A STUDY ON REHABILITATION& UPGRADATION OF NH165 FROM 0.00KM TO 58.02KM IN THE STATE OF ANDHRA PRADESH ON EPC MODE

[1]P. Sai Phani Raghu Veer, [2]R. Manohara Reddy, [3]G. Sasi Rekha,[4]Siddharth Gupte, [5]Jayesh Juremalani
[1]M. Tech Student, [2]Superintending Engineer, [3]Deputy Executive Engineer, [4]Assistant Professor, [5] Assistant Professor
[1]Transportation Engineering,
[1]Parul University, Vadodara, Gujarat.

Abstract: ***Maintenance of condition of pavement during construction as it was before is called Rehabilitation. Upgradation of pavement comprise of improving Geometric features, reconstruction of core for some distance and improving existing facilities. Present highway NH165 runs through mainly villages and major towns. After knowing the importance of rural roads government funding for upgradation and new construction of many roads through PMGSY (Pradan Mantri Gram Sadak Yojana) schemes etc. Ministry of Road Transport and Highways, Government of India declared one new national highway as NH 165 starts from Pamarru, Krishna, Andhra Pradesh to Digamarru, west Godavari district, Andhra Pradesh. As per IRC SP: 73-2015 (clause no. 23, page no. 10) two laning shall be accommodated within the existing right of way to the extent possible. Total length of this section is 107.66km. MORTH has instructed state Public Works Department to take up fresh study for finalizing most feasible alignment and improvement of existing features to develop same a minimum 2 lane with paved shoulder through EPC mode. Total length divided into 2 packages, package-I comes from Pamarru to Allapadu, Krishna, Andhra Pradesh and remaining section comes under package-II. After studying features, we got 58.02km design length. Due to this project distance and travel time between Vijayawada to Digamarru would be considerably low compare to present connectivity, as 3 new bypasses proposed those runs out of major towns. For detailed project report data collection divided into 3 parts. Traffic data, topography data, geo-tech data. We had followed most realistic and reliable methods while analysing data, like collection of fuel sales data for seasonal variation factors while converting Average Daily Traffic to Annual Average Daily Traffic. And linear regression analysis by using economic models prescribed in IRC: 108-1997. For each 10m interval we have taken total station data. And set up temporary benchmarks by installing GPS Pillar made by concrete. Each 2km interval we have collected soil sample from trail pits and original ground level. Pavement condition survey and Benkelman beam deflection technique conducted on existed pavement. Along the length 4 by-passes proposed to avoid widening in built-up areas. Tech-revetment proposed for canal lining and lime stabilization is favorable for particular CH soil.***

IndexTerms - Upgradation, Rehabilitation, Geometric, Forecast, Benkelman, Tech-Revetment, Soil Stabilization

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I. INTRODUCTION

Ministry of Road Transport& Highways Directed Andhra Pradesh State Public Works Department to Upgrade& Rehabilitate NH 165 With Paved Shoulder on Either Side. Currently Its Having Earthen Shoulder Of 1.5m Each Side. By Knowing Importance And in The Scheme of Infrastructure Development This National Highway Got Directions for Upgradation. Through New Alignment the Travel Time Duration Between Pamarru And Digamarru Can Be Considerably Less. And after investigation we got to know that there are total 34 improper horizontal curves having total length 6.4km, which need to be improve.

NH165 starts from Pamarru T Junction (NTR Circle) 49°58' E, 18°04' N and ends at Allapadu Upputeru bridge 53°63' E, 18° 32' N. Existing length of study stretch is 61.1km after topography survey design length 58.02km acquired. Study area falls in Andhra Pradesh, climate is hot and humid. Minimum and maximum temperatures are 20° to 45°. 1/3rd of total rainfall due to NE Monsoons around Oct month. Seismic zone III(Z=1.16) according to IRC:6-2014. No major changes in terrain are observed& alignment passes through mostly built-up and green area. Aim of study or investigation is to develop adequate supportive database for selecting and preparing most appropriate proposals to meet the functional and structural efficiency and safety purpose. Design speed is 80kmph (35kmph at built-up area) and 40kmph for superelevation. Design life of pavement is 15 years. 1 major, 20 minor bridges along the length. 18box, 76 pipe type culverts, 17 bus bays, 2 truck lay bays, 1 toll plaza, 32 minor intersections, 9 major intersections, 2 road over bridges are proposed along the stretch. After preliminary survey total section divided into 2 parts homogeneous section-I starts from 0 km to 21+900km and homogeneous section-II starts from 21+900km to 58+02km. Existing pavement is almost bituminous type 0.565km length having Cement Concrete road. And there are 26 deficient horizontal curves of length 4.52km& needs curve improvement.

II. DATA COLLECTION& ANALYSIS

Main aim of data collection is for selection of the most appropriate proposal to meet the functional& structural efficiency& safety requirement. Data collection part influence whole project, as geometric elements and pavement core design are mainly dependent on test results and existing features. Whatever data needed for this case study is classified into 3 types given below

- Traffic Data
- Topography Data
- Geo-Technical Data

2.1 Traffic Data

Information on traffic characteristics of particular stretch plays a pivotal role in the geometric design as well as pavement design of highway. This information(data) may comprise of minimum traffic parameters like traffic volume, axle load, pedestrian volume and commercial vehicles per day. For collection of data traffic survey points should have to be installed, as place of installation decided after

preliminary survey. By observing traffic composition place of traffic survey location deciding is part of preliminary survey. Particular 58.02km length highway we had set up two survey points at 4.5km and 51.8km chainage respectively, and conducted traffic volume survey for 7 days, 48 hours axle load survey. Passenger Car Units factors adopted for design as per IRC:37- 2012.

Objectives of Traffic Study:

- Traffic Estimation in Terms of Volume on Various Sections
- Growth Factor Estimation for Traffic Forecasting
- Capacity Assessment Based on Traffic Forecasting for Next 30 Years
- Pavement& Intersection Design

Through continuous 7day traffic volume survey, we got ADT values, mentioned below

ADT @ 4.5KM = 8442PCU

ADT @ 51.8KM = 7111PCU

For forecasting future traffic, present traffic should have indicated in AADT. In order to convert ADT to AADT seasonal variation factor needed, that would be calculated from fuel sales data of past 10 years along study area chainage. and values are tabulated below

Table.1 Seasonal Variation Factor Results

Fuel Station Chainage	Year	MS SVF AVG	MSD SVF AVG
Koganti Oil Corp IOCL @ 5.8km	2015-16	1.01	0.99
	2014-15		
Vijayageetha Oil Corp @ 24.8km	2015-16	1.01	1
	2014-15		
HPCL @ 35.4km	2015-16	1.01	1.06
Sai Rajgopal Filling Station @ 47.3km	2015-16	1.01	1.04
	2014-15		

After applying seasonal variation factor. AADT values are

AADT @ 4.5KM = 8378PCU

AADT @ 51.8KM = 7400PCU

While doing future traffic forecasting we have followed IRC: 108- 1997. According to that code we have collected past 10 years economic indicators, population and past vehicle registration data of Andhra Pradesh. And analyzed in MS Excel for finding projected growth rate through linear regression model. Sample Regression model inscribed below

Table.2 Regression Analysis Summary

	R Square Value				Growth Rate			
Vehicle Type	**PCI**	**Population**	**NSDP**	**GSDP**	**PCI**	**Population**	**NSDP**	**GSDP**
Cars/ Jeeps	0.24	0.20	0.23		5.44	4.81	5.41	
Trucks			0.28	0.27			7.09	6.92
2w	0.34	0.30	0.34		5.10	4.61	5.09	
Bus	0.32	0.27	0.31		8.68	7.66	8.63	
3W	0.53	0.51	0.53		8.52	8.00	8.55	

Table.3 Projected Growth Rate (%) Values for Capacity/ Revenue

Period	2 W	Car jeep	Bus	3W	Truck			LCV
					2A	3A	MA	
Up to 2018	4.0	5.0	7.0	7.0	5.0	7.0	7.0	7.0
2019 -2023	3.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0
2024 – 2028	2.0	3.0	5.0	5.0	3.0	5.0	5.0	5.0
2029 – 2033	2.0	2.0	5.0	5.0	2.0	4.0	4.0	4.0
Beyond 2033	2.0	2.0	5.0	5.0	2.0	3.0	3.0	3.0

By 48 hours axle load survey at two survey locations Cumulative Million Standard Axles calculated for pavement design. Vehicle Damage Factor values are also calculated at different survey locations. Design MSA values for 15 years are mentioned below

CMSA @ 4.5KM = 30MSA

CMSA @ 51.8KM = 10MSA

2.2 Topography Data

GPS control points are marked on cement concrete pillars embedded in the ground. In order to ensure a high degree of survey accuracy, control points at an approximate interval of 5km are established along the length of road. Each GPS control pillars is supplemented by one additional interval- visible pillar of same specification within the vicinity of 200 to 300m, the coordinates of all these control points are observed using GPS receivers in differential mode. The twin pillars facilitate the checking the bearing and are being used for the starting of

independent survey in any 2km stretch. The concrete pillars are suitably numbered and their description has been prepared to ensure easy identification& accessibility in future.

2.3 Geo-Technical Data

Before going to upgradation of pavement, collection of geotechnical data plays a pivotal role in the design of pavement. As that data influence design standards, methodology and cost of construction. Whatever data we have collected, has been divided into below sections

1. Pavement investigation
2. Construction Material Investigation

The primary objective of the existing pavement investigation is to assess as to whether& what extent the pavement fulfils the intended requirements. So that important jobs could be planned properly. Performance of flexible pavements is closely related to the elastic deflection of pavement under wheel loads. The deformation or elastic deflection under a given load depends upon parameters like subgrade soil type, its moisture content and compaction thickness& quality of the pavement layers, drainage conditions, pavement surface temperatures. The main aim of this investigation is to evaluate structural adequacy of the pavement. Following survey/ tests were conducted to evaluate structural condition of existing road.

- Pavement condition survey
- Non-destructive test by Benkelman Beam Deflection Technique
- Destructive tests like Trail pits for existing crust evaluation
- NGL samples to study soil properties

According to IRC: 81-1997 we have investigated pavement condition by assigning PCI values and got 57.64%.

BBD test was carried out on the project road assess the condition of the existing flexible pavement. It was done on the both sides of carriageway at every 50m staggered interval. The BBD test was carried as per IRC:81-1997. At each spot we have taken initial, intermediate& final readings were recorded pavement temperature was recorded at every 1Hour interval by drilling hole in the asphalt, filled with glycerin. Temperature corrections for deflection values were applied 0.01mm for each degree centigrade change from the standard temperature of 35^0c. The correction will be positive for the pavement temperature lower than 35^0c and vice versa. As stated before IRC code, as per clause 6 characteristic deflection find out. As per clause 7 fig.9 design curves the thickness of overlay is designed.

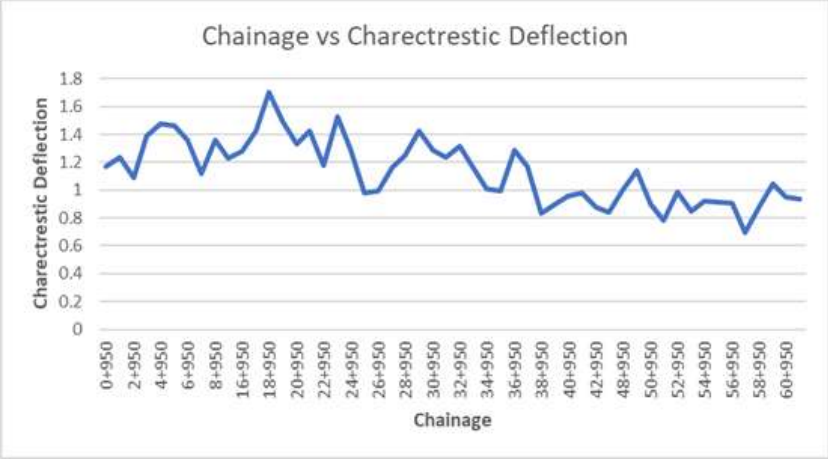

Figure.1 Characteristic deflection variation at different chainages

III. RESULTS& DISCUSSIONS

As per IRC: 81-1997 overlay thickness calculated, values are

Overlay @ 4.5km (0km- 21.9km) = 120mm

Overlay @ 51.8km (21.9km- 51.2km) = 90mm

In this section all the results and the discussions should be made.

Pavement Design as per IRC: 37-2012

According to soil properties of natural ground level soil dug at 300mm depth. Homogeneous Section-I soil type High Plasticity Clay(CH) having CBR value 1.5%. And Homogeneous Section-II soil type Silty Sand(SM) having CBR value 2.5%. borrow soil having CBR 9% for both HS-I& HS-II. If existing soil CBR is different from Borrow soil CBR value then effective CBR value should be considered for pavement design. According to clause 5.2 inscribed in IRC:37-2012 effective CBR value of subgrade is taken as 9%.

After all investigations guided in IRC code, plate number 7, page number 28, total thickness of pavement designed for 30MSA and 10 MSA for HS-I& HS-II respectively.

Table.3 Pavement composition Results

Section	HS-1	HS-II
Granular Sub-Base	200mm	200mm
Granular Base	250mm	250mm
Dense Bituminous Macadam	95mm	50mm
Bituminous Concrete	40mm	40mm

IV. CONCLUSION

While future traffic forecasting, used economic models as per IRC, if past data having more than 10 years then accuracy could be more. We have considered growth rate 5% as per IRC in spite of forecasting results, as they are less than 5%. We used IRC codes and IITPAVE Software for pavement thickness design, anyway both are giving same values. At the places of realignment and new construction lime stabilization is feasible. If distance between center line of carriageway and canal edge vary from 9-12m, then tech revetment (stone pitching over the geo-textile sheet) proposed.

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