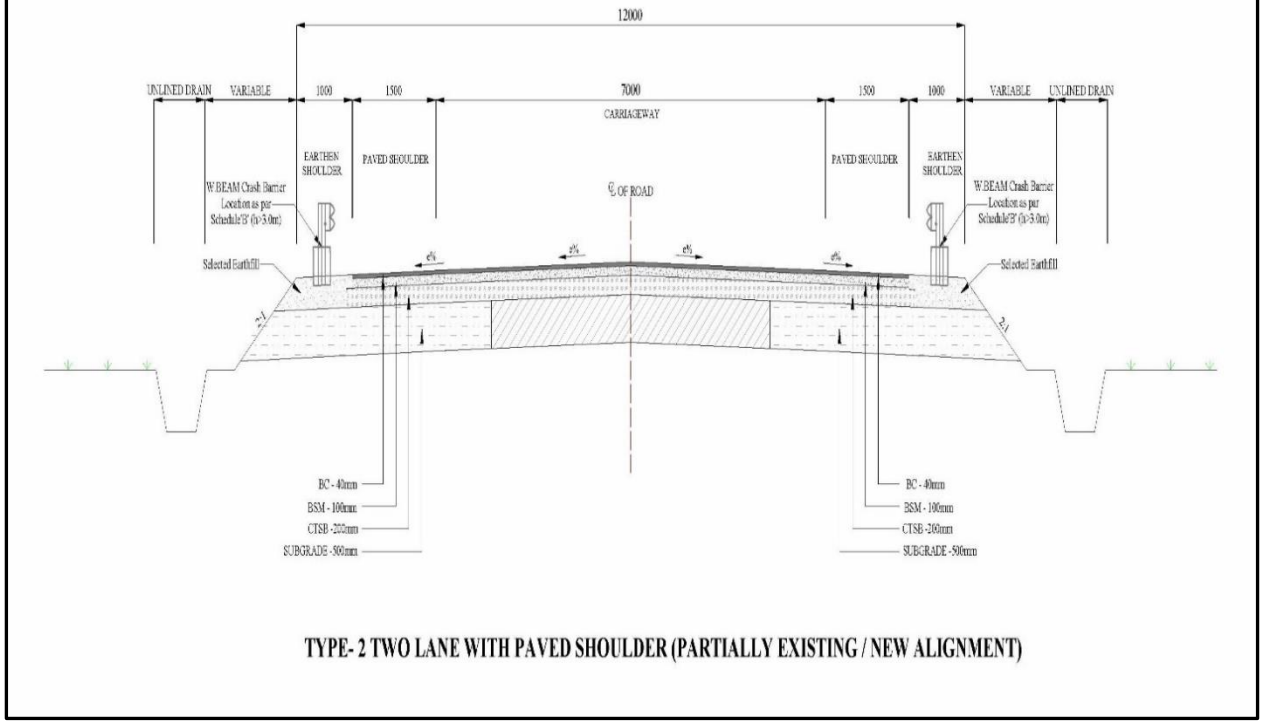
**Proposed Typical cross sections are shown here –**



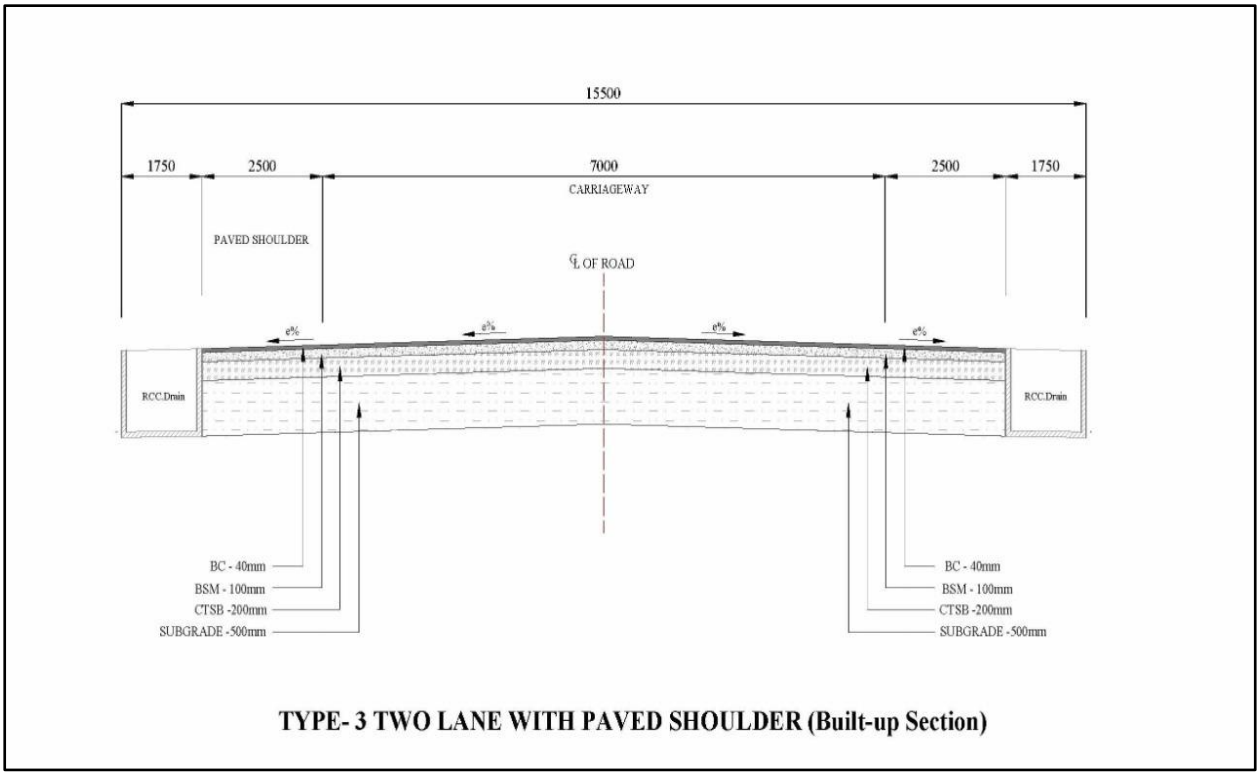

TYPE- 1 TWO LANE WITH PAVED SHOULDER (New Construction)



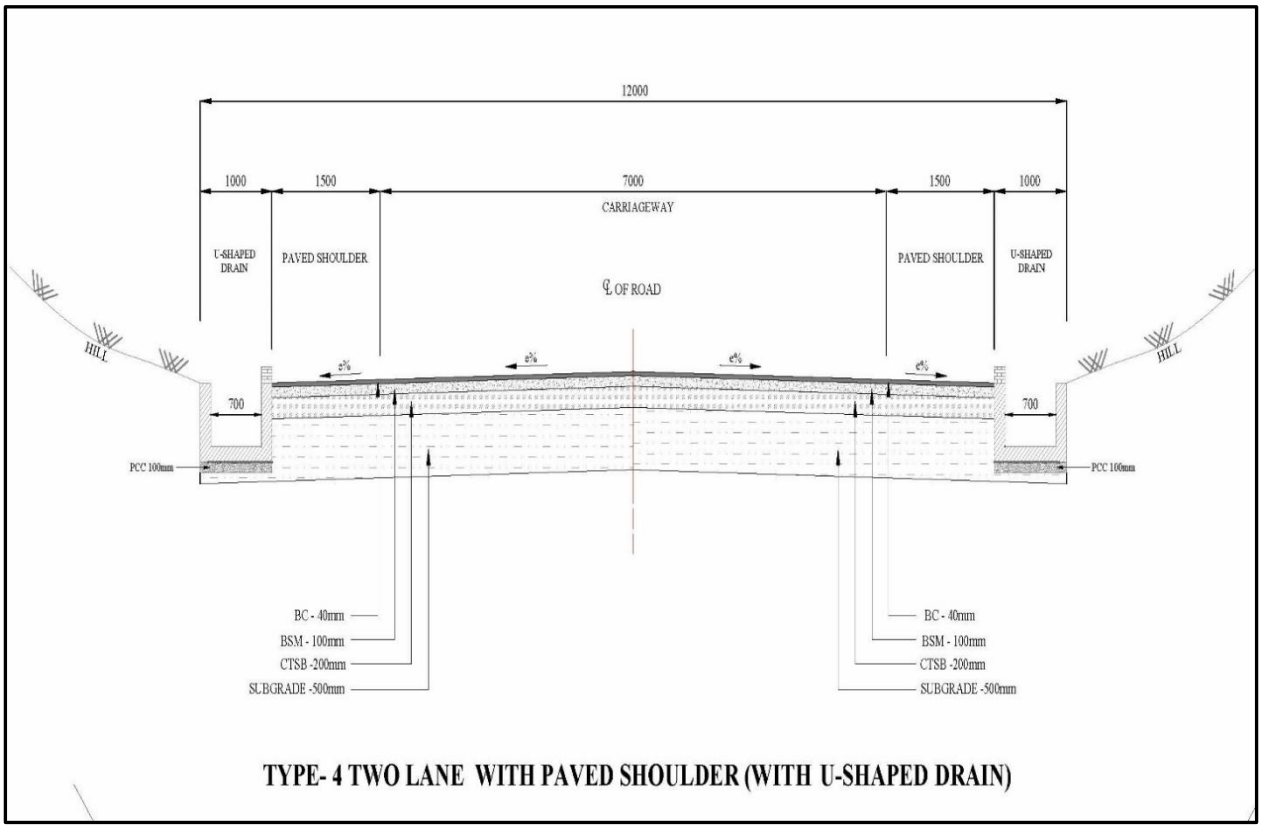

TYPE- 1B -TWO LANE WITH PAVED SHOULDER (HIGH EMBANKMENT)



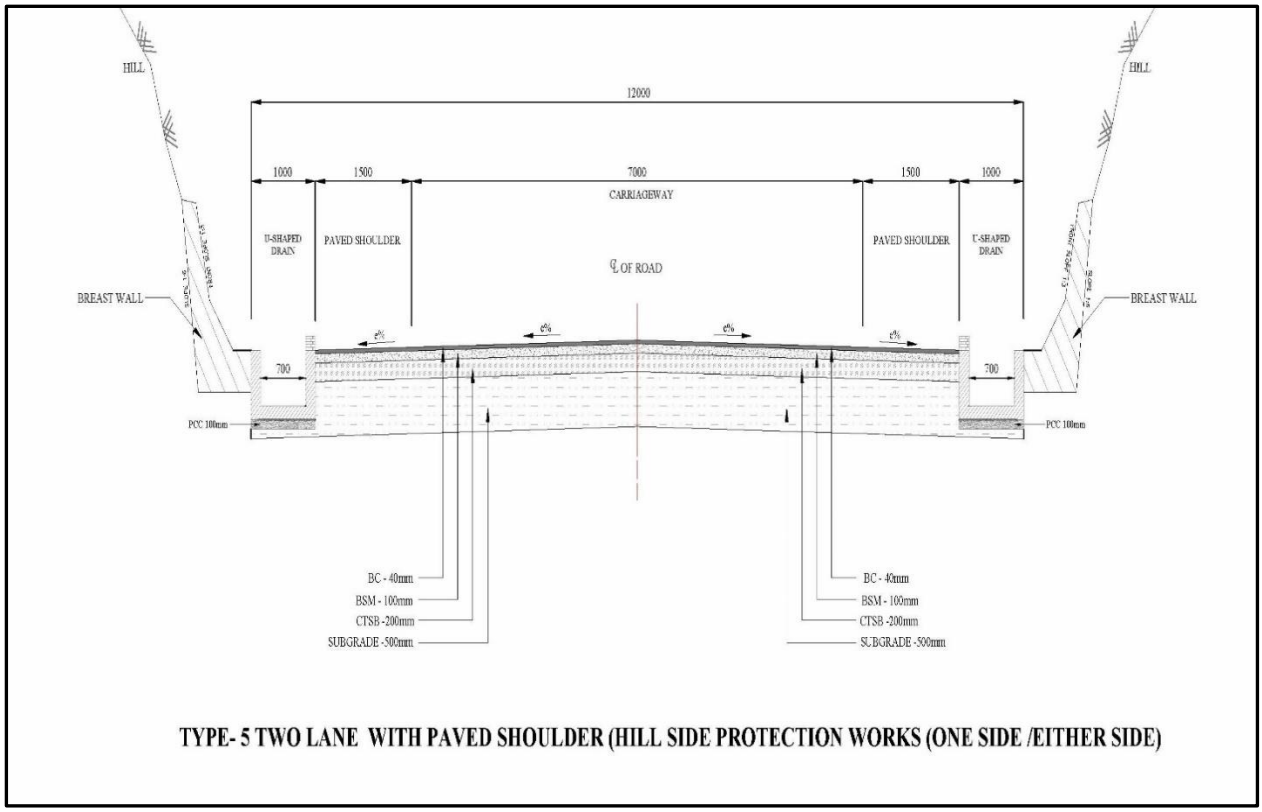

TYPE- 2 TWO LANE WITH PAVED SHOULDER (PARTIALLY EXISTING / NEW ALIGNMENT)



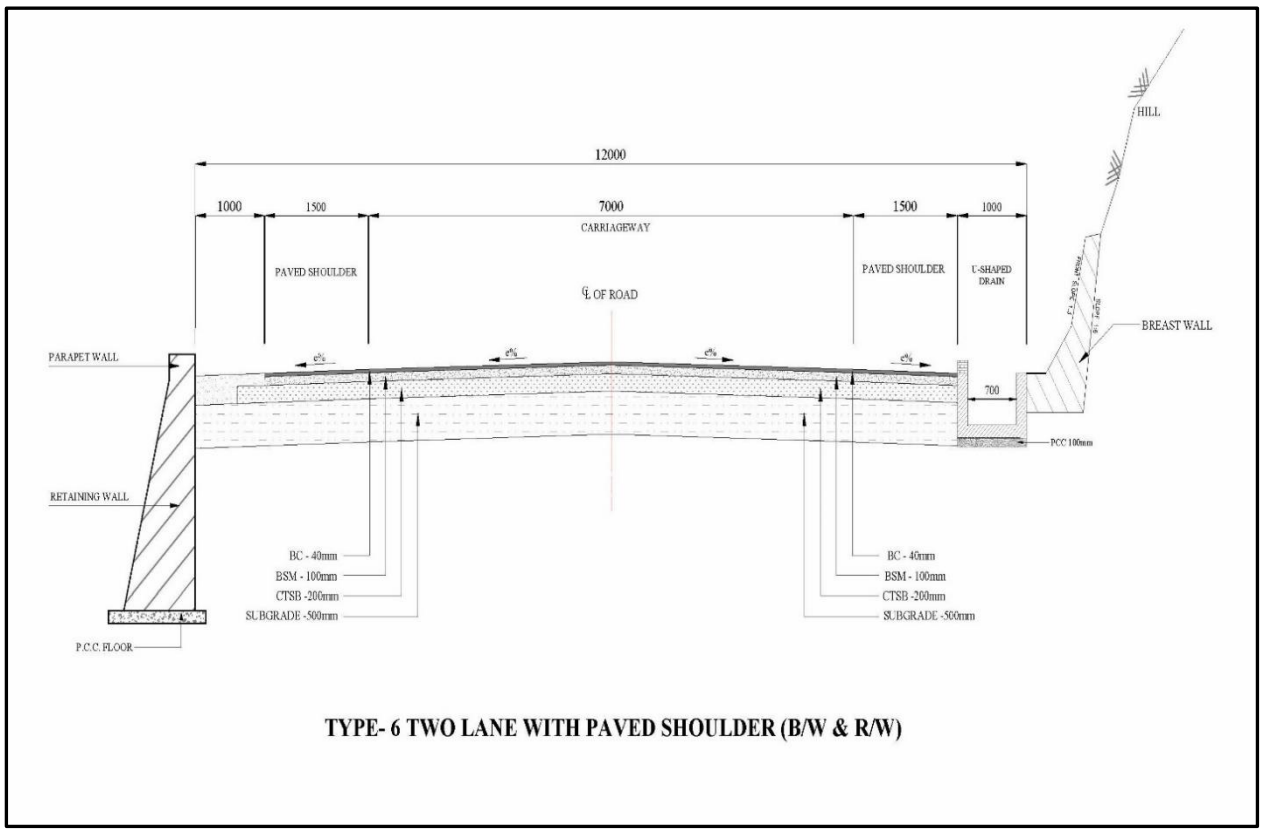

**TYPE- 3 TWO LANE WITH PAVED SHOULDER (Built-up Section)**




**TYPE- 4 TWO LANE WITH PAVED SHOULDER (WITH U-SHAPED DRAIN)**




**TYPE- 5 TWO LANE WITH PAVED SHOULDER (HILL SIDE PROTECTION WORKS (ONE SIDE /EITHER SIDE)**




**TYPE- 6 TWO LANE WITH PAVED SHOULDER (B/W & R/W)**

***TCS Schedule -***

| Sl. No | Design Chainage (Km) | | Bridge Length (m) | Total length | TCS Type | Description |
|---|---|---|---|---|---|---|
| | From | To | | | | |
| 1 | 72+000 | 72+300 | 26 | 0+274 | TCS-1 | Two Lane With Paved Shoulder (New Construction) |
| 2 | 72+300 | 75+560 | 23 | 3+237 | TCS-2 | Two Lane With Paved Shoulder |
| 3 | 75+560 | 75+820 | | 0+260 | TCS-5 | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 4 | 75+820 | 76+900 | 16 | 1+064 | TCS-2 | Two Lane With Paved Shoulder |
| 5 | 76+900 | 78+600 | | 1+700 | TCS-1 | Two Lane With Paved Shoulder (New Construction) |
| 6 | 78+600 | 78+820 | | 0+220 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 7 | 78+820 | 80+340 | 27 | 1+493 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 8 | 80+340 | 82+300 | | 1+960 | TCS-1 | Two Lane With Paved Shoulder (New Construction) |
| 9 | 82+300 | 83+580 | 15 | 1+265 | TCS-2 | Two Lane With Paved Shoulder |
| 10 | 83+580 | 83+740 | | 0+160 | TCS-5 | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 11 | 83+740 | 84+380 | | 0+640 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 12 | 84+380 | 84+940 | | 0+560 | TCS-5 | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 13 | 84+940 | 85+820 | 33 | 0+847 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 14 | 85+820 | 85+960 | | 0+140 | TCS-5 | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 15 | 85+960 | 86+140 | | 0+180 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 16 | 86+140 | 90+000 | 0 | 3+860 | TCS-6 | Two Lane With Paved Shoulder in hill (BW & RW) |
| 17 | 90+000 | 96+520 | 50 | 6+470 | TCS-6 | Two Lane With Paved Shoulder in hill (BW & RW) |

| Sl. No | Design Chainage (Km) | | Bridge Length (m) | Total length | TCS Type | Description |
|---|---|---|---|---|---|---|
| | From | To | | | | |
| 18 | 96+520 | 99+620 | 124 | 2+976 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 19 | 99+620 | 101+520 | | 1+900 | TCS-1 | Two Lane With Paved Shoulder (New Construction) |
| 20 | 101+520 | 101+700 | | 0+180 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 21 | 101+700 | 101+840 | | 0+140 | TCS-5 | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 22 | 101+840 | 104+860 | 50 | 2+970 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 23 | 104+860 | 105+100 | | 0+240 | TCS-5 | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 24 | 105+100 | 105+540 | | 0+440 | TCS-4 | Two Lane With Paved Shoulder (b/s PCC drain) |
| 25 | 105+540 | 107+654 | | 2+114 | TCS-2 | Two Lane With Paved Shoulder |
| | | | | | | |
| | **Total Length..** | | **364** | **35+290** | | |

| | | |
|---|---|---|
| 5+834 | **TCS-1** | Two Lane With Paved Shoulder (New Construction) |
| 7+680 | **TCS-2** | Two Lane With Paved Shoulder |
| 0+000 | **TCS-3** | Two lane with paved shoulder (Built-up section) |
| 9+946 | **TCS-4** | Two Lane With Paved Shoulder (b/s PCC drain) |
| 1+500 | **TCS-5** | Two Lane With Paved Shoulder in hill B/s Breast wall |
| 10+330 | **TCS-6** | Two Lane With Paved Shoulder in hill (BW & RW) |

## 0.16 Horizontal Design of Project road

The horizontal alignment design report is tabulated below.

**Table 0.10: Horizontal Report**

| Curve No. | HORIZONTAL CURVE | | | | Terrain | Transition length | Speed (Kmph) |
|---|---|---|---|---|---|---|---|
| | Start Chainage | End Chainage | Radius | Direction | | | |
| 117 | 72+757.908 | 73+041.025 | 2000 | Left | Plain | 0 | 100 |
| 118 | 73+543.327 | 73+905.585 | 1500 | Left | Plain | 35 | 100 |
| 119 | 74+594.026 | 74+866.404 | 2000 | Left | Plain | 0 | 100 |
| 120 | 75+267.567 | 75+621.435 | 1200 | Right | Plain | 40 | 100 |
| 121 | 76+322.942 | 76+567.163 | 2000 | Right | Plain | 0 | 100 |
| 122 | 77+158.735 | 77+363.135 | 500 | Left | Plain | 95 | 100 |
| 123 | 77+759.379 | 77+833.027 | 600 | Right | Plain | 80 | 100 |
| 124 | 78+589.036 | 79+198.958 | 1500 | Right | Plain | 35 | 100 |
| 125 | 80+109.567 | 80+357.037 | 800 | Left | Plain | 60 | 100 |
| 126 | 80+947.199 | 81+966.426 | 1500 | Right | Plain | 35 | 100 |
| 127 | 82+976.468 | 83+060.794 | 2000 | Left | Plain | 0 | 100 |
| 128 | 83+952.645 | 84+143.597 | 1200 | Left | Plain | 40 | 100 |
| 129 | 84+823.108 | 85+353.531 | 200 | Right | Hilly | 35 | 50 |
| 130 | 85+793.230 | 85+803.627 | 200 | Right | Hilly | 35 | 50 |
| 131 | 86+053.979 | 86+108.641 | 150 | Left | Hilly | 30 | 50 |
| 132 | 86+268.584 | 86+294.991 | 75 | Left | Hilly | 30 | 40 |
| 133 | 86+502.192 | 86+690.398 | 200 | Left | Hilly | 35 | 50 |
| 134 | 86+861.866 | 86+864.942 | 150 | Right | Hilly | 40 | 65 |
| 135 | 87+005.110 | 87+017.276 | 800 | Right | Hilly | 40 | 65 |
| 136 | 87+176.846 | 87+274.123 | 150 | Right | Hilly | 40 | 65 |
| 137 | 87+389.973 | 87+478.712 | 75 | Left | Hilly | 30 | 40 |
| 138 | 87+566.418 | 87+627.165 | 300 | Left | Hilly | 20 | 50 |
| 139 | 87+705.250 | 87+736.490 | 100 | Right | Hilly | 45 | 50 |
| 140 | 87+831.004 | 87+917.095 | 75 | Left | Hilly | 30 | 40 |
| 141 | 87+986.898 | 88+042.436 | 75 | Right | Hilly | 30 | 40 |
| 142 | 88+120.162 | 88+127.838 | 150 | Right | Hilly | 30 | 50 |
| 143 | 88+265.583 | 88+297.418 | 75 | Right | Hilly | 60 | 40 |
| 144 | 88+395.492 | 88+454.599 | 150 | Left | Hilly | 30 | 50 |
| 145 | 88+533.458 | 88+590.413 | 200 | Left | Hilly | 35 | 50 |
| 146 | 88+727.788 | 88+786.106 | 75 | Right | Hilly | 30 | 40 |
| 147 | 88+843.927 | 88+874.289 | 300 | Left | Hilly | 20 | 50 |
| 148 | 89+026.296 | 89+093.427 | 100 | Left | Hilly | 45 | 50 |
| 149 | 89+237.102 | 89+278.776 | 125 | Right | Hilly | 50 | 65 |
| 150 | 89+394.911 | 89+401.480 | 150 | Left | Hilly | 40 | 65 |
| 151 | 89+561.326 | 89+699.407 | 100 | Left | Hilly | 20 | 40 |
| 152 | 89+892.427 | 90+021.462 | 500 | Right | Hilly | 0 | 50 |
| 153 | 90+320.860 | 90+395.077 | 200 | Right | Hilly | 35 | 50 |
| 154 | 90+677.013 | 90+947.181 | 500 | Right | Hilly | 0 | 50 |
| 155 | 91+158.602 | 91+276.162 | 125 | Right | Hilly | 35 | 50 |

| Curve No. | HORIZONTAL CURVE | | | | Terrain | Transition length | Speed (Kmph) |
|---|---|---|---|---|---|---|---|
| | Start Chainage | End Chainage | Radius | Direction | | | |
| 156 | 91+518.828 | 91+660.751 | 200 | Left | Hilly | 35 | 50 |
| 157 | 91+771.030 | 91+878.330 | 350 | Left | Hilly | 30 | 65 |
| 158 | 92+099.230 | 92+151.808 | 350 | Left | Hilly | 30 | 65 |
| 159 | 92+291.612 | 92+381.763 | 500 | Right | Hilly | 0 | 50 |
| 160 | 92+536.855 | 92+620.269 | 75 | Right | Hilly | 30 | 40 |
| 161 | 92+693.178 | 92+816.001 | 90 | Left | Hilly | 25 | 40 |
| 162 | 92+895.389 | 92+963.214 | 100 | Right | Hilly | 30 | 65 |
| 163 | 93+043.030 | 93+073.373 | 150 | Left | Hilly | 40 | 65 |
| 164 | 93+175.952 | 93+199.385 | 200 | Right | Hilly | 35 | 50 |
| 165 | 93+392.952 | 93+597.525 | 300 | Left | Hilly | 20 | 50 |
| 166 | 93+809.293 | 93+854.336 | 150 | Right | Hilly | 30 | 50 |
| 167 | 93+970.247 | 94+076.395 | 150 | Left | Hilly | 40 | 65 |
| 168 | 94+571.123 | 94+748.095 | 600 | Left | Hilly | 80 | 100 |
| 169 | 94+901.728 | 95+019.630 | 200 | Right | Hilly | 35 | 50 |
| 170 | 95+132.644 | 95+166.982 | 75 | Left | Hilly | 30 | 40 |
| 171 | 95+257.898 | 95+362.789 | 75 | Right | Hilly | 30 | 40 |
| 172 | 95+479.005 | 95+547.214 | 500 | Right | Hilly | 0 | 50 |
| 173 | 95+618.854 | 95+659.510 | 150 | Left | Hilly | 40 | 65 |
| 174 | 95+777.921 | 95+840.050 | 200 | Right | Hilly | 35 | 50 |
| 175 | 96+019.006 | 96+120.864 | 150 | Left | Hilly | 40 | 65 |
| 176 | 96+241.554 | 96+348.938 | 75 | Right | Hilly | 30 | 40 |
| 177 | 96+415.058 | 96+451.067 | 75 | Left | Hilly | 30 | 40 |
| 178 | 96+971.998 | 97+192.373 | 400 | Left | Plain | 55 | 80 |
| 179 | 97+747.431 | 98+106.372 | 1500 | Left | Plain | 35 | 100 |
| 180 | 98+609.883 | 98+680.150 | 1200 | Left | Plain | 40 | 100 |
| 181 | 99+400.635 | 99+624.023 | 1000 | Right | Plain | 50 | 100 |
| 182 | 99+825.601 | 99+976.861 | 800 | Left | Plain | 60 | 100 |
| 183 | 100+372.003 | 100+486.190 | 600 | Left | Plain | 80 | 100 |
| 184 | 100+696.743 | 100+765.041 | 500 | Right | Plain | 45 | 80 |
| 185 | 100+993.290 | 101+109.353 | 250 | Left | Plain | 90 | 80 |
| 186 | 101+294.629 | 101+991.041 | 500 | Right | Plain | 45 | 80 |
| 187 | 102+655.204 | 103+088.688 | 600 | Left | Plain | 80 | 100 |
| 188 | 103+907.173 | 104+235.258 | 500 | Right | Plain | 45 | 80 |
| 189 | 104+767.773 | 105+657.071 | 1800 | Left | Plain | 30 | 100 |
| 190 | 106+136.475 | 106+213.084 | 2000 | Right | Plain | 0 | 100 |
| 191 | 106+836.758 | 106+933.273 | 1200 | Right | Plain | 40 | 100 |
| 192 | 107+244.296 | 107+502.010 | 500 | Right | Plain | 95 | 100 |

**Table 0.11: Deviation in Horizontal curves**

| Curve No. | HORIZONTAL CURVE | | | | Terrain | Transition Length (m) | Speed (Kmph) | Reason of Deviation |
|---|---|---|---|---|---|---|---|---|
| | Start Chainage (Km) | End Chainage (Km) | Radius | Direction | | | | |
| Nil | | | | | | | | |

## 0.17 Vertical Design of Project road

Vertical design report is tabulated below.

**Table 0.12: Vertical Report**

| PVI No | PVI Design Chainage (km) | PVI Level (m) | Curve Length (m) | Gradient (%) IN | Gradient (%) OUT | Chainage (m) Start of Curve (km) | Chainage (m) End of Curve (km) | Level (m) Start of Curve (m) | Level (m) End of Curve (m) | Type Of Curve | K Value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 73+337.657 | 62.675 | 400 | 0.466 | -0.486 | 73+137.657 | 73+537.657 | 61.743 | 61.703 | Hog | 419.812 |
| 2 | 76+373.177 | 47.91 | 250 | -0.486 | 0.478 | 76+248.177 | 76+498.177 | 48.518 | 48.507 | Sag | 259.353 |
| 3 | 77+606.633 | 53.8 | 400 | 0.478 | -0.779 | 77+406.633 | 77+806.633 | 52.845 | 52.242 | Hog | 318.313 |
| 4 | 79+490.128 | 39.125 | 400 | -0.779 | 0.439 | 79+290.128 | 79+690.128 | 40.684 | 40.003 | Sag | 328.499 |
| 5 | 80+644.369 | 44.187 | 450 | 0.439 | -0.441 | 80+419.369 | 80+869.369 | 43.201 | 43.195 | Hog | 511.59 |
| 6 | 82+056.046 | 37.961 | 350 | -0.441 | 0.799 | 81+881.046 | 82+231.046 | 38.733 | 39.359 | Sag | 282.332 |
| 7 | 84+107.613 | 54.345 | 350 | 0.799 | -0.575 | 83+932.613 | 84+282.613 | 52.948 | 53.339 | Hog | 254.844 |
| 8 | 84+988.317 | 49.283 | 350 | -0.575 | 1.341 | 84+813.317 | 85+163.317 | 50.289 | 51.629 | Sag | 182.733 |
| 9 | 85+909.871 | 61.637 | 200 | 1.341 | 5.88 | 85+809.871 | 86+009.871 | 60.297 | 67.517 | Sag | 44.06 |
| 10 | 86+319.369 | 85.715 | 300 | 5.88 | 6.025 | 86+169.369 | 86+469.369 | 76.895 | 94.752 | Sag | 2067.061 |
| 11 | 87+813.623 | 175.743 | 600 | 6.025 | -5.709 | 87+513.623 | 88+113.623 | 157.668 | 158.617 | Hog | 51.135 |
| 12 | 88+727.282 | 123.584 | 150 | -5.709 | -1.519 | 88+652.282 | 88+802.282 | 127.866 | 122.445 | Sag | 35.802 |
| 13 | 89+347.267 | 114.166 | 300 | -1.519 | -1.665 | 89+197.267 | 89+497.267 | 116.445 | 111.669 | Hog | 2057.717 |
| 14 | 90+035.166 | 102.714 | 400 | -1.665 | -5.5 | 89+835.166 | 90+235.166 | 106.043 | 91.714 | Hog | 104.297 |
| 15 | 90+915.000 | 54.323 | 200 | -5.5 | 0 | 90+815.000 | 91+015.000 | 59.823 | 54.323 | Sag | 36.364 |
| 16 | 91+251.472 | 54.323 | 200 | 0 | 4.931 | 91+151.472 | 91+351.472 | 54.323 | 59.254 | Sag | 40.556 |
| 17 | 92+325.613 | 107.294 | 500 | 4.931 | -1.753 | 92+075.613 | 92+575.613 | 94.965 | 102.913 | Hog | 74.805 |
| 18 | 93+197.264 | 92.018 | 225 | -1.753 | -4.241 | 93+084.764 | 93+309.764 | 93.989 | 87.246 | Hog | 90.403 |
| 19 | 93+875.330 | 63.258 | 300 | -4.241 | 1.608 | 93+725.330 | 94+025.330 | 69.62 | 65.67 | Sag | 51.285 |
| 20 | 95+275.000 | 85.768 | 350 | 1.608 | -0.563 | 95+100.000 | 95+450.000 | 82.954 | 84.783 | Hog | 161.215 |
| 21 | 96+131.825 | 80.946 | 400 | -0.563 | -2.86 | 95+931.825 | 96+331.825 | 82.072 | 75.227 | Hog | 174.16 |
| 22 | 97+120.000 | 52.689 | 200 | -2.86 | -0.526 | 97+020.000 | 97+220.000 | 55.549 | 52.163 | Sag | 85.697 |
| 23 | 98+050.000 | 47.8 | 200 | -0.526 | -0.917 | 97+950.000 | 98+150.000 | 48.326 | 46.883 | Hog | 510.786 |
| 24 | 98+649.617 | 42.3 | 100 | -0.917 | -0.3 | 98+599.617 | 98+699.617 | 42.759 | 42.15 | Sag | 162.008 |

| PVI | PVI | | Curve Length (m) | Gradient (%) | | Chainage (m) | | Level (m) | | Type Of Curve | K Value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Design Chainage (km) | Level (m) | | IN | OUT | Start of Curve (km) | End of Curve (km) | Start of Curve (m) | End of Curve (m) | | |
| 25 | 99+100.000 | 40.949 | 100 | -0.3 | -0.573 | 99+050.000 | 99+150.000 | 41.099 | 40.662 | Hog | 366.199 |
| 26 | 99+807.058 | 36.897 | 200 | -0.573 | 2.893 | 99+707.058 | 99+907.058 | 37.47 | 39.79 | Sag | 57.695 |
| 27 | 100+300.000 | 51.16 | 425 | 2.893 | -0.156 | 100+087.500 | 100+512.500 | 45.011 | 50.828 | Hog | 139.37 |
| 28 | 101+245.870 | 49.684 | 500 | -0.156 | -1.168 | 100+995.870 | 101+495.870 | 50.074 | 46.764 | Hog | 494.038 |
| 29 | 102+141.338 | 39.225 | 200 | -1.168 | -0.585 | 102+041.338 | 102+241.338 | 40.393 | 38.64 | Sag | 343.012 |
| 30 | 104+000.000 | 28.352 | 100 | -0.585 | 0 | 103+950.000 | 104+050.000 | 28.644 | 28.352 | Sag | 170.944 |
| 31 | 104+228.145 | 28.352 | 100 | 0 | 1.655 | 104+178.145 | 104+278.145 | 28.352 | 29.18 | Sag | 60.408 |
| 32 | 104+920.000 | 39.805 | 500 | 1.655 | -1.651 | 104+670.000 | 105+170.000 | 35.666 | 35.677 | Hog | 151.207 |
| 33 | 105+910.000 | 23.457 | 300 | -1.651 | 2.302 | 105+760.000 | 106+060.000 | 25.934 | 26.91 | Sag | 75.887 |
| 34 | 106+615.797 | 39.704 | 600 | 2.302 | -2.125 | 106+315.797 | 106+915.797 | 32.798 | 33.329 | Hog | 135.534 |

## 0.18 Extra Width on Curves

| Sl. No. | HORIZONTAL CURVE | | | | | Terrain | Transition length (m) | Extra width (m) As per IRC SP 73-2018 | Surface Area | | Road Delineators | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Start Chainage (km) | End Chainage (km) | Length of curve (m) | Radius (m) | Direction | | | | Curve surface | Taper surface | Spacing | Numbers |
| 1 | 84830.857 | 85361.281 | 530.424 | 200 | Right | Hill | 35 | 0.6 | 318.25 | 21.00 | 20 | 27 |
| 2 | 85800.910 | 85811.444 | 10.534 | 200 | Right | Plain | 35 | 0.6 | 6.32 | 21.00 | 20 | 1 |
| 3 | 86049.301 | 86114.166 | 64.865 | 150 | Left | Plain | 30 | 0.6 | 38.92 | 18.00 | 12 | 6 |
| 4 | 86272.207 | 86321.325 | 49.118 | 75 | Left | Plain | 30 | 0.9 | 44.21 | 27.00 | 8 | 7 |
| 5 | 86381.780 | 86386.82 | 5.04 | 80 | Right | Plain | 25 | 0.9 | 4.54 | 22.50 | 8 | 1 |
| 6 | 86433.757 | 86448.204 | 14.447 | 200 | Left | Hill | 15 | 0.6 | 8.67 | 9.00 | 20 | 1 |
| 7 | 86502.033 | 86505.768 | 3.735 | 75 | Left | Hill | 30 | 0.9 | 3.36 | 27.00 | 8 | 1 |
| 8 | 86561.183 | 86644.89 | 83.707 | 200 | Left | Hill | 35 | 0.6 | 50.22 | 21.00 | 20 | 5 |
| 9 | 86743.483 | 86771.625 | 28.142 | 200 | Left | Hill | 35 | 0.6 | 16.89 | 21.00 | 20 | 2 |
| 10 | 86866.520 | 86890.811 | 24.291 | 150 | Right | Hill | 40 | 0.6 | 14.57 | 24.00 | 12 | 3 |
| 11 | 87192.019 | 87289.297 | 97.278 | 150 | Right | Hill | 40 | 0.6 | 58.37 | 24.00 | 12 | 9 |
| 12 | 87405.146 | 87493.885 | 88.739 | 75 | Left | Hill | 30 | 0.9 | 79.87 | 27.00 | 8 | 12 |
| 13 | 87581.591 | 87642.339 | 60.748 | 300 | Left | Hill | 20 | 0.6 | 36.45 | 12.00 | 25 | 3 |
| 14 | 87720.423 | 87751.663 | 31.24 | 100 | Right | Hill | 45 | 0.9 | 28.12 | 40.50 | 12 | 3 |
| 15 | 87846.177 | 87932.268 | 86.091 | 75 | Left | Hill | 30 | 0.9 | 77.48 | 27.00 | 8 | 11 |
| 16 | 88002.071 | 88057.61 | 55.539 | 75 | Right | Hill | 30 | 0.9 | 49.99 | 27.00 | 8 | 7 |
| 17 | 88135.336 | 88143.011 | 7.675 | 150 | Right | Hill | 30 | 0.6 | 4.61 | 18.00 | 12 | 1 |
| 18 | 88280.757 | 88312.591 | 31.834 | 75 | Right | Hill | 60 | 0.9 | 28.65 | 54.00 | 8 | 4 |

| Sl. No. | HORIZONTAL CURVE | | | | | Terrain | Transition length (m) | Extra width (m) As per IRC SP 73-2018 | Surface Area | | Road Delineators | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Start Chainage (km) | End Chainage (km) | Length of curve (m) | Radius (m) | Direction | | | | Curve surface | Taper surface | Spacing | Numbers |
| 19 | 88410.665 | 88469.772 | 59.107 | 150 | Left | Hill | 30 | 0.6 | 35.46 | 18.00 | 12 | 5 |
| 20 | 88548.631 | 88605.586 | 56.955 | 200 | Left | Hill | 35 | 0.6 | 34.17 | 21.00 | 20 | 3 |
| 21 | 88742.961 | 88801.28 | 58.319 | 75 | Right | Hill | 30 | 0.9 | 52.49 | 27.00 | 8 | 8 |
| 22 | 88859.100 | 88889.462 | 30.362 | 300 | Left | Hill | 20 | 0.6 | 18.22 | 12.00 | 25 | 2 |
| 23 | 89033.779 | 89100.91 | 67.131 | 100 | Left | Hill | 45 | 0.9 | 60.42 | 40.50 | 12 | 6 |
| 24 | 89244.585 | 89286.259 | 41.674 | 125 | Right | Hill | 50 | 0.6 | 25.00 | 30.00 | 12 | 4 |
| 25 | 89402.394 | 89408.963 | 6.569 | 150 | Left | Hill | 40 | 0.6 | 3.94 | 24.00 | 12 | 1 |
| 26 | 89568.809 | 89706.89 | 138.081 | 100 | Left | Hill | 20 | 0.9 | 124.27 | 18.00 | 12 | 12 |
| 27 | 90328.343 | 90402.56 | 74.217 | 200 | Right | Hill | 35 | 0.6 | 44.53 | 21.00 | 20 | 4 |
| 28 | 91166.085 | 91283.645 | 117.56 | 125 | Right | Hill | 35 | 0.6 | 70.54 | 21.00 | 12 | 10 |
| 29 | 91526.311 | 91668.234 | 141.923 | 200 | Left | Hill | 35 | 0.6 | 85.15 | 21.00 | 20 | 8 |
| 30 | 92544.339 | 92627.752 | 83.413 | 75 | Right | Hill | 30 | 0.9 | 75.07 | 27.00 | 8 | 11 |
| 31 | 92700.662 | 92823.485 | 122.823 | 90 | Left | Hill | 25 | 0.9 | 110.54 | 22.50 | 8 | 16 |
| 32 | 92902.872 | 92970.697 | 67.825 | 100 | Right | Hill | 30 | 0.9 | 61.04 | 27.00 | 12 | 6 |
| 33 | 93050.513 | 93080.857 | 30.344 | 150 | Left | Hill | 40 | 0.6 | 18.21 | 24.00 | 12 | 3 |
| 34 | 93183.435 | 93206.868 | 23.433 | 200 | Right | Hill | 35 | 0.6 | 14.06 | 21.00 | 20 | 2 |
| 35 | 93400.435 | 93605.009 | 204.574 | 300 | Left | Hill | 20 | 0.6 | 122.74 | 12.00 | 25 | 9 |
| 36 | 93815.886 | 93862.595 | 46.709 | 150 | Right | Hill | 30 | 0.6 | 28.03 | 18.00 | 12 | 4 |
| 37 | 93974.209 | 94087.864 | 113.655 | 150 | Left | Hill | 40 | 0.6 | 68.19 | 24.00 | 12 | 10 |
| 38 | 94921.843 | 95027.479 | 105.636 | 200 | Right | Hill | 35 | 0.6 | 63.38 | 21.00 | 20 | 6 |
| 39 | 95133.971 | 95168.993 | 35.022 | 75 | Left | Hill | 30 | 0.9 | 31.52 | 27.00 | 8 | 5 |
| 40 | 95259.492 | 95364.383 | 104.891 | 75 | Right | Hill | 30 | 0.9 | 94.40 | 27.00 | 8 | 14 |
| 41 | 95620.448 | 95661.104 | 40.656 | 150 | Left | Hill | 40 | 0.6 | 24.39 | 24.00 | 12 | 4 |
| 42 | 95779.515 | 95841.644 | 62.129 | 200 | Right | Hill | 35 | 0.6 | 37.28 | 21.00 | 20 | 4 |
| 43 | 96020.600 | 96122.458 | 101.858 | 150 | Left | Hill | 40 | 0.6 | 61.11 | 24.00 | 12 | 9 |
| 44 | 96243.148 | 96350.532 | 107.384 | 75 | Right | Hill | 30 | 0.9 | 96.65 | 27.00 | 8 | 14 |
| 45 | 96416.652 | 96452.661 | 36.009 | 75 | Left | Hill | 30 | 0.9 | 32.41 | 27.00 | 8 | 5 |
| 46 | 100994.884 | 101110.95 | 116.063 | 250 | Left | Hill | 90 | 0.6 | 69.64 | 54.00 | 20 | 6 |
| | | | | | | | | | 2432.33 | 1122.00 | | **295** |
| | | | | | | | | | **3554.33** | | | |

## 0.19 Sight Distance

**Table 0.14: Sight Distance**

| PVI | PVI | | Curve | Type of | K Value | Safe stopping Sight Distance | Speed |
|---|---|---|---|---|---|---|---|
| No. | Design Chainage (km) | Level (m) | Length | Curve | | | |
| 1 | 72585 | 56.495 | 200 | Sag | 164.857 | | |
| 2 | 73226 | 62.224 | 400 | Hog | 275.213 | 347.869 | |
| 3 | 74860 | 53.086 | 300 | Sag | 347.038 | | |
| 4 | 75606 | 55.364 | 300 | Hog | 219.814 | 311.089 | |
| 5 | 76273 | 48.295 | 250 | Sag | 176.648 | | |
| 6 | 77350 | 52.128 | 400 | Hog | 555.753 | 505.46 | |
| 7 | 78231 | 48.923 | 300 | Hog | 724.376 | 680.854 | |
| 8 | 79490 | 39.125 | 400 | Sag | 340.603 | | |
| 9 | 80644 | 43.7 | 450 | Hog | 488.228 | 463.53 | |
| 10 | 82190 | 35.58 | 350 | Sag | 235.165 | | |
| 11 | 84108 | 54.045 | 350 | Hog | 270.418 | 344.825 | |
| 12 | 84925 | 51.336 | 350 | Sag | 472.415 | | |
| 13 | 85893 | 55.299 | 200 | Sag | 37.162 | | |
| 14 | 87910 | 172.134 | 600 | Hog | 51.143 | 149.96 | |
| 15 | 88727 | 123.584 | 150 | Sag | 33.927 | | |
| 16 | 89347 | 114.166 | 200 | Hog | 161.844 | 277.909 | |
| 17 | 89815 | 101.276 | 300 | Sag | 188.52 | | |
| 18 | 90739 | 90.531 | 350 | Hog | 101.765 | 211.534 | |
| 19 | 91515 | 54.784 | 125 | Sag | 30.809 | | |
| 20 | 91703 | 53.763 | 150 | Sag | 22.991 | | |
| 21 | 92608 | 107.9 | 250 | Hog | 46.359 | 142.774 | |
| 22 | 93483 | 113.026 | 350 | Hog | 66.25 | 170.677 | |
| 23 | 94659 | 57.787 | 400 | Sag | 52.823 | | |
| 24 | 95752 | 89.228 | 400 | Hog | 101.528 | 211.288 | |
| 25 | 96829 | 77.771 | 500 | Hog | 186.016 | 285.994 | |
| 26 | 97598 | 48.904 | 200 | Sag | 48.739 | | |
| 27 | 98122 | 50.747 | 200 | Hog | 142.724 | 256.891 | |
| 28 | 98725 | 44.417 | 200 | Sag | 285.804 | | |
| 29 | 99630 | 41.25 | 250 | Sag | 224.674 | | |
| 30 | 100456 | 47.547 | 300 | Hog | 757.298 | 704.981 | |
| 31 | 101248 | 50.451 | 300 | Hog | 369.336 | 420.665 | |
| 32 | 101795 | 48.011 | 300 | Hog | 410.039 | 450.494 | |
| 33 | 102960 | 34.298 | 250 | Sag | 306.826 | | |
| 34 | 104792 | 27.656 | 300 | Sag | 114.872 | | |
| 35 | 105470 | 42.903 | 600 | Hog | 146.042 | 253.407 | |
| 36 | 106460 | 24.496 | 200 | Sag | 54.714 | | |
| 37 | 107210 | 37.966 | 550 | Hog | 139.983 | 248.095 | |

## 0.20 Road Junctions/ Intersections

The details of cross roads/ junction development is as under -

**Table 0.15: Improvement proposal at the intersection**

| Sl. No. | Section | Existing Junctions | Proposals |
|---|---|---|---|
| 1 | Section III km 72.0 to km 107.654 | 104 (1 Major & 103 Minor junctions) | 86 (1major & 85 minor intersection) coming in project alignment shall be improved. |

## 0.21 Railway Track& Proposals

No any Railway track exists on this Project road.

## 0.22 Cross Drainage Works

### 0.22.1 Bridges

- **32 bridges** exist on project alignment including one bridge between km 127.319 & km 128.559.
- 4 existing bridges are proposed to reconstruction.
- 1 box culvert proposed to construct as minor bridge (at km 76+600)
- 1 bridge proposed to widen upto 18m, (at km 127.469, between khowai chowmuhani & South pulinpur)
- 27existing bridges are retained due to realignment.
- 42 additional new bridges (1major & 41 minor including bridge at km 76+600) are proposed on the realignment and bypass.

Details of existing bridges & the proposal of new bridges are tabulated below –

**Table 0.16: Major Bridge (Existing)**

| Sl. No. | Survey Chainage (km) | Type of Structure | | | No. of Spans with span length (m) | Width (m) |
|---|---|---|---|---|---|---|
| | | Foundation | Sub-Structure | Super structure | | |
| Nil | | | | | | |

**Table 0.17: Major Bridge (Re-construction)**

| Sl. No. | Chainage (km) | Type of Structure | | | No. of Spans with span length (m) | Width (m) |
|---|---|---|---|---|---|---|
| | | Foundation | Sub-Structure | Super structure | | |
| Nil | | | | | | |

**Table 0.18: Major Bridge (New-construction)**

| Sl. No. | Chainage (km) | Type of Structure | | | No. of Spans with span length (m) | Width (m) |
|---|---|---|---|---|---|---|
| | | Foundation | Sub-Structure | Super structure | | |
| Nil | | | | | | |

**Table 0.19: Minor Bridge (Existing)**

| Sl. No. | Survey Chainage (km) | Type of Structure | | | No. of Spans with span length (m) | Width (m) |
|---|---|---|---|---|---|---|
| | | Foundation | Sub-Structure | Super structure | | |
| 1 | 87+370 | CONCRETE BRIDGE | | | 9 | 5.2 |
| 2 | 91+500 | OLD WOODEN BRIDGE | | | 30 | 3 |
| 3 | 95+150 | CONCRETE BRIDGE | | | 31 | 7.5 |
| 4 | 96+520 | CONCRETE BRIDGE | | | 5.8+5.8 = 11.6 | 7.4 |
| 5 | 113+350 | CONCRETE BRIDGE | | | 6.9+6.9+7.1 = 20.9 | 7.5 |
| 6 | 120+860 | CONCRETE BRIDGE | | | 4+4+4 = 12 | 7.2 |
| 7 | 124+050 | CONCRETE BRIDGE | | | 24 | 7.5 |
| 8 | 129+000 | CONCRETE BRIDGE | | | 6.0 | 7.5 |

**Table 0.20: Proposal of Minor Bridges (Re-construction)**

| Sl. No. | Chainage (km) | Type of Structure | | | No. of Spans with span length (m) | Width (m) |
|---|---|---|---|---|---|---|
| | | Foundation | Sub-Structure | Super structure | | |
| 1 | 73+600 | RCC BOX | | | 2x8 | 18m |

**Table 0.21: Proposal of Minor Bridges (New Construction)**

| Sl. No. | Chainage (km) | Type of Structure | | | No. of Spans with span length (m) | Width (m) |
|---|---|---|---|---|---|---|
| | | Foundation | Sub-Structure | Super structure | | |
| 1 | 72+400 | RCC BOX | | | 1x10 | 18m |
| 2 | 76+600 | RCC Box | | | 2x11.5 | 18m |
| 3 | 77+000 | RCC BOX | | | 2x8 | 18m |
| 4 | 80+270 | RCC BOX | | | 3x9 | 18m |
| 5 | 83+400 | RCC BOX | | | 2x7.5 | 18m |
| 6 | 85+270 | RCC BOX | | | 1x10 | 18m |
| 7 | 85+445 | RCC BOX | | | 1x12.5 | 18m |
| 8 | 85+725 | RCC BOX | | | 1x10 | 18m |
| 9 | 91+100 | PSC Girder | | | 2x25.35 | 18m |
| 10 | 97+715 | RCC Girder | | | 2x22.7 | 18m |
| 11 | 97+885 | RCC Girder | | | 1x20 | 18m |
| 12 | 98+800 | RCC Girder | | | 2x22.7 | 18m |
| 13 | 98+960 | RCC BOX | | | 2x11.33 | 18m |
| 14 | 104+080 | PSC Girder | | | 1x25.35 | 18m |

Tapper width @ 1:15m shall be adopted to match the road width with CD structure width.

### 0.22.2 Culverts

Total 106 culverts exist on Project alignment in which -

- 20 culverts are proposed for reconstruction.
- 86 culverts are retained due to proposal of realignments/bypasses.
- 88 new culverts are proposed in entire length as balancing culverts.

**Table 0.22 – Proposal of Existing Culverts**

| Existing Detail | | | | | | New Proposal | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Existing Chainage (Km) | Type of Structure (Pipe/Slab /Box /Arch) | Span Arrangement | | C'way Width (m) | Design Chainage (Km) | Proposal | Type | Size(m) |
| | | | No | Vent Width (m) (Clear) | | | | | |
| 1 | 85+785 | PIPE | 3 | 0.3 | 3.2 | - | Retained due to Realignment/Bypass | | |
| 2 | 85+930 | BOX | 1 | 1.7 | 3.5 | - | Retained due to Realignment/Bypass | | |
| 3 | 86+200 | BOX | 1 | 1.5 | 3.4 | - | Retained due to Realignment/Bypass | | |
| 4 | 86+385 | BOX | 1 | 1.4 | 3.2 | 72+655 | Reconstruction | Box Culvert | 1x2x2m |
| 5 | 86+725 | BOX | 1 | 1.4 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 6 | 86+900 | BOX | 1 | 1.5 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 7 | 87+070 | PIPE | 1 | 1 | 3.3 | - | Retained due to Realignment/Bypass | | |
| 8 | 87+210 | BOX | 1 | 1.6 | 3.5 | 73+450 | Reconstruction | Box Culvert | 1x2x2m |
| 9 | 87+260 | PIPE | 1 | 1 | 3.2 | 73+500 | Reconstruction | Box Culvert | 1x2x2m |
| 10 | 87+460 | SLAB | 1 | 1.3 | 3.2 | 73+690 | Reconstruction | Box Culvert | 1x5x4m |
| 11 | 87+550 | SLAB | 1 | 0.6 | 3.4 | - | Retained due to Realignment/Bypass | | |
| 12 | 87+940 | BOX | 1 | 1.2 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 13 | 88+130 | BOX | 1 | 1.2 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 14 | 88+480 | SLAB | 1 | 0.6 | 3.2 | - | Retained due to Realignment/Bypass | | |
| 15 | 88+950 | BOX | 1 | 1.3 | 3.4 | - | Retained due to Realignment/Bypass | | |
| 16 | 89+130 | SLAB | 1 | | 4.5 | - | Retained due to Realignment/Bypass | | |
| 17 | 90+250 | BOX | 1 | 0.9 | 3.4 | 76+210 | Reconstruction | Box Culvert | 1x2x2m |
| 18 | 90+600 | SLAB | 1 | 6 | 4 | - | Retained due to Realignment/Bypass | | |
| 19 | 90+680 | BOX | 1 | 0.8 | 3.2 | - | Retained due to Realignment/Bypass | | |
| 20 | 90+900 | BOX | 1 | 0.8 | 3.8 | 76+800 | Reconstruction | Box Culvert | 1x2x2m |
| 21 | 91+190 | BOX | 1 | 0.8 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 22 | 91+325 | BOX | 1 | 1.4 | 4.1 | - | Retained due to Realignment/Bypass | | |
| 23 | 91+590 | SLAB | 1 | 3.2 | 3.9 | - | Retained due to Realignment/Bypass | | |
| 24 | 91+670 | BOX | 1 | 0.7 | 3.5 | - | Retained due to Realignment/Bypass | | |
| 25 | 91+770 | SLAB | 1 | 1 | 3.9 | - | Retained due to Realignment/Bypass | | |

| Existing Detail | | | | | | New Proposal | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Existing Chainage (Km) | Type of Structure (Pipe/Slab /Box /Arch) | Span Arrangement | | C'way Width (m) | Design Chainage (Km) | Proposal | Type | Size(m) |
| | | | No | Vent Width (m) (Clear) | | | | | |
| 26 | 91+970 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 27 | 92+120 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 28 | 92+310 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 29 | 92+430 | BOX | 1 | 0.8 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 30 | 93+810 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 31 | 94+025 | BOX | 1 | 0.8 | 3.5 | - | Retained due to Realignment/Bypass | | |
| 32 | 94+290 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 33 | 94+420 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 34 | 94+640 | BOX | 1 | 1.8 | 4 | - | Retained due to Realignment/Bypass | | |
| 35 | 94+760 | BOX | 1 | 0.8 | 3.4 | 79+710 | Reconstruction | Box Culvert | 1x2x2m |
| 36 | 94+890 | BOX | 1 | 0.8 | 4 | - | Retained due to Realignment/Bypass | | |
| 37 | 95+890 | BOX | 2 | 3.4 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 38 | 96+650 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 39 | 96+970 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 40 | 97+790 | BOX | 2 | 2 | 3.9 | - | Retained due to Realignment/Bypass | | |
| 41 | 97+840 | SLAB | 1 | 5.7 | 4 | - | Retained due to Realignment/Bypass | | |
| 42 | 98+210 | BOX | 1 | 1.7 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 43 | 98+330 | BOX | 1 | 1.8 | 3.7 | 82+700 | Reconstruction | Box Culvert | 1x2x2m |
| 44 | 98+630 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 45 | 98+750 | BOX | 2 | 3.7 | 3.7 | 83+100 | Reconstruction | Box Culvert | 1x3x4m |
| 46 | 98+870 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 47 | 98+930 | BOX | 1 | 0.8 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 48 | 100+730 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 49 | 100+835 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 50 | 101+970 | SLAB | 1 | 5.9 | 3.9 | - | Retained due to Realignment/Bypass | | |
| 51 | 102+100 | BOX | 1 | 1.4 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 52 | 103+575 | BOX | 2 | 3.4 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 53 | 104+320 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |

| Existing Detail | | | | | | New Proposal | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Existing Chainage (Km) | Type of Structure (Pipe/Slab /Box /Arch) | Span Arrangement | | C'way Width (m) | Design Chainage (Km) | Proposal | Type | Size(m) |
| | | | No | Vent Width (m) (Clear) | | | | | |
| 54 | 104+500 | BOX | 2 | 5.6 | 3.5 | - | Retained due to Realignment/Bypass | | |
| 55 | 104+530 | BOX | 1 | 1 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 56 | 104+650 | SLAB | 1 | 2.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 57 | 104+830 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 58 | 105+050 | BOX | 1 | 0.8 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 59 | 105+320 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 60 | 105+390 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 61 | 105+460 | BOX | 1 | 0.8 | 3.9 | 85+610 | Reconstruction | Pipe Culvert | 1x1.2m |
| 62 | 105+790 | BOX | 1 | 0.8 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 63 | 105+950 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 64 | 106+080 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 65 | 106+185 | BOX | 1 | 5 | 3.5 | - | Retained due to Realignment/Bypass | | |
| 66 | 106+330 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 67 | 106+800 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 68 | 107+225 | BOX | 1 | 0.8 | 3.7 | 86+860 | Reconstruction | Pipe Culvert | 1x1.2m |
| 69 | 107+440 | BOX | 1 | 0.8 | 3.6 | 87+030 | Reconstruction | Box Culvert | 1x3x3m |
| 70 | 108+400 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 71 | 109+075 | BOX | 1 | 1.6 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 72 | 109+550 | BOX | 1 | 0.8 | 3.9 | 88+765 | Reconstruction | Box Culvert | 1x2x2m |
| 73 | 110+180 | BOX | 1 | 0.8 | 3.6 | 89+130 | Reconstruction | Box Culvert | 1x2x2m |
| 74 | 110+430 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 75 | 110+730 | BOX | 1 | 0.8 | 3.7 | 89+385 | Reconstruction | Box Culvert | 1x3x4m |
| 76 | 111+000 | BOX | 1 | 0.8 | 3.5 | - | Retained due to Realignment/Bypass | | |
| 77 | 111+210 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 78 | 111+910 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 79 | 111+930 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |

| Existing Detail | | | | | | New Proposal | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Existing Chainage (Km) | Type of Structure (Pipe/Slab /Box /Arch) | Span Arrangement | | C'way Width (m) | Design Chainage (Km) | Proposal | Type | Size(m) |
| | | | No | Vent Width (m) (Clear) | | | | | |
| 80 | 112+060 | BOX | 1 | 0.8 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 81 | 112+225 | SLAB | 1 | 0.5 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 82 | 112+470 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 83 | 112+750 | BOX | 1 | 0.8 | 3.9 | - | Retained due to Realignment/Bypass | | |
| 84 | 112+910 | BOX | 1 | 1.7 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 85 | 112+970 | BOX | 1 | 1.2 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 86 | 113+150 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 87 | 113+960 | BOX | 1 | 0.8 | 3.5 | 91+600 | Reconstruction | Box Culvert | 1x2x2m |
| 88 | 114+100 | BOX | 1 | 0.8 | 3.7 | 91+730 | Reconstruction | Box Culvert | 1x2x2m |
| 89 | 115+450 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 90 | 115+610 | BOX | 1 | 0.8 | 3.6 | 93+100 | Reconstruction | Box Culvert | 1x2x2m |
| 91 | 115+860 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 92 | 116+870 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 93 | 116+980 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 94 | 117+135 | BOX | 1 | 0.8 | 3.8 | 94+240 | Reconstruction | Box Culvert | 1x2x2m |
| 95 | 118+250 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 96 | 120+200 | BOX | 1 | 1.7 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 97 | 120+950 | BOX | 1 | 1.7 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 98 | 121+700 | BOX | 1 | 0.8 | 4 | - | Retained due to Realignment/Bypass | | |
| 99 | 122+260 | BOX | 1 | | 3.8 | - | Retained due to Realignment/Bypass | | |
| 100 | 122+560 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 101 | 124+270 | BOX | 1 | 0.8 | 3.8 | - | Retained due to Realignment/Bypass | | |
| 102 | 125+230 | BOX | 1 | 0.8 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 103 | 126+035 | SLAB | 1 | 1 | 3.8 | 101+620 | Reconstruction | Box Culvert | 1x2x2m |
| 104 | 127+150 | SLAB | 1 | 1 | 3.6 | - | Retained due to Realignment/Bypass | | |
| 105 | 127+270 | SLAB | 1 | 1 | 3.7 | - | Retained due to Realignment/Bypass | | |
| 106 | 130+980 | BOX | 1 | 2.7 | 3.8 | - | Retained due to Realignment/Bypass | | |

## Culverts (Reconstruction)

**Table 0.23 – Proposal of Existing Culverts (Reconstruction)**
**Details have been shown in table 0.22**

## Additional Culverts

**Table 0.24 – Proposal of additional culverts**

| Sl. No. | Design Chainage (Km) | Type of Culvert | Span / Opening with span length (m) | Width (m) |
|---|---|---|---|---|
| 1 | 72+000 | Box Culvert | 1x2x2 | 12m |
| 2 | 72+260 | Box Culvert | 1x2x3 | 12m |
| 3 | 73+000 | Pipe Culvert | 1x1.2 | 20m |
| 4 | 73+160 | Pipe Culvert | 1x1.2 | 12.5m |
| 5 | 73+870 | Box Culvert | 1x2x2 | 12m |
| 6 | 74+135 | Pipe Culvert | 1x1.2 | 25m |
| 7 | 74+360 | Box Culvert | 1x2x2 | 12m |
| 8 | 74+650 | Pipe Culvert | 1x1.2 | 20m |
| 9 | 74+900 | Pipe Culvert | 1x1.2 | 12.5m |
| 10 | 75+240 | Box Culvert | 1x5x4 | 12m |
| 11 | 75+540 | Box Culvert | 1x2x2 | 12m |
| 12 | 75+840 | Box Culvert | 1x2x2 | 12m |
| 13 | 77+240 | Box Culvert | 1x5x4 | 12m |
| 14 | 77+535 | Box Culvert | 1x3x4 | 12m |
| 15 | 77+800 | Box Culvert | 1x4x4 | 12m |
| 16 | 78+240 | Pipe Culvert | 1x1.2 | 30m |
| 17 | 78+540 | Box Culvert | 1x5x4 | 12m |
| 18 | 78+970 | Pipe Culvert | 1x1.2 | 27.5m |
| 19 | 79+100 | Box Culvert | 1x4x4 | 12m |
| 20 | 79+340 | Box Culvert | 1x4x3 | 12m |
| 21 | 79+850 | Box Culvert | 1x2x3 | 12m |
| 22 | 80+605 | Box Culvert | 1x6x3 | 12m |
| 23 | 80+910 | Box Culvert | 1x5x4 | 12m |
| 24 | 81+380 | Box Culvert | 1x6x3 | 12m |
| 25 | 82+035 | Box Culvert | 1x2x2 | 12m |
| 26 | 82+200 | Box Culvert | 1x4x4 | 12m |
| 27 | 82+590 | Box Culvert | 1x2x2 | 12m |
| 28 | 82+960 | Box Culvert | 1x5x3 | 12m |
| 29 | 83+700 | Box Culvert | 1x5x3 | 12m |
| 30 | 83+740 | Pipe Culvert | 1x1.2 | 12.5m |

| Sl. No. | Design Chainage (Km) | Type of Culvert | Span / Opening with span length (m) | Width (m) |
|---|---|---|---|---|
| 31 | 84+240 | Box Culvert | 1x2x2 | 12m |
| 32 | 84+540 | Box Culvert | 1x2x2 | 12m |
| 33 | 85+120 | Box Culvert | 1x2x2 | 12m |
| 34 | 85+530 | Pipe Culvert | 1x1.2 | 17.5m |
| 35 | 85+810 | Pipe Culvert | 1x1.2 | 12.5m |
| 36 | 86+060 | Pipe Culvert | 1x1.2 | 12.5m |
| 37 | 86+270 | Box Culvert | 1x2x2 | 12m |
| 38 | 86+525 | Box Culvert | 1x3x3 | 12m |
| 39 | 86+710 | Box Culvert | 1x2x2 | 12m |
| 40 | 87+430 | Box Culvert | 1x2x2 | 12m |
| 41 | 87+830 | Box Culvert | 1x2x2 | 12m |
| 42 | 88+400 | Box Culvert | 1x2x2 | 12m |
| 43 | 89+285 | Pipe Culvert | 1x1.2 | 17.5m |
| 44 | 89+575 | Box Culvert | 1x2x3 | 12m |
| 45 | 90+185 | Box Culvert | 1x2x2 | 12m |
| 46 | 90+315 | Pipe Culvert | 1x1.2 | 12.5m |
| 47 | 90+650 | Pipe Culvert | 1x1.2 | 12.5m |
| 48 | 91+250 | Pipe Culvert | 1x1.2 | 12.5m |
| 49 | 92+215 | Box Culvert | 1x2x2 | 12m |
| 50 | 92+520 | Box Culvert | 1x2x2 | 12m |
| 51 | 92+930 | Pipe Culvert | 1x1.2 | 12.5m |
| 52 | 93+290 | Pipe Culvert | 1x1.2 | 30m |
| 53 | 93+830 | Box Culvert | 1x2x3 | 12m |
| 54 | 94+000 | Box Culvert | 1x4x5 | 12m |
| 55 | 94+130 | Pipe Culvert | 1x1.2 | 12.5m |
| 56 | 94+610 | Box Culvert | 1x2x2 | 12m |
| 57 | 95+285 | Pipe Culvert | 1x1.2 | 12.5m |
| 58 | 95+560 | Box Culvert | 1x2x2 | 12m |
| 59 | 95+970 | Box Culvert | 1x2x2 | 12m |
| 60 | 96+240 | Box Culvert | 1x2x2 | 12m |
| 61 | 96+490 | Box Culvert | 1x2x3 | 12m |
| 62 | 96+850 | Box Culvert | 1x2x2 | 12m |
| 63 | 97+140 | Box Culvert | 1x2x2 | 12m |
| 64 | 97+490 | Box Culvert | 1x2x2 | 12m |
| 65 | 97+990 | Pipe Culvert | 1x1.2 | 27.5m |
| 66 | 98+170 | Pipe Culvert | 1x1.2 | 22.5m |
| 67 | 98+490 | Box Culvert | 1x2x3 | 12m |

| Sl. No. | Design Chainage (Km) | Type of Culvert | Span / Opening with span length (m) | Width (m) |
|---|---|---|---|---|
| 68 | 99+155 | Box Culvert | 1x4x5 | 12m |
| 69 | 99+620 | Box Culvert | 1x3x4 | 12m |
| 70 | 99+845 | Box Culvert | 1x4x4 | 12m |
| 71 | 100+310 | Pipe Culvert | 1x1.2 | 12.5m |
| 72 | 100+850 | Box Culvert | 1x2x2 | 12m |
| 73 | 101+190 | Box Culvert | 1x2x2 | 12m |
| 74 | 101+890 | Box Culvert | 1x2x2 | 12m |
| 75 | 102+240 | Pipe Culvert | 1x1.2 | 30m |
| 76 | 102+690 | Pipe Culvert | 1x1.2 | 25m |
| 77 | 103+090 | Pipe Culvert | 1x1.2 | 25m |
| 78 | 103+580 | Box Culvert | 1x2x2 | 12m |
| 79 | 103+840 | Box Culvert | 1x2x2 | 12m |
| 80 | 104+265 | Pipe Culvert | 1x1.2 | 12.5m |
| 81 | 104+690 | Box Culvert | 1x2x2 | 12m |
| 82 | 105+190 | Box Culvert | 1x3x4 | 12m |
| 83 | 105+890 | Box Culvert | 1x4x4 | 12m |
| 84 | 106+190 | Box Culvert | 1x4x5 | 12m |
| 85 | 106+490 | Box Culvert | 1x2x2 | 12m |
| 86 | 106+790 | Pipe Culvert | 1x1.2 | 15m |
| 87 | 107+090 | Pipe Culvert | 1x1.2 | 12.5m |
| 88 | 107+390 | Pipe Culvert | 1x1.2 | 20m |

## 0.23 Bus Lay Byes

6 (3 x 2) Bus bays are proposed on both side of Project road.
The locations are–

**Table 0.25- Proposed Bus Bays**

| Sl. No. | Design Chainage (Km) | | Remarks |
|---|---|---|---|
| | LHS | RHS | |
| 1 | 76.885 | 75.960 | |
| 2 | 82.840 | 83.210 | |
| 3 | 103.280 | 103.470 | |

## 0.24 Truck Lay Bye

- No Truck lay bye exist/Proposed along the Project road,

## 0.25 Religious Structures

5 religious structures exist along the project road and their details are presented in table below-

**Table 0.27: Religious Structures**

| Sl. No. | Design Chainage (km) | Existing Chainage (km) | Side | Type | Remarks |
|---|---|---|---|---|---|
| 1 | 73+880 | - | LHS | Temple | Refer Design Chainage |
| 2 | 78+650 | 93+470 | LHS | Temple | Refer Existing Chainage |
| 3 | 98+320 | - | LHS | Temple | Refer Design Chainage |
| 4 | 106+650 | 131+830 | RHS | Temple | Refer Existing Chainage |
| 5 | 107+500 | 132+700 | BHS | Temple | Refer Existing Chainage |

## 0.26 School Details

4 School exist along the project road and details are presented in table below:

**Table 0.28: School Details**

| Sl. No. | Design Chainage (km) | Existing Chainage (km) | Side | Type | Remarks |
|---|---|---|---|---|---|
| 1 | 76+040 | 90+050 | LHS | School | Refer Existing Chainage |
| 2 | 83+450 | - | LHS | School | Refer Design Chainage |
| 3 | 89+330 | 110+450 | LHS | School | Refer Existing Chainage |
| 4 | 104+870 | | RHS | School | Refer Design Chainage |

## 0.26 Pond Location

28 ponds exist along the project road and details are presented in table below:

**Table 0.29: Pond Locations**

| Sl. No. | Design Chainage (Km) | Side | Remarks |
|---|---|---|---|
| 1 | 73+000 | BHS | |
| 2 | 73+700 | BHS | |
| 3 | 77+800 | BHS | |
| 4 | 77+850 | BHS | |
| 5 | 78+300 | BHS | |
| 6 | 78+340 | BHS | |
| 7 | 78+400 | BHS | |
| 8 | 79+100 | BHS | |
| 9 | 80+680 | BHS | |
| 10 | 80+900 | BHS | |
| 11 | 81+100 | BHS | |
| 12 | 82+450 | LHS | |
| 13 | 97+400 | RHS | |
| 14 | 97+950 | BHS | |
| 15 | 98+100 | BHS | |
| 16 | 100+800 | BHS | |
| 17 | 101+600 | RHS | |
| 18 | 102+300 | BHS | |
| 19 | 102+980 | RHS | |
| 20 | 103+100 | LHS | |
| 21 | 103+490 | RHS | |
| 22 | 104+750 | LHS | |
| 23 | 105+430 | BHS | |
| 24 | 105+950 | BHS | |
| 25 | 106+150 | RHS | |
| 26 | 106+300 | BHS | |
| 27 | 107+550 | BHS | |
| 28 | 107+620 | RHS | |

Retaining wall with sad filling is proposed on above locations to protect seepage in embankment.

## 0.27 Toll Plaza

No toll plaza is exist and proposed.

## 0.28 Submergence Details

The existing road found submergence at some locations, although realignments are proposed in maximum length for betterment of its geometry and a minimum height of 2.5m is considered of embankment to keep away from submergence.

## 0.29 Proposed Bypasses & Realignments

### 0.29.1 Bypasses

No bypass is proposed in this section of Project length.

### 0.29.2 Realignments

The details of realignments are:

**Table 0.31: Details of Realignments**

| Sl. No | Existing Chainage (Km) | | | Design Chainage (Km) | | | Remarks |
|---|---|---|---|---|---|---|---|
| | From | To | Length | From | To | Length | |
| 1 | - | - | - | 72000 | 75600 | 3.60 | |
| 2 | 89850 | 113850 | 24.00 | 75840 | 91480 | 15.64 | |
| 3 | 114270 | 119000 | 4.73 | 91890 | 95900 | 4.01 | |
| 4 | 119400 | 124800 | 5.40 | 96280 | 100430 | 4.15 | |
| 5 | 125150 | 125475 | 0.33 | 100760 | 101050 | 0.29 | |
| 6 | 125875 | 128475 | 2.60 | 101460 | 103650 | 2.19 | |
| 7 | 128675 | 131650 | 2.98 | 103850 | 106470 | 2.62 | |
| 8 | 132075 | 132882 | 0.81 | 106900 | 107654 | 0.75 | |
| | | | | | | | |

## 0.30 Protection Works

Protection works like Retaining walls, Breast Walls, W-Beam crash barrier are provided at different locations as per site requirement, the details of protection works with their details are presented below:-

**a) Breast walls –**

**Table 0.32**

| Sl. No. | Description | LHS (m) | RHS (m) | Section |
|---|---|---|---|---|
| 1 | Breast Wall 1m height | 1320 | 1467 | Km 72+0 to km 108+0 |
| 2 | Breast Wall 2m height | 1894 | 2107 | |
| 3 | Breast Wall 3m height | 1493 | 1658 | |
| 4 | Breast Wall 4m height | 1034 | 1147 | |
| | **Total** | **5741** | **6379** | |

**The chainage wise details of Breast wall is presented in Vol. 8:: Bill of Quantity**

b) **Retaining Wall** - Retaining wall is proposed for length given below:

**Table 0.33**

| Sl. No. | Description | Km 72.0 to km 108.0 |
|---|---|---|
| 1 | Retaining wall 1.5m height | 2852 |
| 2 | Retaining wall 3.0m height | 1908 |
| 3 | Retaining wall 1.5m height in Pond areas (minimum) | 925 |
| | **Total** | **5685** |

c) **W-Beam crash Barrier**- W- Beam crash barrier is proposed in **18380m** length (Where height of embankment is more than 3.0m), The chainage wise detail of W-Beam crash barrier is presented in Vol. 8:: Bill of Quantity.

d) **RCC Drain** - Nil

e) **PCC Drain** - PCC drain is provided in **18600m** length. The chainage wise detail of PCC drain is presented in Vol. 8:: Bill of Quantity.

f) **Unlined surface drain** – Unlined surface drain is provided in **27.028km** length.

g) **Providing PC** on embankment slope at bridge approaches (15 bridges)

**h) SLOPE PREOTECTION WORKS - From km 90+240 to km 90+960 & km 91+440 to km 92+100, protection works proposed by providing Geogrid with nail stabilization for high cut slopes. The detail cross section is attached with drawing volume.**

**The Details of above all protection works has been provided in Vol.8:: Bill of Quantity.**

## 0.31 Road Side furniture

Road side furniture shall be provided in accordance with Section 11 of the Manual of Specification and Standards for Two Laning of Highways through EPC.

## 0.32 Landscaping and Tree Plantation

Landscaping and tree plantation shall be provided in accordance with Section 12 of the Manual of specification and Standards for Two Laning of Highways through EPC.

## 0.33 Highways Lighting

Street lighting shall be provided in accordance with para 13.3 of Section 13 of the Manual of Specification and Standards for Two Laning of Highways through EPC.

## 0.34 Safety

Keeping view of these all features, a proper safety precautions are recommended on roadway width, the safety items to be provided are –

i) W Beam Crash Barrier/ Concrete Crash Barrier on either side of carriageway,
ii) Pavement Marking on Centre and edges lines,
iii) Provide adequate warning of hazards,
iv) Providing Bio-turfing for Slope protection,

## 0.35 Utilities

Utilities shifting estimates have been obtained from concerned departments, the details of amount received from departments is as under –

| SI NO. | Package | Chainage | | DWS Amount | WRD Amount | TSECL Amount | Total Amount |
|---|---|---|---|---|---|---|---|
| | | From | To | | | | |
| 1 | Package 5 | 72+000 | 90+000 | 12051903 | 631297 | 26955150 | 39638350 |
| 2 | Package 6 | 90+000 | 107+654 | 19218780 | 0 | 19905302 | 39124082 |
| | Junctions | | | 4690602 | 94695 | 7029068 | 31983182.4 |
| | | | | **35961285** | **725992** | **53889520** | **78762432** |
| **Grand Total** | | | | | | | **78762432** |

## 0.36 Land Acquisition

Approximate Rs 171.000 Cr considered for land acquisition of package 4 as per average circle rate.

## 0.37 Forest Clearance

Approximate Rs 45.000 Cr considered for Forest clearance of package 4.

## 0.38 Resettlement and Rehabilitation (R & R) Policy

The Ministry of Rural Development (Department of Land resources) has prepared the National Policy on Resettlement and Rehabilitation for the people who will be affected by the project. The policy describes the principle and approach to minimize and mitigate the negative social and economic impacts caused by the project. The R & R policy broadly addresses all issues such as compensation, assistance, replacement value, vulnerable group, etc. The policy ensures that people affected by project must be able to restore their livelihood to the pre project level.