JUSTIFICATION FOR LOCATING PROJECT IN FOREST AREA

From Chungthung alignment again traverses towards north east on the left hill of the Lachung Chhu (Lachung River). It passes through the small settlements in the hill like Bop, Maltin, Beechu, Lanchung on same side of the valley. After crossing Lachung (RL 8695 ft.), alignment enter Yumthang Valley Natural Reserve at approx. Km 53. Hot springs are at the Chhachhu location near the river. The Zero point Yume-Samdang Border (RL 15900 ft.), i.e. the end of the alignment is within the perimeter of the Natural Reserve. The road further traverses 4.3 km more to reach the end at Zero Point Mile stone.

This section is around 34.00 km in length.

The road network has been shown in Figure 1 & Figure 2 as below and detailed features of the existing road has been detailed in Table 1.


Lapchaten
Zadong
Yume Samdong
(Momo Samdong)
Chombu
Shewapho
Phyakchen
Chhebabke
Singna Phyakunen
Sebo Khongmo
Burumkhangcha
YUMTHANG
R
A
N
G
E
Lachungthosa
Chugalung
Thomchaaa
Dombang
Rabomthang
Dongyothong
LACHUNG
Phadong
Khiangi
Chamerlagu
Byangya
Khedum
Latong
Yugang
Solop
CHUNGTHANG
Chhateng
Ningla
Thang Kar La
Kapwak
Zaku Phyak

Figure 1: Road Network from Yumthang to Yume Samdang Border

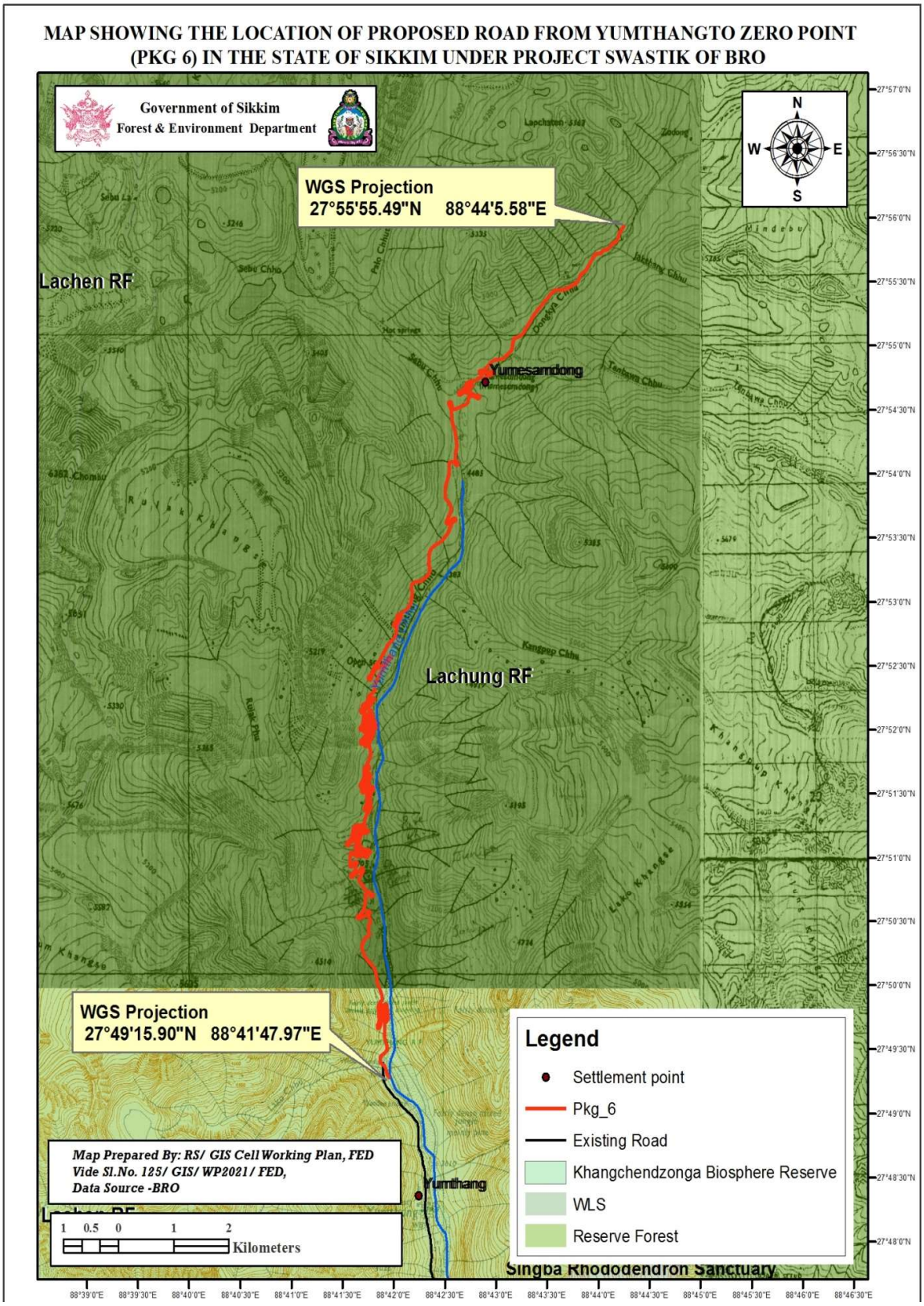


Figure 2: Alignment Passing Through Forest Land

Table 1: Overview of proposed road (Yumthang to Yume Samdang Border)

Sl. No.	Description of item	Details
1	Road length	Existing - 34.000 km Design – 31.352 km
2	Road Configuration	Existing road having 3.75 m wide carriageway with unpaved shoulders for entire length
3	Terrain	Mountainous and Steep
4	Land use pattern	Mixed land use between forest, built up
5	Existing Surface of carriageway	Flexible pavement with BC for entire length
6	Shoulder width	Proposed Shoulder – 0.9m
7	Existing Formation width	5.5m -6.0m (in general)
8	Right of Way (RoW)	25.0 m (Proposed) 8.0-9.0m (Existing)
9	Pavement Condition	Fair - Poor
10	New Flexible Pavement thickness	BC- 40mm; DBM- 70mm; WMM- 250mm; GSB- 200mm
11	Design CBR	10%
12	Junctions	Minor- 01
13	Traffic	AADT-568 MSA-20
14	Cross drainage structures	Existing: Culvert- 38 Proposed: Minor bridge-06, Culvert-123
15	General remarks	• Slide Zones present at few places along the existing road • Carriageway width restricted to 3.5 – 4.0 m

		at slide zone areas

Estimation of Benefits

The following process has been employed to estimate the aforesaid benefits: I.

Identification of sections used to travel 34 km.

II. Estimation of the local values for RUE and RD calibration.

III. Entry of data in the model and sub-models.

The model used for analysis is up-gradation of existing road network module of HDM-4 and the above factors help to estimate total VOC, time cost, etc. EIRR and NPV estimation have taken the sum of benefits from

- VOC savings
- Time savings

When considered together these give the total net benefits for the project. The total net benefits are considered against the economic cost of project to determine the EIRR and NPV at a discount rate of 12%, which has been used as Social Discount Rate (SDR) as per Government of India, World Bank and Asian Development Bank (ADB).

Project Benefits

Savings in Distance

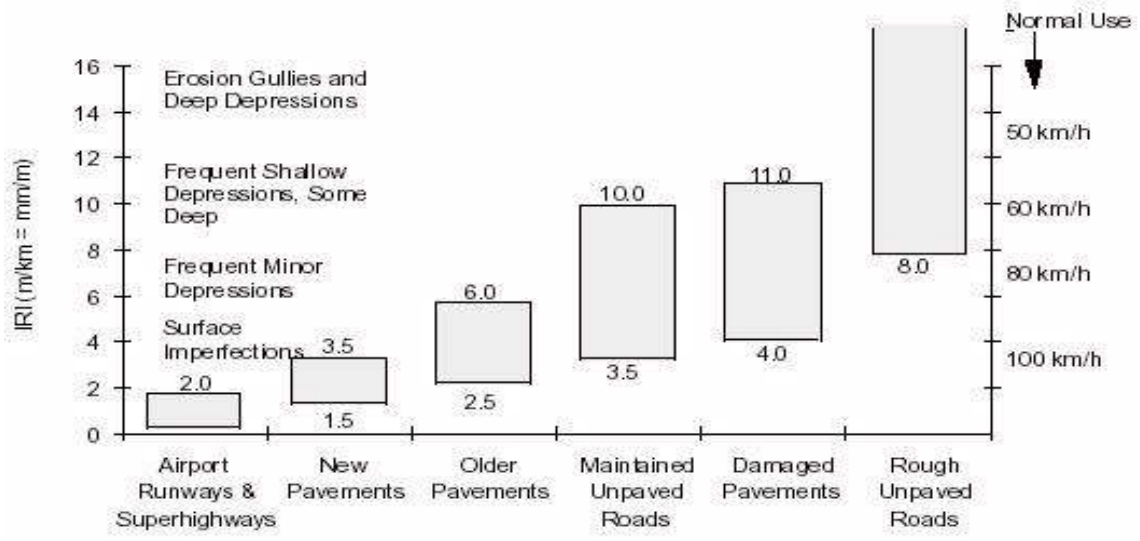
There is a significant change or reduction in the length of new corridor of Yumthang to Yume Samdang Border. The initial length of the corridor is presently 34.0 km and after upgradation it will be 28.9 km. Another major advantage of this project is savings in road user cost after introduction of the new corridor.

Vehicle Operating Cost Savings

The model comprehensively predicts the performance and operating costs of motorized vehicles in the selected fleet. Motorized vehicle performance predictions include speeds (free flow and congested conditions) and consumptions. Predictions for vehicle operating costs include fuel, oil, tyre and parts costs, crew and maintenance labour costs, capital depreciation, borrowing costs, and overhead costs. HDM-4 was used to estimate the Vehicle Operating Costs (VOC) for traffic in each vehicle category on each selected road with and without new road. The model estimates VOC in both the with- and without-project situations taking into account the speed and travel time including surface quality and road congestion. The resulting VOC values for each road and section can be found in the HDM results.

Roughness in Existing and Improved Road

Roughness in IRI of the under improved conditions are given below. In case of AC a roughness bellow



2.0 is difficult to achieve. So in the case of AC it has been considered as 3.5 IRI.

Speed Reduction Factor

The speed reduction factor for the existing road has been taken as 1.1. For the new road, vehicles will maintain a mean speed more than design speed so the speed reduction factor has been taken a 1.1.

Roadside Friction

Roadside friction is a function of carriageway width, percentage of slow moving vehicles, roadside parking and other activities along the corridor. The friction factor has been taken as 1.0, that is, free from roadside friction.

Travel Time Saving

The model estimates the Value of Travel Time (VTT) for passengers and goods in transit in both the with- and without-project scenarios taking into account speed and travel time including surface quality, road congestion etc.

Accident Cost Savings

There can be some anticipated reduction of accidents due to improved signing and engineering intervention, the benefits deriving from this rehabilitation project are deemed to be moderate and consequently the accident-related benefits have not been discounted in the HDM-4 analysis. As a result the actual economic return in respect of increased of Road Safety would be expected to be somewhat higher than the rates of return presented in this report.

Economic Viability

The Economic Internal Rate of Return (EIRR) is calculated by the model applying a project discount rate of 12% to the annual undiscounted net differences of the economic elements considered in the analysis. The sum of these discounted values gives the economic Net Present Value (NPV) of the project which is generated and presented, together with the associated EIRR in the HDM-4 output sheets for sectional and project basis attached in last, respectively.

The results of the HDM-4 analysis are summarized below in Table 69 for original model generated sheets.

Table 2: Results of the Economic Analysis

Road Code	Road	EIRR (%)	NPV at 12% (Rupees Million)
NSH	New road from Chungthang to Zero Point	**12.7**	**870.39**

Source: HDM-4 Output sheets

Sensitivity Analysis

A sensitivity analysis has been performed under the following scenarios and found that the project is economically viable in all scenarios of sensitivities. The sensitivity analysis is presented in **Table 3**.

Table 3: Sensitivity Analysis of EIRR (%)

Scenario	EIRR (%)	NPV (Rupees Million)
Base case	**12.7**	**870.39**
1. 15% increase in capital cost	11.3	-973.55
2. 15% decrease in MT volume	11.9	-71.06
3. 15% decrease in MT VOC	12.4	466.48
4. 15% decrease in MT time	12.4	479.55
5. All scenarios together	10.0	-2606.03

Source: HDM-4 Output sheets

Conclusion

The project is found economically viable, having base case EIRR above 12%. Thus, the project may be recommended for implementation.