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Design and case study Analysis of NH-18

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KEYWORDS

Highway Design, NHDP, Mix Designskability, compressive strength, NHAI

ABSTRACT

The National Highway development programme (NHDP) is carried out by National Highway Authority of India. In India as well as in the whole world transport system plays a very important role in the development of the country as an economic way. In other ways also such as development of agriculture and industries. It also helps us to reduce poverty by creating employment. Our project deals with the detailed study on Rehabilitation and Upgradation of NH-18 from Kadapa and Kurnool (from Kadapa (km 167.750 to km 356.502) to Kurnool, which has the design length of project road of 188.752 km) The length of test section to be 1000mto four lanes under NHDP=18 in the state of Andhra Pradesh on EPC mode. The study includes that material production, conduct the tests on CBR, Abrasion Test, Compressive tensile tests and mix designs, which involves an up-gradation of national highway.

INTRODUCTION

The National Highways Authority of India (NHAI) is the nodal agency responsible for building, upgrading and maintaining most of the national highway's network. It operates under the Ministry of Road Transport and Highways. The National Highways Development Project (NHDP) is a major effort to expand and upgrade the network of highways. NHAI often uses a publicprivate partnership model for highway development, maintenance and toll-collection. While national highways constitute 1.8% of Indian roads, they carry 40% of the traffic. The majority of existing national highways are two-lane roads (one lane in each direction), though much of this is being expanded to four-lanes and some to six or more lanes. Some sections of the network are toll roads. The National Highways Act, 1956 provides for private investment in the building and maintenance of the highways. Some existing roads have been reclassified as national highways. Bypasses have recently been constructed around larger towns and cities to provide uninterrupted passage for highway traffic. The hugely varied climatic, demographic, traffic, and sometimes political situation in India results in national highways being single lane in places with low traffic to six lanes in places with heavy traffic. National highways are being upgraded or are under construction. Some national highways are long while some are short spurs

off other national highways to provide connectivity to nearby ports or harbours.

II RESEARCH METHODOLOGY

The method used in obtaining the details of the challenges mentioned in this work was site visitation. The proposed upgradation of NH-18 (Kadapa and Kurnool) was proposed to be executed on the left-hand side according to the report obtained from Government of Andhra Pradesh Public Works Department and questioning. The site was visited along the road stretch where work was in progress. Careful observations were made and as well questions asked to the workers on site.For the purpose of Pavement Performance Study (PPS) in Andhra Pradesh the following road stretches is selected for the study in the Kurnool district based on the selected parameters and criteria, and different major cities between on NH-18 are presented in Table.

III STUDY AREA DISCREPTION

Kurnool is a district in Andhra Pradesh, India Kurnool District has an area of 17600 km2, and a population of 4,78,124 of which having 704mm annual rain fall. The district is bounded by Mahbubnagar district to the north, Prakasham district to the east and Kadapa district to the southeast, and Karnataka state to the west, Anantapur district to the south .Kandanavolu' which in course of time came to be known as Kurnool. Kurnool is well known for its temples. The Kurnool district headquarter is Kurnool city.

Transport at Kurnool: Kurnool is considered as the Gateway of Rayalaseema as one must pass through Kurnool to reach Kadapa or Chittor or Anantapur districts while travelling from Hyderabad. Kurnool is having the third largest bus station in Andhra Pradesh after Hyderabad and Vijayawada. Kurnool is connected to most cities and towns in Andhra Pradesh as well as to Bengaluru and Chennai by the Andhra Pradesh State Road Transport Corporation (APSRTC) and the Karnataka State Road Transport Corporation (KSRTC). National Highway 7 connects Kurnool to Hyderabad (210 km, 4.5 hours), Anantapur (140 km, three hours), Hindupur {245 km, 5.5 hours} and Bengaluru (360 km. The State Highway 51 connects to Srisailam, Vinukonda, Guntur, Vijayawada. The National Highway 18 Kurnool-Chittoor connects the city to Panyam, Nandyal,Allagadda,Ahobilam(near to the highway),Mahanandi(near to the highway),Maidukuru, Kadapa, RayachotyPileru, and Chittoor.

IV RESULTS AND DISCUSSIONS

Highways form a vital role in the economic prosperity of any nation, due to its importance, the Government at all levels desire to have a good road network to facilitate the movement of goods and services, however, the construction of these highways are very capital intensive projects thus leading to the higher cost on the government or the major client of the project, as the cost of upgrading existing highways will not be compared to the initial cost of construction of the highway, this is because the numerous factors to be considered like labour, cost of materials, cost of land acquisition, cost of survey, cost of earth machines , cost of construction etc. keeps increasing and hardly falls. Thus, the Cost will be significantly higher in upgrading existing highways after years of initial construction.

Figure: The four-laning of the Kadapa-Kurnool Road

The four-laning of the Kadapa-Kurnool section of National Highway -18 (new NH-40) has been put on track following the Prime Minister's Pro-Active Governance for Active and Timely Implementation (PRAGATI) launched by Prime Minister Narendra Modi. The project was taken up under the Build Operate and Transfer (BOT) mode under the National Highways Development Project (NHDP) Phase III in 2010. However, the project came to a grinding halt in 2013 as banks stopped disbursing funds, while concessionaire failed to bring in extra equity. The project was expected to be completed by May 12, 2013.

Meanwhile, National Highways Authority of India (NHAI) officials said the project was on the brink of becoming NPA. But, things began moving in the right direction soon after the project was identified by the

Centre under the PRAGATI. Incidentally, the Kadapa-Kurnool section was one of the 20 badly delayed NH projects across the country.

The Rs. 1,585-crore project connects Kadapa, an industrial and mining district, and Tirupati with Telangana, Maharashtra and the rest of India through the North-South Corridor. The road meets the North-South corridor at Kurnool. M/s. Rayalaseema Expressways Private Limited is executing the project, and the appointed date was November, 2010 with a construction period of 910 days.

When contacted, NHAI Project Director G. Sreedhar said high level interventions by the State government helped in resolving long-pending land acquisition issues. Board level decisions in the NHAI were taken to take the project to a logical conclusion. This helped investors bring in extra equity and works resumed. A substantial section of the road has been completed

Existing design of road:

The selected section is consisting of different layers of pavement consists of bituminous concrete layer of thickness 40mm,dense bituminous concrete layer of thickness 110mm,wet mix macadam layer of thickness 250mm,granular sub base of 200mm, sub-grade of 500mm and reaming as embankment as shown below.

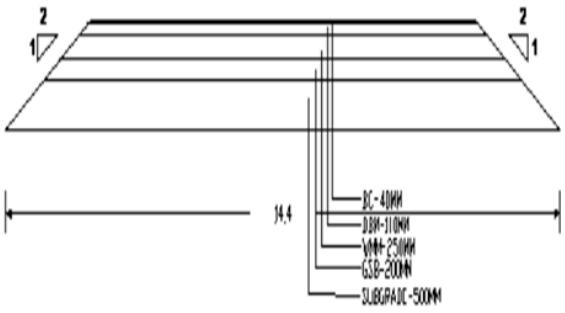


Figure: cross section of existing road

The grade of bitumen used is -------19mm+10mm+SD+FILLER+CRMG-60 grade of Bitumen

The material used in the DBM------40mm+20mm+10mm+SD+FILLER+Bitumen

The materials used in the WMM---40mm+20mm+10mm+SD+WATER

The material used in the GSB-------CRUSHED STONE/NATURAL GRAVEL+SD

The material used in the sub grade—GRAVELLY SOIL/MOORUM

DESIGN

The design of highway involves the following components after preparing the ground:

Bleeding:

Fig 4.3 bleeding

A film of asphalt binder on the pavement surface. It usually creates a shiny, glass-like reflecting surface (as in the third photo) that can become quite sticky.

Fig: block cracking

Interconnected cracks that divide the pavement up into rectangular pieces. Blocks range in size from approximately 0.1 m2 (1 ft2) to 9 m2 (100 ft2). Larger blocks are generally classified as longitudinal and transverse cracking. Block cracking normally occurs over a large portion of pavement area but sometimes will occur only in non-traffic areas.

Sub-grade

- In a fill section, the sub grade is the top of the embankment or the fill;
- In a cut section, the sub grade is the bottom of the cut;
- The sub grade supports the sub base and/or the pavement section; and
- The rough grade is the top grade of the embankment as built using the provided on the grade sheets.

Select Material

Good quality construction materials make superior pavements. Thickness, performance and efficiency of pavements depend upon quality of highway materials.

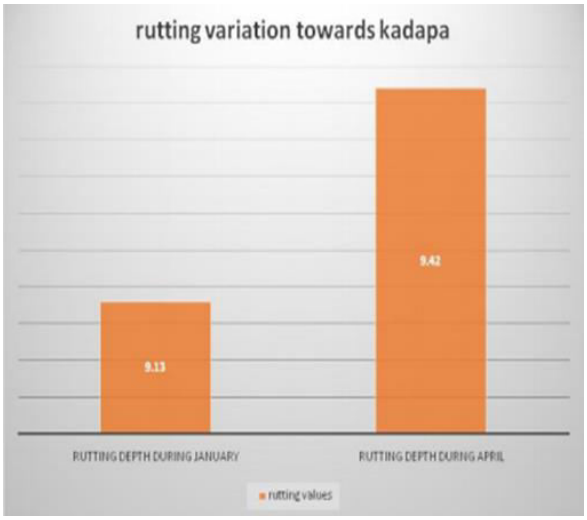
- Sub-grade soil;
- Stone aggregates;
- Bituminous materials; and
- Cement and cement concrete Hence these are the materials that have been selected for the construction of National Highway.

Base Course

• A base course is the layer immediately under the wearing surface;
• This definition applies whether the wearing surface is bituminous or Portland-cement concrete 8 in. or more thick;
• Because the base course lies close under the pavement surface, it is subject to severe loading; and
• Base course must be of higher quality than the under laying 'basement' soils.

Pavement:

• The pavements of the early Roman roads can be divided into three main types, according to the quality of their construction;
• Viaeterrenae, the lowest type, which were made of levelled earth;
• Viae glareatae, which had gravelled surfaces; and
• Viae munitae, the highest type, which were paved with rectangular polygonal stone blocks. A road pavement is a structure of superimposed layers of selected and processed materials that is placed on the basement soil or sub grade. Component layers of flexible pavements
• The uppermost layer of a flexible pavement is called the surfacing;
• The primary function of this layer is to provide a safe, smooth, stable riding surface, i.e. a carriage way, for traffic; and
• The secondary functions are to contribute to the structural stability of the pavement and protect it from the natural elements. Component layers of a rigid pavement
• The cross-section of a rigid roadway comprises a pavement superimposed upon the sub grade, and most usually this pavement is composed of a cement concrete slab on top of a sub base;
• Concrete slabs in rigid pavements are either jointed unreinforced or reinforced; and
• If the sub grade is strong then, technically, a sub base can be omitted from the pavement.



Graph: shows variation rutting depth TOWARDS KADAPA

the nominal effects of pavement roughness on vehicle-pavement interaction are demonstrated. Pavement roughness is the primary cause for moving dynamic tyre loads on pavements. Control and management of pavement roughness can aid in limiting the magnitude of moving dynamic tyre loads on a pavement. Although it has been known for long that pavement roughness deteriorates with traffic and time, the effect on moving dynamic tyre loads and structural pavement lives could not easily be quantified. In the paper a simplified and practical method is demonstrated that can be used to obtain an initial quantification of the effects of pavement roughness on these parameters, based on input data from the vehicle population and pavement roughness.

COST ESTIMATE

The cost estimation for the project is extremely important as the viability and implementation of a project depends on the project cost. Therefore, cost estimates have been carried out with due care. Estimation of preliminary cost, a primary pre-requisite for economic and financial evaluation, has been carried out for construction of new bridges, cross drainage structures, road furniture, bus bays, rest areas, toll plazas etc. Based on the improvement options considered, the quantities are worked out for the adopted Flexible pavement design based on the traffic data and other design criteria. The analysis of rates was carried out as per the Standard Data Book of MORT&H. The rates of materials were obtained from the SSR of Andhra Pradesh (2018-19). Market rates were adopted for items for which the rates were not available in SSR.

Table: Materials required for the Execution of 1km Rigid Pavement

S. No	Description	Unit	Qty	Remark
	Portland Cement	Ton	9,596	4qnt/m3
	Aggregate (gravel)	Cu.M	360	0.15/m3
	River sand	Cu.M	960	0.40/m3
	Sub base Material	Cu.M	3,045	

The analysis of breakdown of works is given in Table above. The major constituents are concrete works, toppings, fabric reinforcement, crushed stone base, preliminaries and blinding layer. These constitute 46.28%, 13.79%, 11.60%, 7.61%, 4.80%, and 4.36% respectively. the Cost analyses of the breakdown of the cost of construction are given in table 4 above. The major components are asphalt pavement, weaning course, sub-base material and preliminaries.

V DISCUSSIONS:

Based on the design above, the quantity of various materials required for the construction for a four-lane highway is formulated below:

- Economically the construction of highway design is very high;
- The construction of highway have been referred from IS 2720; and
- This highway constructions will be taking much time to complete the project

VI CONCLUSIONS

From the above study, it is recommended that traffic studies should be done effectively and more lasting forecasting models be used in determining traffic volumes to avoid upgradation of highways within a short period of time. Construction of highways should be taken seriously with good quality control measures, to avert partial or full upgradation and as well rehabilitationwithin a short period of time. Contractors and politicians should be made to understand the importance of quality works and should not intrude and insist on profit at the detriment of the project and or the people and the environment.

The total quantity of materials required for a highway at Kadapa to Kurnool are as given below:

- The designed cross-section of highway compares very well that of the design of NH 18;
- This highway road increases the speed efficiency of the vehicles; and
- By laying this highway we can increase the transportation facilities.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Christelle Didier, Engineering ethics at the Catholic University of Lille (France): research and teaching in a European context, Eur. J. Eng. Educ. 25 (February) (2000) 325–335, https://doi.org/10.1080/03043790050200368.

[2] Michiel Brumsen, Ethics in engineering in The Netherlands: the role of professional associations, universities, and law, Int. J. Eng. Educ. 21 (3) (2005) 391–401.

[3] Hengli Zhang, Michael Davis, Engineering ethics in China, Bus. Prof. Ethics J. 37 (1) (2018) 105–135, https://doi.org/10.5840/bpej201821967.

[4] Geoffrey M. Hodgson, What are institutions? J. Econ. Issues 40 (1) (2006) 1–25, https://doi.org/10.1080/00213624.2006.11506879.

[5] Douglass C. North, Institutions, institutional change and economic performance. Political Economy of Institutions and Decisions, Cambridge University Press, Cambridge, 1990. https://books.google.com/books?id=oFnWbTqgNPYC.

[6] E. Ostrom, R. Gardner, A. Agrawal, J. Walker, J.M. Walker, J. Walker, Rules, Games, and Common-Pool Resources. ACLS Humanities E-Book, University of Michigan Press, 1994. https://books.google.com/books?id=DgmLa8gPo4gC.

[7] Clifford Geertz, What is a country if it is not a nation? Brown J. World Aff. 4 (2) (1997) 235–247. [8] Sara R. Jordan, Phillip W. Gray, Responsible conduct of research training for engineers: adopting research ethics training for engineering graduate students, in: Engineering Ethics for a Globalized World, Springer, 2015, pp. 213–228.

[9] Gary Lee Downey, Juan C. Lucena, Carl Mitcham, Engineering ethics and identity: emerging initiatives in comparative perspective, Sci. Eng. Ethics 13 (4) (2007) 463–487, https://doi.org/10.1007/s11948-007-9040-7.

[10] Brock E. Barry, Joseph R. Herkert, Overcoming the challenges of teaching engineering ethics in an international context: a us perspective, in: Engineering Ethics for a Globalized World, Springer, 2015, pp. 167–187.

[11] Abdi O. Shuriye, Mohammad H. Hassan, Waleed F. Faris, Islamic engineering ethics: foundation, integration and practice, Future Text Publication (2006) 67–73.

[12] E. Ostrom, Understanding Institutional Diversity, Princeton University Press, Princeton, 2005.

[13] Michael D. McGinnis, An introduction to IAD and the language of the Ostrom workshop: a simple guide to a complex framework, Pol. Stud. J. 39 (1) (2011) 169–183, https://doi.org/10.1111/j.1541-0072.2010.00401.x.