A study of Detailed Project Report for Upgradation of Nh-3 from Two to Four Lane

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***Abstract* - The national highway development programme (NHDP) in India is carried out by a national highway authority of India (NHAI) . In India as well as in the whole world transport system plays very important role in the development of country as a economic way and in the other ways also such as development of agriculture and industries. It also helps us to reduce poverty by creating employment. Faster roads in India without sacrifices the safety are great achievement in development of highways also reduce the environmental pollution. The national highway development programmen was implemented by Mr. ATAL BIHARI VAJPAYEE in 1998. The total length of national highway in India is 66,590 kms. Recently the finance minister Mr. ARUN JAITELY announce the budget for highways development of Rs. 2,18,000 crores. One of longest highway in India is NH3. It starts from agra and ends in Mumbai. The approximation length of NH3 is 1,190 kms. The development is going on NH3 and its becoming 4 lane from 2 lane. Some portions of NH3 highways are completed by becoming 4 lane highway from 2 lane but some portion are still the under construction. The project area in this research paper are start at guna in madhya pradesh and ends in Raghogarh –vijaypur.**

INTRODUCTION

A better road network plays very important role in the development of the country in many ways such as economy etc. From the last few years the traffic in the citys as well as on the highways are continously increasing thats why the rate of accident are also increasing. Government are continously working on the development of roads for the safety of people. Many highways are already developed and some are going on. One of the developing highway is NH3. The some parts of NH3 highway are already developed by converting into 4 lane from 2 lane. But some part of highway are still under construction.

The length of highways in india is 66,590 kms. The NH3 highway is one of the largest india national highway which starts from agra in uttar pradesh and ends in mumbai in maharastra. The highway is passes through the citys of uttar pradesh , rajasthan , madhya pradesh and maharastra. The NH3 highway is also known as agra – bombay highway. The length of NH3 highway is 1,190 kms. Currently the road between agra and gwalior is four lane. But the road from gwalior to shivupuri , guna , maksi , dewas is not four lane . the condition of road is very poor but construction is going on .

Fig 1. **NH3 HIGHWAY**

SIGNIFICANCE OF STUDY

Tarnsportaion plays very imporatnt role in the development of the country. It contribute to the economical , cultural and industrial development. The development generally based on the developed roads. The NHAI already devleoped some roads and highways into four lane. The significance of the developed road are as following –

- ✓ A developed road saves the travelling time.
- ✓ A developed road reduce the accident.

- ✓ A developed road provied the better riding quality.
- ✓ A developed road reduce the fuel requirenment of the vehicle.
- ✓ A developed road helps in the reduction of the environmental pollution specially the air and noise pollution.

OBJECTIVE OF THE STUDY

The objective of the study states that what student or the reseacher wants to do in the project. The main focus in this study is that how NHAI is playing important role in the development of the NH3 highway in the area of guna to raghogarh-vijaypur in madhya pradesh. The centre area in project are as follow-

- ✓To design a four lane highway from two lane to reduce the traffic.
- ✓To rupture the travel time.
- ✓To devleop easy , short and economic trasportation system.
- ✓To compare the economic of the pavements.
- ✓Calculate the project costing.

ROUTE PLANNING

Planning with respect to road construction takes into the account of present and near uses of the transportation system to satisfy maximum service with a minimum of financial and environmental cost. The main objective of the initial phase of road network development is to establish specific goals and prescriptions for road network development along with the more general location needs the route planning phase is the time to calculate enviornmental and econmic settlement and should set the stages for the remainder of the road development process.

ROUTE LOCATION

A poor road can appoximate always be fixed. However , no amount of quality surveying or design work can perfect any powerful location error. Some factors to remember when locating roads include :

- ➢ Avoid high consumption hazard sites , particularly where mass collapse is a possibilty.
- ➢ Locate roads where maximum resources are available.
- ➢ Avoid sideslip locations on long, elevated, or unsettled slopes.
- ➢ Utilize natural terrain features such as stable benches, ridgetops, and low gradient slopes to minimize the area of road disturbance.

PAVEMENT DESIGN

FLEXIBLE PAVEMENT DESIGN BY **IRC 37:2001**

PARAMETER FOR DESIGN –

- ✓ Design traffic in term of cumulative number of standard axles.
- ✓ CBR value of sub grade.

For estimating Design traffic, the following information is needed:

- ✓ Initial traffic after construction in terms of number of commercial vehicles per day(CVPD)
- ✓ Traffic growth rate r (%)
- ✓ Design life in number of years
- ✓ Vehicle damage factor(VDF)
- ✓ Distribution of commercial traffic over the Carriageway.

DESIGN DATA

- ✓ Category: NH
- ✓ Type of road: Four lane divided road
- ✓ Initial traffic in each direction in the year of completion of construction: 2048 CV/day
- ✓ Design life: 20 years (as per IRC 37-2001 page no.11)
- ✓ Design CBR of subgrade soil: 3 % (as per test results of collecte samples)
- ✓ Traffic growth rate: 7.5 % (as per IRC 37-2001 page no. 11)

DESIGN CALCULATION

- ✓ Vehicle damage factor: 4.5 (as per IRC 37-2001 page no.: 12)
- ✓ LDF: 75% of number of commercial vehicles in each direction (as per IRC 37-2001 page no.: 13)

Cumulative number of standard Axles

$N= \{365[(1 + r)^n -1]/r\}*A*D*F$

$N= 365*[(1+0.075)^{20} - 1] *2048*0.75*4.5/ 0.075 = 109$ MSA

Total Pavement thickness =870mm (as per IRC 37- 2001 Design chart pg no.9)

Thickness of BC= 50mm

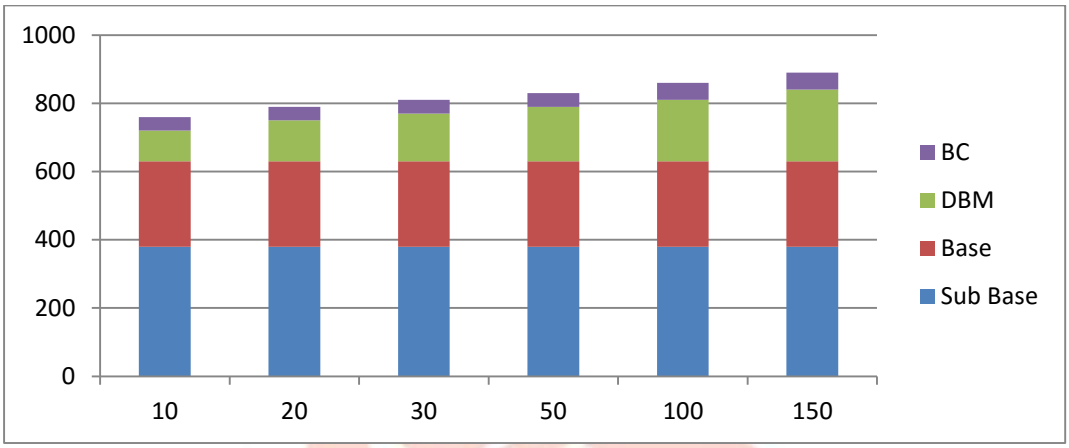
Thickness of DBM=190mm

Thickness of Base=250mm

Thickness of sub base=380mm
Individual thicknesses are according IRC 37-2001 Plate no.2 page no.30.

Cumulative Traffic (msa)	Total pavement Thickness (mm)	Pavement Composition			
		BC (mm)	DBM (mm)	Base	Sub Base
10	760	40	90	250	380
20	790	40	120	250	380
30	810	40	140	250	380
50	830	40	160	250	380
100	860	50	180	250	380
150	890	50	210	250	380

IRC37-2001 Design Chart MSA and CBR of 3% sub grade soil



DESIGN CHART

- **RIGID PAVEMENT DESIGN :** DESIGN BY **IRC 58:2002**

DESIGN DATA

- ✓ Category: NH
- ✓ Type of pavement: Four lane divided road
- ✓ Total two way traffic: 4192 CV/day
- ✓ Design life: 20 years (as per IRC 58-2002, clause 4.4)
- ✓ Size of concrete: 40 MPa
- ✓ Flexural strength of cement concrete: 45kg/cm^2
- ✓ Design CBR of sub-grade soil: 3 % (as per test results of collected soil)
- ✓ Effective modulus of sub-grade & 3 given in appendix): 9.7 kg/cm^2/cm (as per IRC 58-2002, table 2 of DLC sub-base
- ✓ Elastic modulus of concrete: 3*10^5 kg/cm^2
- ✓ Poisson's ratio: 0.15
- ✓ Co-efficient of thermal co-efficient of concrete: 10*10^{-6}/^{o}C
- ✓ Tyre pressure: 8 kg/cm^2(as per IRC 58-2002, clause 4.2)
- ✓ Traffic growth rate: 7.5 % (as per IRC 58-2002 clause 4.4)

DESIGN

- ✓ Traffic rate: 4192 CV/day
- ✓ Design life: 20 years
- ✓ Cumulative repetition in 20 years: 66.25 msa
- ✓ Design traffic 25% of total repetition of commercial vehicles: 16.56 msa

Cumulative repetition= Traffic volume *no of days in a year * $\{(1+r)^n - 1\}/r$ =66.25 msa
r = traffic growth rate , n = no of years of design life.

Trial thickness 32 cm

Cumulative Fatigue Damage Calculation						
Axle Load(AL), tonnes	AL*1.2	Stress (Kg/cm^2)	Stress Ratio(SR)	Expected Repetitions (n)	Fatigue Life(N)	Fatigue life consumed (n/N)
Single Axle						
0	0	0	0.00	0.0E+00	Infinite	0.000
20	24	24.5	0.54	5.6E+04	1.66E+05	0.33

18.5	22.2	22.5	0.5	1.1E+05	7.62E+05	0.144
16.5	19.8	19.5	0.43	3.4E+05	infinite	0.00
14.5	17.4	19	0.42	2.2E+05	Infinite	0.000
12.5	15	17.5	0..38	3.3E+06	infinite	0.000
10.5	12.6	12.5	0.27	7.0E+06	infinite	0.000

Tandem Axle						
0	0		0.000	0.0E+00	infinite	0.000
32.5	39	17.5	0.38	5.6E+04	infinite	0.000
28.5	34.2	16	0.35	0.0E+00	infinite	0.000
24.5	29.4	14	0.31	6.2E+05	infinite	0.000
20.5	24.6	11	0.24	2.0E+06	infinite	0.000
16.5	19.8	10	0.22	9.6E+05	infinite	0.000
Less than 14			0.00	2.8E+05	infinite	0.000
				Total CFD	=0.474	**0.474**

DESIGN CALCULATION FOR CFD

As CFD is less than 1 so design acceptable

COST ESTIMATION

The cost of construction of pavement is a major criterion for choice of road type, flexible or solid, particularly when the funds are few and the government funding is limited. It is therefore required to examine the economics of various pavement types not only for the initial construction cost but also for the life cycle costs which includes the discounted maintenance and overlay costs that are incurred during the design life of the pavement. The cost of road thus includes (a) initial construction Cost (b) Maintenance and Re-habilitation Costs.

RIGID PAVEMENT

Initial cost

Item	**Length (Meter)**	**Breadth (Meter)**	**Thickness (Meter)**	**Volume (Metre^3)**	**Rate (Rs)**	**Total (Rs)**
DLC	1000	15	0.10	1500	2757	4135500
Cement concrete pavement	1000	15	0.32	4800	3998	19190400
steel				33(tonne)	42500 (tonne)	1402500
					TOTAL	**24728400**

INITIAL COST CALCULATION

Maintenance Cost

Maintenance cost for rigid pavement is taken as 1% of initial construction cost for every year for total design life.

LIFE CYCLE COST

For calculating life cycle cost design life is taken as 20 years and inflation rate is taken as 10%. Life cycle cost of rigid pavment after 20 years is Rs. 26833668.09 .

FLEXIBLE PAVEMENT

Initial Cost

Item	**Length (Meter)**	**Breadth (Meter)**	**Thickness (Meter)**	**Volume (Metre^3)**	**Rate (Rs)**	**Total (Rs)**
Asphalt layer	1000	15	0.25	3750	4600	17250000
Base	1000	15	0.25	3750	741	2778750
Subbase	1000	15	0.38	5700	400	2280000
					Total	**22308750**

INITIAL COST CALCULATION

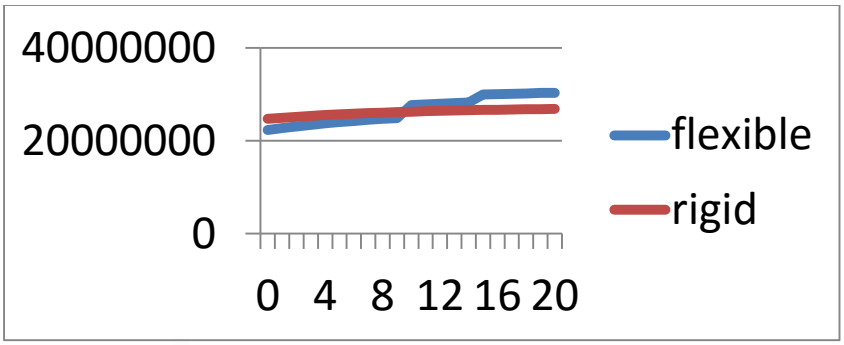
Maintenance Cost

Maintenance cost of flexible pavement is taken as 2% and overlay of 100mm of asphalt layer is provided in 10^{th} and 15^{th} year.

Life Cycle Cost

For calculating life cycle cost design life is taken as 20 years and inflation rate is taken as 10%.
Life cycle cost of flexible pavement after 20 years is Rs. 30327985.32 .

Cost comparison



COST COMPARISON GRAPH

The initial cost of construction of rigid pavement is 21% more than flexible pavement**.** But after including maintenance cost for 20 years cost of flexible pavement increases by 6%.

Economic Development:

Highways development program can contribute to economic development by encouraging the attraction of business to sites equipped with good access and by improving the travel efficiencies of existing business and to start a new avenues. They also help for Development of industries such as GAIL and NFL, Development of new project sites., Infrastructure projects, Employment Opportunity Highway development project serves as an important employment generator and provide employment opportunity during construction period.

Reductions in Accidents:

Development of highway projects, especially 2/4 lanes divided carriageway of NH-3 projects in reducing the number of accidents through the following developments. Improved crossing and alternatives access routes by use of signage, junctions, & alternate arrangement for local traffic circulation has been provided.

Reductions in Operation Cost:

Vehicle operating cost (VOC) will be reduced when a road is improved. Fuel consumption, wear and tear of tires, suspension will be benefited when a geometric design is improved and the road surface is made more even.

CONCLUSION

Highway projects promote access to markets, materials and opportunities by facilitating movement of persons and goods and improve earning and thereby level of living. The ultimate aim of the development activities, such as NH-3 is to promote societal welfare of Guna area of Madhya Pradesh State . The benefit of proposed widening of NH-3 may also be seen from a different angle, viz, the local benefit and the wider regional or national level benefit. Devleopment lead to changes in the level of well-being and human development, through their benefit of consumption level, educational attainment, health status etc. The road construction will provide better transportation facility for tourists visiting guna region .

In this paper we design both rigid as well as flexible pavment. But rigid pavment is more comfortable than flexible pavment. We also compared the cost of both the pavment and we found that rigid pavment is more economic than flexible pavment after adding the 20 year life cycle cost.

For reduction in accident installation of proper road safety system through signage, barricades, crash barriers, edge posts / parapets will add to be safety of the vehicular traffic on the stretch of the road.

REFRENCES

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