

Cost effective analysis of road widening from single lane to double lane (Parlakhemundi-Mohana road, SH-34) between chain ages 0km to 5km

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Abstract: Road Traffic has been growing with very rapid rate, hence the traffic intensity and volume on the road is high. The present road network is necessary to improve to accommodate the future traffic and to provide the good riding quality. The Parlakhemundi- Mohana road is proposed on cost analysis (basing on Cost-Benefit Ratio method), connecting two numbers state highway starting from parlakhemundi being its (intercept at 52/0 km of SH -4) and terminates at Mohana being its 102/9 km (intercept at 66/0km of SH-17) This road passes through the block head quarter of Rayagada, R.Udayagiri and Mohana connecting the district head quarter at Parlakhemundi. The total length of the road used for widening is up to 5kms length. The Traffic volume survey was also conducted on this road. The analysis of traffic volume data was done by projection up to 10 years. The need for widening of road from single lane to two lanes is justified as per the capacity of road. Based on the data collection toll fixation rates should be adopted for the improvement of the road in future. A method was adopted Cost- Benefit ratio method) which concludes that the road is economically viable for the proposed up gradation and improvements.

Index Terms: traffic intensity, single lane, double lane, cost-benefit ratio method, and up-gradation

I. Introduction

Road lane width impacts on vehicle user's. Due to increase of Road Traffic with very rapid rate i.e. 8 % per annum, hence the traffic intensity and volume on the road is high. The present road network is necessary to improve to accommodate the future traffic and to provide the good riding quality. This literature review provides guidelines to assist in the improvements of single lane to double lane carriage way in cost effective manner. A better understanding between present status of the traffic and its demand is necessary. State Highway (SH-34 of 5/0 km length) is selected as study routes based on their location, length and geometric characteristics. **Details of Project study area:** Parlakhemundi-Mohana road, SH-34 came under Gajapati District of Odisha. The district is lying between 18^o.46' North and 19^o.39' North latitude and 83^o.48' east and 84^o.08' East longitude. The area is abutting the state boundary i.e. Andhra Pradesh towards South. Ganjam district bound this district on the East, Rayagada district on the West, Phullabani district on the South. This road is of 102.9 km length having plain terrain with some section of rolling terrain, which connects district head quarter of Gajapati district (Parlakhemundi) and passing through thickly populated tribal blocks of the district.

Problems due to existing lane width: The entire length of road proposed in this project is black topped surface, mostly single lane carriage way of 3.30mt having crust thickness of 300mm. The details of road section under study were collected through Test Pit. Existing Crust Composition on present road had found as follows in Table 1.1

Table-1(Showing existing crust composition)

Thickness	Composition
150 mm	Sub grade soil
150 mm	WBM
25 mm	SDBC

The main objective of this paper is to investigate the traffic volume survey, to design the computation of future traffic.

Provisions for the improvement of existing pavement based on pavement design (as per IRC: 37-2001). Cost benefit ratio after improving from single lane to double lane.

Since, this has been badly distressed in several stretches due to plying of heavy commercial vehicle, improvement of this is essential to cater the modern traffic demand to facilitate the people of this region.

Above studies, motivated the authors to investigate the traffic survey, design of traffic, design of pavement and cost-benefit ratio analysis to know economic viable of the project.

II. Methodology Adopted

Based on the selected route, to achieve the objectives a methodology is adopted which includes generation of different module. Each module calculates the required results. Following modules have been developed

Module1: Design of traffic

Module 2: Overlay design

Module 3: Widening design

Module 4: Cost analysis

Module1: Design of traffic

In this Module traffic volume has been projected for Parlakhemundi-Mohana Road for the year 2014, considering growth rate 7.5 % per year as per the IRC guideline. Result shows that after 10 years the traffic is projected up to 2330 PCU per day.

Table-2(Showing traffic survey for a stretched road (5KM) for a week)

SL No	Vehicle Type	CVPD
A	Light Loaded Truck	55
B	Light Bus	33
C	Light Loaded Tractor	63
D	Heavy Bus	6
E	Heavy Loaded Truck	26
F	Heavy Loaded Tanker	4
	TOTAL	187

Calculation of Cumulative Million Standard Axles (CMSA): CMSA have been calculated by considering following parameter:

1. Growth rate :7.5 %
2. VDF for plain terrain :3.5
3. Lane Distribution factor: 0.75
4. Projected traffic A: 591 CVPD

The result for calculation of CMSA for different type of commercial vehicles is found to be 20 MSA.

Module 2: Overlay design

In this module overlay design for the road section has been done .Following design thickness have been recommended for overlay of Parlakhemundi-Mohana road.

Thickness(mm)	Composition
150	GSB
150	WBM
110	DBM
40	SDBC

Module 3: Widening design

In this Module Design of widening has been done. In the road inventory survey it is found that at some portion central widening is needed due to inadequate ROW and at some portion side widening can be adopted. Design for widening portion has been done as per IRC: 37-2001 & the recommended crust thickness for 20 MSA and CBR of 4 % are given below:

Thickness(mm)	Composition
330	GSB
250	WBM
110	DBM
40	SDBC
730	Total

Module 4: Cost Analysis

Cost analysis has been done for the entire project on the basis of overlay and widening design as per the schedule of rates OPWD, April 2013. The cost comes out to be Rs 4, 20, 00000(Rupees Four cores and Twenty Lakhs) only. The total estimates are prepared as per the, lead statement (quarry map of the study area)

III. Result And Discussion

3.1 Design Analysis: Following results are coming,

3.1.1 For projected traffic

Grand Total Load per one day: 2254.20

Grand Total P.C.U per day: 2330.00

Grand Total Commercial Vehicle per day : 187.00

Projected traffic, $A = P(1+r)^{x+n}$: 591 CVPD

N =Cumulative number of standard axles to be created for the design =19.45 Or Say 20 MSA (Design as per IRC: 37-2001 for 10-150 MSA adopted). Since the PCU per day is 2000 for single lane as per IRC. Hence widening required.

3.1.2 For sub grade properties

Sub grade soil is of clay type having sand content of 38% to 45%, L.L ranges from 28 to 32%, P.I. ranges from 9 to 14%. Since the sub grade should not have less value of 25% for L.L. and 6% for P.I., and the sub grade is suitable for design pavement. The values of OMC ranges from 11 to 16%, MDD from 1.82 to 1.84g/cc., Soaked CBR after 4 days comes out of 4%

3.1.3 Design of pavement

As per IRC: 37-2001, pavement thickness is calculated basing on standard axle load and CBR value obtained from sub grade.

3.2 Cost Analysis: Following results are coming,

Estimated cost of the entire project and cost-benefit ratio to be determined to know the viability of the project after widening.

IV. Conclusions

Based on the findings of the present investigations, following conclusions are drawn.

1. The traffic volume was calculated as 2330 PCU/day in the year 2014 which exceeds the capacity of a single lane, (i.e. 2000 PCU/day) as given by IRC. Hence, there is a need to widen the road up to two lanes.
2. The result of cost benefit ratio value is more than one (1.78). So, it can be concluded that the road is economically viable for the proposed up gradation and improvements.

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