

# **Executive Summary of Detailed Project Report for a Highway from Setpyitpyin (Kaletwa) to India – Myanmar Border in Myanmar**

## **0.1 General**

Under the bilateral agreement between Government of India and Government of Myanmar, there is a proposal to develop a trade route between the two countries along the river Kaladan known as “Chhimtuipui” river inside Indian border (Mizoram State). River Kaladan (Chhimtuipui) emanates from central Mizoram and empties into Bay of Bengal at Sittwe, a port located in the State of Rakhine, Myanmar.

The Feasibility study, carried out in 1999-2000, brought out that river Kaladan is navigable from its confluence point with the Bay of Bengal near Sittwe, up to Setpyitpyin (Kaletwa) on its north. Beyond Kaletwa, towards India border, the river is not navigable owing to shallow water depth and frequent rapids. Transport by road is, therefore, proposed for this stretch. The proposed road link from Kaletwa in Myanmar to Lawngtlai on NH-54 forms a part of the proposed development of trade route along the river Kaladan (Chhimtuipui) between Mizoram (India) and chin State in Myanmar.

For connectivity from Sittwe Port to India-Myanmar border, the trade route is proposed to provide transportation by two modes of transport i.e. from Sittwe port to Kaletwa by waterway and from Kaletwa to India-Myanmar border by road.

As part of the planned development of the trade route between India and Myanmar, Government of India through Ministry of External Affairs, awarded the work of preparation of detailed Project Report for construction of highway from Kaletwa (Setpyitpyin) to India-Myanmar border in Chin State of Myanmar to RITES Ltd in February 2002.

## **0.2 Project Road**

The project road runs, in the South – North direction in the Chin State of Myanmar, parallel to Kalet River/Chaung. The total length of the proposed alignment of the project Road is 62km and the entire length traverses through hilly terrain. There are eleven villages situated nearby the proposed alignment of the project road.

## **0.3 Engineering Surveys and Investigations**

Detailed engineering surveys and investigation have been carried out along the selected alignment of the project road and major findings are given below.

- **Terrain**

The alignment of the project road passes through mountainous terrain exceeding 25% ground slope across the alignment.

- **Topographic Survey**

The topographic surveys have been carried out using sophisticated and precision instruments like Total Station, Auto level and Global Positioning System. The survey covered a strip of 50 – 60m width with cross sections taken at 20-metre intervals to form a Digital Terrain Model (DTM). Data are stored in electronic format. Control points/ Reference beacons, consisting cement concrete pillars with central nail point, have been fixed at every 200 to 250m intervals depending upon site conditions. The survey maps have been prepared in 1:1000 scale, using the engineering design software Moss/ Mx-Road and Auto-Cad.

- **River / Water Streams**

The proposed alignment is on the west of ridge line (watershed line) between Kalada River and Kalet Chaung river. The proposed alignment runs south to north and all streams fall across the alignment flows east to west and meets the Kalet Chaung on west of the alignment.

There are eleven streams, which cross the alignment. Eleven bridges are proposed on the alignment where it crosses main rivers/streams.

- **Soil**

The soil along the alignment of project road is fairly homogenous in nature and character. Soil type varies from silty clay to sandy clay of medium plasticity, Plasticity Index (PI) found to be varying from 9 to 27. The soaked CBR value ranges between 3.0 and 8.0. The test results on soil along the road alignment are given in Table 0.1.

**Table 0.1: Summary of Test Results on Soil along the Road Alignment**

| Total Samples | Liquid Limit |     | Plasticity Index (PI) |       | CBR Socked |     |    |
|---------------|--------------|-----|-----------------------|-------|------------|-----|----|
|               | >35          | <35 | <10                   | 10-20 | >20        | 4-5 | >5 |
| 35            | 23           | 12  | 1                     | 30    | 4          | 6   | 23 |

Soil along the alignment predominately belongs to lean clays of low to medium plasticity (CL to CI) category, as per IS classification. Based on strength of soil along the project road, the project road can be divided into three homogenous sections and CBR values for the design of flexible pavement on these ratings are given in Table 0.2

**Table 0.2: Homogeneous Sections with respect to Soil Strength.**

| Section No. | Chainage (km) |       | Length of Section | Range of CBR Strength |
|-------------|---------------|-------|-------------------|-----------------------|
|             | From          | To    |                   |                       |
| I           | 0.00          | 12.15 | 12.15 km          | 5% to 7%              |
| II          | 12.15         | 26.40 | 14.25 km          | 3% to 5%              |
| III         | 26.40         | 62.00 | 35.60 km          | 5% to 8%              |

- **Construction Material and Stores**

Stone quarries or suitable rock outcrops / deposits are not available in the vicinity of the project road. The major source of stone (shingles, cobbles / boulders) is from bed of river Kaladan near the take-off point of project road, at Kaletwa. The streams / rivers crossing the alignment can also be considered as source for stone-aggregate and sand as they have some quantity of stone (rock outcrops/ cobbles/ boulders and sand) at isolated locations.

Since one end of the project road is at India-Myanmar border, the source of construction material has also been explored in Indian territory.

The source of sand is river Kaladan and quality of sand is found to be good having fineness modulus from 2.72% to 2.78%. Most of the aggregate samples are just meeting the specified strength (Impact value <30%) but they fail in water absorption, which ranges from 2% to 6% against the specified value of less than 2%. Stones available in the vicinity of project road, in territory of Myanmar, are not suitable for wearing course. For surfacing layer of road-pavement and structural concrete works the stone aggregate will have to be imported from India(Southern Mizoram).

#### **0.4 Up-gradation & Construction Proposal**

The proposals include provision for the major items as given below:

- Layout of horizontal alignment and construction of new formation in cut;
- Pavement structure;
- Culverts and Bridges
- Protection work; and,
- Road appurtenances.

##### **0.4.1 Cross Section Elements**

The design standards adopted for the project road are based on relevant Indian Roads Congress Codes, Specifications for Road and Bridges of Ministry of Road Transport & Highways (MoRTH), and also technical papers available on the subject.

The project road is proposed as a new link that is expected to develop as an international trunk route in due course of time. It has been proposed to provide carriageway width of intermediate lane for the project road. However, the formation has been proposed for two-lane width. The cross-drainage structures and bridges are proposed to be of two-lane width.

The proposed standards in respect of various cross-section elements for the project road, are summarized in Table 0.3:

**Table 0.3: Proposed Cross-section Elements**

| SL No. | Design Elements         | Dimension |
|--------|-------------------------|-----------|
| 1.     | Roadway width           |           |
|        | At Road and Culverts*   | 8.80 m    |
|        | At Bridges**            | 10.50 m   |
| 2.     | Carriageway width       | 3.75 m    |
| 3.     | Cross-slopes/camber (%) | 2.5%      |

\* Roadway width is excluding width of side drain and parapet wall / Crash Barrier.

\*\* Roadway width is Overall Width between outermost faces of the railing.

#### 0.4.2 Road Geometry

The project road traverses through mountainous terrain and a design speed of 30kmph has been kept except at hair-pin bends. However the minimum values have been applied only where serious restrictions are placed by technical or economic considerations.

The summary of proposed horizontal alignment and vertical alignment is given below in Table 0.4 and Table 0.5.

**Table 0.4: Summary of Proposed Horizontal Curves**

| Total Curves | No. of Curves with Design Speed in Km/h |       |       |     | No of Curve with Radius (m) |       |     |
|--------------|---|-------|-------|-----|-----------------------------|-------|-----|
|              | <30                                     | 30-40 | 40-50 | .50 | 30                          | 30-50 | .50 |
| 515          | 130                                     | 379   | 6     | 0   | 91                          | 259   | 204 |

Of 91 curves of radius less than thirty, 35 curves are hair-pin bend, which are designed with 20m radius.

**Table 0.5: Summary of Proposed Vertical alignment**

| Length of project road | Length Distribution and Gradient Class |                 |                 |                 |
|------------------------|--|-----------------|-----------------|-----------------|
|                        | <4%                                    | 4% - 5%         | 5% - 6%         | 6% - 7%         |
| 62.0 km                | 37.3km<br>(60%)                        | 18.4km<br>(30%) | 5.4km<br>(8.7%) | 0.9km<br>(1.6%) |

### 0.4.3 Pavement

The details of pavement thickness proposed for the project road is given in Table 0.6.

**Table 0.6: Proposed Pavement Structure**

| Pavement Layer | Road Sections & Proposed Pavement Structure                   |  |
|----------------|---|--|
|                | From km 0.0 to km 12.15 & from km 26.4 to km 62.0             | From km 12.15 to km 26.4   |
| Surfacing      | 20mm PC + 40mm BM   | 20mm PC + 40mm BM  |
| Base           | 225mm – WMM, comprising 3 layers of 75mm each                 | 225mm – WMM, comprising 3 layers of 75mm each                          |
| Sub- base      | 200mm – Additive stabilized layer to be laid in single layer. | 350mm- Additive Stabilised (to be laid in two layers, 200mm and 150mm) |

PC: Premix Carpet, BM: Bituminous, WMM: Wet Mix Macadam:  
Additive Stabilisation: Additive may be Cement or Lime

### 0.4.4 Culverts

Based on the field investigations and geometric design of alignment, 387 culverts have been proposed, as given in Table 0.7.

**Table 0.7: Proposed Culverts Works**

| Length of Project Road | Number of Culverts |                     | Total No. of Culverts |
|------------------------|--------------------|---------------------|-----------------------|
|                        | Hume Pipe Culverts | Box / Slab Culverts |                       |
| 62.0                   | 375                | 12                  | 387                   |

### 0.4.5 Bridges

There are 11 minor streams crossing the project alignment, across which minor bridges are proposed. All these streams are flowing in west to east direction before merging into Kalet Chaung and are perennial & flashy in nature. The crossing are also subjected to back flow during peak discharge in Kalet Chaung. These streams are all meandering in between the small hill ranges forming deep pools with bed width varying from 10m to 25m. The sites are located in remote areas with low bearing capacity of soils, highly weathered or disintegrated rocks & shales. In order to overcome the site constraints and to achieve simplicity in execution, it is proposed to provide reinforced concrete Box Cell structures on these locations. Overall formations width of the approaches (0.0m) have been continued over these structures. Based on waterway requirements, two types of the Box Cell structures are proposed as listed below:

**Twin Cell Reinforced concrete Box Cell Structure:** These structures (at 7 locations) are proposed with two cells of 10m span and 6.5m clear height, resting out 1.5m to 3.0m below the lowest bed level. Earth cushion varying from 0.6m to 3.5m height above the top slab of box cell is proposed on these structures to achieve road formation level and accordingly the length of the box structure is adjusted giving margin for a side slope of 1:2 to the formation width.

**Triple Cell Reinforced concrete Box Cell Structure:** These structures ( at 4 locations) are proposed with two cells of 10m span and 6.5m/9.5m clear height, resting out 1.5m to 3.0m below the lowest bed level. Earth cushion varying from 0.6m to 3.5m height above the top slab of box cell is proposed on these structures to achieve road formation level and accordingly the length of the box structure is adjusted giving margin for a side slope of 1:2 to formation width.

#### 0.4.6 Protection works

Adequate protective structures have been proposed to effectively retain cut and fill slopes and to ensure a stable road, as given in Table 0.8.

**Table 0.8: Proposed protection works**

| Type of Structure            | Length | Remarks                             |
|------------------------------|--------|-------------------------------------|
| Stone Masonry Retaining wall | 3645   | Height varying between 3.0m to 9.0m |
| Gabion wall                  | 410    | Upto height of 5m                   |
| Breast wall                  | 31000  | Proposed standard height of 1.5m    |
| Toe wall                     | 2800   |                                     |

### 0.5 Material, Labour and Equipment

#### 0.5.1 Material

Rock deposits are not available along the road alignment except at one isolated location, near village Satchain. However, bed of Kaladan river, between Kaletwa and Meesa village, contains a good source of river sand, shingles, cobbles and boulders and that would be feeding the major chunk of aggregate and sand requirement.

Other constructional materials (stores) such as bitumen, cement, steel etc. are not available locally and have to be transported from India, preferable by water route along river Kaladan from Prot of Sittwe. The overall requirement of construction Stores for the development of the road has been worked out as given in Table 0.9.

**Table 0.9: Requirement of Construction Stores**

| Sl No. | Name of Item | Quantity (MT) |
|--------|--------------|---------------|
| 1.     | Cement       | 54000         |
| 2.     | HYSD Steel   | 2600          |
| 3.     | Bitumen      | 2000          |

## **0.5.2 Labour and Equipment**

Sufficient local labour, for road construction work, is not available. Further, the cultivation and harvesting season clash with the working season. Since this is a highly malaria prone area, imported labourers are not willing to work in such remote area. Helipads & emergency evacuation mechanism, dispensaries, well equipped to combat malaria, need to be established at few convenient places before commencement of the project. Therefore, it is envisaged that equipment / machine intensive methods would be adopted construction works.

## **0.5.3 Transportation of Construction Items and Equipments**

The project is located in remote area of the hilly areas of Chin State. Access to the area is poor and limited through mode of water-transport and on foot only. In the present scenario, the river Kaladan in the stretch from Paletwa to Kaletwa is navigable from middle of June to middle of November (5 months). Besides, presently there is a blockage of the river by boulders / rock at Taung Seik (at 6km downstream of Daletme) due to landslide. Removal of the blockage is essential to ensure through navigation.

## **0.6 Unit Rates and Cost Estimate**

The cost estimates for the proposed construction works have been based on the quantities derived from the design drawings and unit rates for different items of works.

### **0.6.1 Unit Rate**

No construction activity (road / bridge / structure) has ever been carried out in the project area. The project road is located in the hinterland, without any proper road connectivity. The currency used for rate analysis is Indian Rupee. The road construction works, in Indian territory, near to Project Area are carried out by Mizoram PWD and Border Roads Organisation (BRO). In order to workout the unit rates of construction items following standard document have been referred to:

- Schedule of Rates 2000 (for Southern Mizoram) of PWD, Mizoram
- Border Roads SSR – 1998
- Standard Data Book of MoRTH 2003

**0.6.2 Project Cost of Construction of Road from Sitpyitpyin (Kaletwa) to India-Myanmar border US \$ 49.14 million**

**0.7 Implementation Schedule**

The length of the project road is 62km. The project is proposed to be completed within three years time after mobilization of resources, which may take about three months. A total period of 15 months from the overall construction period of 3 years may be effectively lost because of monsoon period. This leaves the project with practically 19 working-months.

In order to successfully implement this project located in difficult terrain and remote area, large-sized experienced construction firms of repute need to be short-listed for the project. It is, thus, necessary to make the entire project under one Contract to keep the size of project viable. Further, keeping in view the transportation of construction material and stores from one end of the project road (i.e. take-off point from Kaladan river bank) the entire project length ought to be taken under the package.