

## CHAPTER - 2

**PRE-FEASIBILITY REPORT FOR THE CONSTRUCTION OF  
TRANS-ARUNACHAL HIGHWAY**

ROAD FROM KHODASO (CH. 110.450 KM) TO DAKTE HOJ  
(CH. 212.450 KM) VIA SAGALEE, TORU, KHEEL - 102.000 KM) IN ARUNACHAL PRADESH

**EXECUTIVE SUMMARY**

1. The proposed Trans-Arunachal Highway, a 2-Lane National Highway Standard Trunk Route about 1811 km in length running along the middle belt of Arunachal Pradesh from Tawang in the North Western tip to Kanubari on the South Western end of the State forms a part of the development package announced by the Hon'ble Prime Minister Shri Manmohan Singh during his visit to Itanagar on 31.01.2008.
2. This Highway would be interconnecting 12 out of 16 District Head Quarter towns of the State and would provide to improve connectivity to important locations of populations concentration and economic activity, including major Hydro Electric Power Projects. The Highway would pass through important places such as Bomdila, Nechipu, Seppa, Sagalee, Hoj, Yupia, Ziro, Daporijo, Along, Pasighat, Roing, Tezu, Mahadevpur, Namchik, Changlang, Khonsa, Kanubari etc. and would greatly help in reducing isolation of the people of the State.
3. This route has been considered for taking up under SARDP Phase-A. It is intended for completion of the project by Government of India during 11<sup>th</sup> & 12<sup>th</sup> Five Year Plan for ensuring connectivity to all District Headquarters including missing links in between NH37 and NH52, in addition to bringing connectivity to all power sector projects as announced by the Hon'ble Prime Minister. The Highway will be developed by upgrading the existing road network mostly of ODR standard under GS programme of BRO and State PWD Roads to a 2-Lane National Standard Trunk Road.
4. The present report is a pre feasibility study from Khodaso (110.450 Km) to Hoj (212.450 Km) undertaken by Sagalee PWD Division for the segment assigned to this Division in particular.

**PRELIMINARY DESIGN OF PAVEMENTS AND STRUCTURES**

1. The preliminary assessments for the feasibility study of proposed 102.00 Km from Khodaso (110.450 Km) to Hoj (212.450 Km) involves the following major components:
  - Upgradation of existing single lane road to double lane by way of attaining a formation width of 12.00 mtr.
  - Carriage way 7.00 mtr wide flanged with 2.50 mtr wide shoulders i/c Drain.
  - Cross sectional elements
  - RCC box culverts
  - RCC bridges
  - Retaining Wall & Breast Wall.

- Side Drain
- Pavement corresponding to IRC specification 37-2001 (Second Revision).
- Land acquisition and tentative compensation cost.

2. It has been decided with the approval of competent authority that the overall formation width of National Highways in hilly/mountainous terrain may be kept as 12 mtr, comprising 7 mtr wide carriageways flanked with 1.90 mtr wide shoulders on both side and 0.60 for parapet & 0.60 mtr for Side Drain. The drain and parapet/safety railings will be accommodated within the width of the shoulders.

The increased formation width will enhance operations on the road and traffic movement in hilly areas due to the following:

- (i) More space would be available for the parking of disabled vehicles, without interfering with two way movement.
- (ii) Two lane movement of traffic would be possible in the event of some stretches being affected by Landslides etc.
- (iii) Movement of heavy/large size Military and Commercial vehicles would be easier.
- (iv) Capacity of the road is expected to increase due to large space becoming available for maneuverable.

### 3. **Cross Section Elements.**

The recommendations regarding the cross sectional elements as given in the IRC : 52-1981 have been adopted for the proposed road :

Carriageway width	:	7.00 m
Shoulder width	:	1.90 m (Both Side)
Parapet and drains	:	1.20 m
Camber Carriageway	:	2.5%
Shoulder	:	3%

For defining the edge of pavement and for the safety of traffic, parapets 0.60 m wide and 0.45 m in height in stone masonry have been provided on the valley side following regular geometric edge of the road. The parapets would be in 2 m lengths with 2 m gaps in between them. The parapets would have their transverse faces whitewashed.

### 4. **Design of Pavements**

As explained in earlier section of this report, construction of the proposed Trans-Arunachal Highway segment from Khodaso to Hoj (102.000 Km) in Papum Pare District of Arunachal Pradesh involves the design, construction and up-gradation of existing pavements for the entire length of the alignment. For the present study, the design of new pavements has been based on the guidelines set forth in IRC : 37-2001 (Second Revision) "Guidelines of the Design of Flexible Pavements".

In this method, traffic is defined in terms of cumulative number of standard axles (8160 kg) expected to be carried during the design life. The structural damage caused by a vehicle depends on the axle loads and as such the equivalent load concept is the most widely used method in the world for pavement design purpose.

The design curves given in IRC : 37-2001 (Second Revision) gives pavement thickness for different sub grade strength values and different number cumulative standard axles up to a maximum of 150 million standard axles. The above method would require the traffic and sub grade strength characteristics as the basic inputs for the computation of pavement course thickness. The salient features regarding the estimation of traffic and sub grade parameters and design of different pavement courses are given in the following sub-sections.

## 5 **Traffic Characteristics**

It can be well appreciated that estimation of traffic on a new road is a difficult task and this is more so for rural roads. The minimum assessment of 100 commercial vehicles per day with a growth perception @ 5% per annum has been considered for design purpose for 15 years life span.

It is known that National Highway No. 52 acts as the major arterial route for Arunachal Pradesh. Within the state of Arunachal Pradesh there is hardly any transverse road link so that for traveling from one district to the other, one has to come to NH52, follow NH52 and then take the cross road to the destination. Hence besides the through traffic, NH52 also carries the Arunachal Traffic which originates and terminates in Arunachal Pradesh. The proposed road is expected to attract this volume of traffic which is now using NH52.

The PWD, Arunachal Pradesh suggested that the traffic volume along cross roads (independent links with NH52) is around 6 vehicles per hour. This gives a traffic volume of 100 vehicles per day.

## 6 **Design Traffic**

It follows from the considerations presented in the preceding sections that an average daily traffic of 200 vehicles per day is a reasonable estimate for the road.

Assuming the commercial traffic component to be 50% of the total traffic volume, the total number of commercial vehicle is estimated to be 80 cv per day. Assuming further that freight carriers would be about 70% of the commercial traffic, the truck traffic is estimated to be 60 vehicles per day.

### **Vehicle Damage Factor**

The IRC : 37-2001 gives indicative values for the vehicle damage factors (VDF) for different traffic, terrain and pavement types. For commercial traffic less than 150 vehicles per day and thin bitumen surfacing, the indicate values of VDF are:

Terrain	Initial traffic volume in terms of number of commercial vehicles per day
Hilly	
0.5	0 - 150
1.5	150 - 15001.75
2.5	More than 1500

#### 7. Computation of design traffic

(i)	Two lane carriage way	=	7.00 mtr
(ii)	Initial traffic in the year of construction (A)	=	100 cv/day (sum of both direction)
(iii)	Traffic growth rate per annum (r)	=	5%
(iv)	Design life (N)	=	15 years
(v)	Vehicle damage factor (F)	=	1.5
(vi)	Distribution factor (D)	=	0.75

Cumulative number of standard axles to be created for in the design equation

$$N = \frac{365x[(1+r)^n-1]}{r} \times A \times D \times F = 886069.35 \text{ msa}$$

$$= 0.88 \text{ msa}$$

Adopted for design purpose = 1.00 msa

For the CBR value considering 6% tentatively the thickness requirement as per Pavement Design would be 675 mm and has been adopted inclusive of 75 mm Bituminous Macadam and 25 mm SDBC.

25 mm		SDBC
75 mm		BM
200 mm		WMM
125 mm		WMM
250 mm		GRANULAR SUB BASE

**Total =675 mm**

#### 8. Cross Drainage

As a general rule, the number of such culverts is around five per kilometer. In such a case, if the drains could flow with bed slopes towards two culverts from the central high point, the maximum length of runoff would be 100 m. When the gradient is in one direction only, the length of run-off would be 200 m. The intensity of rainfall is assumed to be 150 mm per hour.

#### 9. Side Drains

The proposed road is provided with a cross slope of 2.5% towards the hill side unless otherwise required for super elevation. A minimum gradient of 0.5% has been prescribed so as to facilitate proper longitudinal drainage without increasing the overall excavation and depth of drain.

The hillside drain is proposed to cater for the run off from the road surface plus a distance of 15 m on the hill slope. It is assumed that the other areas would be drained by the hill slope gully or streams for which cross-drainage are provided. The longitudinal drains are to discharge into culverts. For the present study, the number of culverts has been estimated using model relationships described in the following chapter.

Trapezoidal side drains with a top width of 600 mm, bottom width of 450 mm and depth 600 mm have been provided for the proposed road. The side slopes for the drain are 1 H : 2 V on the hill side and 1.5 H : 1 V on the road side. The flatter slope on the roadside would allow the vehicle to come out easily if by chance it gets into the drain.

For larger discharges, provisions have been made for larger drains. However, drains of depth greater than 600 mm are not generally envisaged except at a few locations.

It is proposed to provide to provide kerb stones at 2 m intervals for the stretches where the depth of drain is more than 300 mm.

The type of surfaces to be provided for the drain is selected on the basis of availability of materials and type of strata. For rocky and hard soil stretches, provisions have been made for cement concrete (1: 3: 6) surfaces with joints at every 3 meters.

#### 10. **Retaining Walls**

The retaining walls have been provided at locations where the side slope is greater than 25°. For the proposed road, provisions have been made for retaining walls for the following areas.

1. Places where the valley side gets saturated in monsoon and slips.
2. Where there is a likelihood of damages caused by streams.
3. Places on the valley centered curves where rain water flows towards the valley because of super elevation being on the hill side.

The retaining walls proposed to be of three types, viz, reinforced concrete, stone masonry and banded. For the stone masonry retaining walls, the front face of the wall is kept vertical when the height is small. For larger heights, a nominal slope of 1 in 50 is given to avoid the feel of overhang when seen from the top.

#### **Breast Walls**

The uphill slopes and the slopes of cutting would affect the stability of the road. Provisions have, therefore, been made for the breast walls for the stretches wherever there is a likelihood of a slip or slide on the road. A standard design of breast wall of 3 m in height in stone masonry with cement mortar has been adopted for the present study.

#### 11. **Bridges**

As explained earlier, the proposed road would cross a number of rivers and streams. The locations of these bridges have been identified 35 nos. of RCC minor and major bridges of span ranging from 8 - 60 mtr are proposed based on the actual requirement. The design discharge and computation of scouring depth are indicated as below.

Sl. No.	Chainage (in Km)	Span (in Mtr)	Name of River/Nallah	Discharge Q=RAP/36 m <sup>3</sup> /sec	Q <sub>max</sub> =1.5xQ m <sup>3</sup> /sec	Scour Depth (in mtr) D <sub>sm</sub> =1.34[(Db <sup>2</sup> /kgf)] <sup>1/3</sup>	Type of river/nallah
1	139.220	12.00	Bobia	41.67	62.505	2.00	Perennial
2	139.320	45.00	Pare	55.55	83.33	2.20	-- Do --
3	139.800	12.00	Dee-Dolo	5.21	7.82	1.00	Seasonal
4	145.070	51.00	Khyate	62.50	93.750	2.23	Perennial
5	150.070	12.00	Gai	5.21	7.815	1.00	Seasonal
6	152.934	15.00	Sabso	46.61	69.915	2.00	Perennial
7	153.070	51.00	Tarso	55.55	83.325	2.20	-- Do --
8	158.870	12.00	Kulungbu	3.47	5.21	0.89	Seasonal
9	160.465	60.00	Pang	69.44	104.160	2.33	Perennial
10	164.680	18.00	Dardang	48.60	72.900	2.10	-- Do --
11	169.400	14.00	Mithun	48.60	72.900	2.10	-- Do --
12	173.670	51.00	Nimte	55.55	83.325	2.20	-- Do --
13	177.220	33.00	Balapu	6.94	10.410	1.08	-- Do --
14	178.400	14.00	Taba Tara	6.25	9.375	1.00	Seasonal
15	178.490	39.00	Pumbang	62.50	93.750	2.40	Perennial
16	186.890	10.00	Mowa	55.55	83.325	1.90	-- Do --
17	188.150	26.00	Soro	48.60	72.900	2.00	-- Do --
18	197.085	25.00	Sho	55.55	83.325	2.20	-- Do --
19	198.705	8.00		41.67	62.505	1.95	-- Do --
20	199.515	25.00	Lusin	62.50	93.750	2.20	-- Do --
21	201.185	20.00		55.55	83.325	2.34	Perennial
22	203.675	20.00	Tallam	55.55	83.325	2.34	-- Do --
23	204.015	10.00		41.67	62.505	1.97	-- Do --
24	204.175	20.00	Taj	48.61	72.915	2.10	-- Do --
25	204.485	10.00		41.67	62.505	1.97	-- Do --
26	205.415	20.00		48.61	72.915	2.10	-- Do --
27	206.125	25.00		62.50	93.750	2.30	-- Do --
28	206.525	20.00		48.61	72.92	2.10	-- Do --
29	206.755	10.00		--	--	--	-- Do --
30	207.245	20.00	Luksin	55.55	83.325	2.20	-- Do --
31	207.855	10.00		41.67	62.505	1.96	-- Do --
32	208.355	25.00		62.50	93.750	2.40	-- Do --
33	208.395	10.00		41.67	62.505	1.97	-- Do --
34	208.645	10.00		41.67	62.505	1.97	-- Do --
35	209.555	15.00		48.61	72.92	2.10	-- Do --

## COST ESTIMATES

1. **Cost Estimate**

The up gradation of existing road length up to 84.00 km to the proposed double lane trunk route and construction of remaining 18.00 km has been tentatively based on the inputs derived from field investigation data and compiled in form of abstract for cost estimation. The basis for cost analysis has been derived from the latest Schedule of Rates (APSR 2007). The difference between the prevailing market rates of A-Class materials like cement, steel and bitumen over APSR 2007, has been projected in the estimation.

2. **Land Acquisition and Compensation Package**

Land acquisition includes separate provisions for permanent land forming right of way on 30.00 mtr on either side from the existing surface. The State having a different set of laws governing the ownership of land bestowed upon the tribal people by a recent enactment of legislation allowing them to be the legal and rightful owner of the areas inherited by them from their forefathers. Their claim over the hillocks being a part and parcel of areas covered under “**Jhoom**” cultivation, dependence on natural forest for their livelihood etc. are to be given due consideration while acquiring the land require for the project. Besides this, the WRC land, Horticulture/Agriculture gardens, Bamboo plantations, Fisheries, Apnavan, dwelling residences of both permanent and semi permanent, business establishment and other community based institutions, religious buildings etc. falling within the projected acquiring zone are to be compensated for.

Keeping in view of these parameters, a tentative assessment of the existing features have been compiled and cost evaluation has been attempted. Further, mandatory forest/environment clearances from the competent authority are also to be given a due consideration prior to the acquiring of the lands require for the project.