1.0 Benefit Cost Analysis

Benefit cost analysis is computed for the project with the approved project alignment of alternative III C with comparison of existing road passing through Tanamcherla, Maripeda, Mahabubabad and Narsampet. The approach methodology and the analysis of benefit cost analysis is discussed in the following subsequent paragraphs.

1.1 Basic Approach of Economic Analysis

The main aim to carry out economic feasibility is maximizing the returns on investment by determining improvement proposals that lead to minimum total transport costs. Benefit Cost analysis is carried out based on invremental costs and benefits comparing the total net benefits in "Do Minimum" situation with "With Project" situation. The term "Do Minimum" is defined as the base strategy for economic analysis i.e., without project situation. The tem "With Project" is defined as widening and strengthening of various sub project roads.

1.2 Model Used

Benefit Cost analysis has been carried out by using HDM-4 model version 1.3 HDM-4 model is a highway design and maintenance program for analyzing the total transport costs of alternative improvements and maintenance strategies.

1.2.1 Various costs considered:

The costs considered comprise agency costs and costs to road users as follows.

Society Costs
- Road Agency Costs
- Road Users Costs

Agency Costs
- Construction and maintenance
- Road user costs

Vehicle Operating Costs
- Travel Time Costs
- Congestion Costs

The agency costs comprise the costs of road construction and maintenance. Road user's costs comprise vehicle operating costs grouped into time and distanace dependent costs. Road congestion costs imply increased vehicle operating costs as a result of increased travel time and consumption of fuel and lubricants, etc.,

Road users experience different costs inm the "With Project" and "Without Project" conditions. The benefits to road users are constituted by the savings in costs. Increasing traffic volumes as a result of the project implies more vehicle kilometres and hence more vehicles operating costs and, possibly showing more saving in with project conditions viz. benefits as a result of the project. All costs for the benefit cost analysis are given in economic terms thus ignoring transfers in the form of taxes and duties.

1.2.2 Methodology

To carry out Benefit Cost analysis is carried out based on improvement costs & benefits comprising the total net benefits in "Do minimum" situtation with "Without Project" situtation. The term "Do minimum" is defined as the base strategy for economic analysis i.e. without project situation. The term "With Project" is defined as widening / strengthening or strengthening alone

Table 1.1: Length/Width of Proposed Project Road Sections

Name of the Sub Projecct Road section	Length (Km)	Width (m)
Km 72+600 - 188+000	115.4	10.0

1.2.3 Inputs to the Model

Analysis period	30 years
Discount rate	12%
Construction Period	2 years
Improved Road to be opened to traffic in 365 (Open to Traffic)	
Standard Conversion factor	0.85
Salvage value	15%

1.2.4 Road Characteristics

General Road Characteristics for the various sub project road sections are given below in Table 1.2.

Table1.2: Values of Model Related other Inputs

Name of the Sub Projecct Road section	UI (mm/Km)	Cracks (%)	Raveling (%)	Potholes No/Km	Surface Thickness(mm)	Type of Drain
Km 72+600 - 188+000	>8000	60	50	45	25 PC	No Drain

1.2.5 Base year Traffic by Composition and Growth rates

The base year traffic for the year 2013 based on Classified Traffic Volume counts for 7 days 24 hours the average AADT (Annual Average Daily Traffic) near Gudur have been carried out at on the project road is given in Table 1.3.

Table1.3: Locations of AADT

Type of Vehicels	7 Days Traffic Volume Near Gudur
Two wheeler	2867
Auto Rickshaw	787
Car/Jeep	183
Pickup Van	127
Mini Bus	45
Stad Bus	255
LCV	345
2-Axle	458
3-Axle	436
Multi Axle	104
Tractor	38
Tractor Trailer	17
Animal Drawn	11
Hand Drawn	8
Cycle	132
Cycle Rickshaw & others	6
Total Vehicles	5821
Total PCUs	7611

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The traffic growth rates have been worked out on the bais of MORT&H published a document named Road Development Plan Vision 2021. The computed growth rates are given below.

Table 1.4: **Recommended Growth rates (Motorized Traffic)**

Type of Vehicels	Up to 2017	2018-2022	2023-2027	2028-2030	>2031
Bus/Mini Bus	6.60%	5.50%	5.00%	5.00%	5.00%
Car/Van/Jeep	8.30%	7.70%	5.00%	5.00%	5.00%
2&3 Wheeler	7.00%	6.00%	5.25%	4.20%	3.25%
All Trucks	6.60%	6.10%	5.00%	5.00%	5.00%
NSDP	7.00%	7.50%	7.50%	7.00%	6.50%

1.2.6 Project Cost

The construction cost includes cost of strengthening and widening of the existing facility to proposed facility. Economic cost has been worked out by converting the financial cost using standards conversion factor of 0.85 as suggested by World Bank for highway projects in India. Computed capital construction cost per kilometre for each sub project road with their improvements considered is given in Table 1.5.

Table 1.5: **Capital Construction Costs (Finanacial cost / Economic cost)**

Name of the Sub Projecct Road section	Total Project Cost (Crore)	Economic Cost (Crores)	Improvements Considered
Km 72+600 - 188+000	287.5	258.75	Construction of 2 lane

Note: Total Project cost is excluding social and environmental cost.

1.2.7 Routine and Periodic Maintenance

Routine maintenance, Periodic maintenance costs have been considered as per the MORT&H guidelines 1997 prices. Routine maintenance, periodic maintenance costs of 1997 prices have been escalated to 2013 prices with an inflation rate of 5%. The details of the maintenance costs and administration charges are given below in Table 1.6.

Table 1.6: **Routine maintenance, Periodic maintenance costs (MORT&H Guidelines)**

Sl.No.	Description	Amount (Rs millions / Km)
1	Routine Maintenance in every year cost per km for Single lane	0.08
2	Routine Maintenance in every year cost per km for Intermediate lane	0.10
3	Routine Maintenance in every year cost per km for Two lanes	0.14
4	Routine Maintenance in every year cost per km for Two lanes with paved shoulder	0.17
5	Periodic Maintenance in every five year	112.5 Rs/Sqm
a)	Thin overlay of 25mm BC (Sqm)	180 Rs/Sqm
b)	Thin overlay of 40 mm BC (Sqm)	159 Rs/Sqm
c)	Patching	159 Rs/Sqm

1.2.8 Vehicl Utilization / Vehicle Fleet Data

Basic vehicle fleet characteristics and vehicle fleet financial unit costs are considered from RUCS as well as world bank report namely "Cost of Deferred Maintenance in India Decemeber 2003 (by Rodrigo Archondo-Callao The World Bank) Second Draft and from the APRDC previous projects". The values given in the report are escalated from the year 2003 to 2013 with an escalation factor of 5%.

1.2.9 Road Side Frcition

Road side friction has to be computed for each sub project road section considering the following.

The road width

Total traffic Volume and its Composition (Slow, Two & Three Wheelers Traffic)

Settlement pattern along the road side

Percentage of Built-up Area

Number and location of Dabhas and Fuel Stations

The number of settlements along the road side and especially the extensive ribbon development that take place, is a major factor influencing road performance. The maximum friction factor for the existing condition is taken as 0.7. Following the improvements of package the roadside friction factor for Two lanes has to be taken as 0.9.

Road side friction factors have been incorporated into VOC as well as vehicle speeds for the given volumes and composition of traffic. Survey speed observations by the traffic planner have validated the speed assumption for the HDM-4 inputs. It is considered that the creation of free flow conditions will be a more improtant yardstick with which to measure the success of any project improvement rather than increase in vehicle speeds.

1.2.10 Benefit Cost Analysis·

Benefit cost analysis has been carried out by estimating the economic benefits in terms of savings in Vehicle Operating Cost (VOC) as well as savings in Travel Time Cost (TTC) savings using HDM model. Economic benefits are computed for a period of 30 years using the project traffic. The economic benefits compared with the project cost of 195 crores, the summary of results are given below:

Table 1.7: **Benefit Cost Analysis (B/C)**

Sl.No.	Name of the Sub Project Road section	Project Cost (Rs millions)	Project Benefits (Rs millions)	B/C Ratio
1	Km 301+000 - 307+000	215.70	958.30	4.44

The summary of computations of economic benefits like VOC and TTC for a period of 30 years is given below.

Table 1.8: **Summary of Economic Benefits**

Year	Project Cost			Project Benefit				Net Benefit
	Capital	R&M	Total	MT-VOC	MT-Time	NMT-Total	Total	
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2014	126.28	0.00	126.28	0.00	0.00	0.00	0.00	-126.28
2015	149.42	0.00	149.42	0.00	0.00	0.00	0.00	-149.42
2016	0.00	0.71	0.71	16.06	0.70	0.00	16.76	16.05
2017	0.00	0.71	0.71	15.85	0.76	0.00	16.61	15.90
2018	0.00	0.71	0.71	17.16	0.82	0.00	17.98	17.26
2019	0.00	0.71	0.71	18.48	0.88	0.00	19.35	18.64
2020	0.00	0.71	0.71	19.95	0.94	0.00	20.89	20.18
2021	0.00	42.13	42.13	21.35	1.01	0.00	22.36	-19.77
2022	0.00	0.71	0.71	22.39	1.08	0.00	23.47	22.75
2023	0.00	0.71	0.71	24.10	1.16	0.00	25.27	24.55
2024	0.00	0.71	0.71	25.76	1.24	0.00	27.00	26.28
2025	0.00	0.71	0.71	27.61	1.32	0.00	28.93	28.21
2026	0.00	0.71	0.71	29.27	1.40	0.00	30.67	29.95
2027	0.00	42.13	42.13	31.16	1.49	0.00	32.66	-9.47
2028	0.00	0.71	0.71	33.34	1.59	0.00	34.94	34.22
2029	0.00	0.71	0.71	35.41	1.69	0.00	37.10	36.38
2030	0.00	0.71	0.71	37.72	1.78	0.00	39.50	38.79
2031	0.00	0.71	0.71	39.75	1.88	0.00	41.63	40.92
2032	0.00	0.71	0.71	42.10	2.00	0.00	44.11	43.39
2033	0.00	42.13	42.13	44.78	2.14	0.00	46.91	4.79
2034	0.00	0.71	0.71	47.64	2.28	0.00	49.92	49.21
2035	0.00	0.71	0.71	50.84	2.45	0.00	53.29	52.57
2036	0.00	0.71	0.71	53.71	2.63	0.00	56.34	55.63
2037	0.00	0.71	0.71	57.07	2.87	0.00	59.94	59.23
2038	0.00	0.71	0.71	60.95	3.19	0.00	64.15	63.43
2039	0.00	42.13	42.13	65.08	3.52	0.00	68.61	26.48
2040	0.00	0.71	0.71	69.64	3.85	0.00	73.49	72.78
2041	0.00	0.71	0.71	73.83	4.24	0.00	78.07	77.36
2042	0.00	0.71	0.71	78.72	4.76	0.00	83.48	82.76
2043	0.00	0.71	0.71	84.54	5.50	0.00	90.04	89.32
2044	0.00	0.71	0.71	90.21	5.97	0.00	96.18	95.46
2045	0.00	42.13	42.13	96.44	6.41	0.00	102.85	60.72

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