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Design & Estimate for Six Laning of Gurgaon-Jaipur Section from Km 25+000 to Km 40+000

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Abstract

The National Highways are the main highways running through the length and breadth of the country connecting major parts, foreign highways, state capitals, large industrial and tourist centres etc. The National Highway no. 8 connecting the two metro cities (The Capital of India) and Mumbai (The Capital of Maharastra) and passing through major cities like Gurgaon, Jaipur, Ajmer, Udaipur, Ahemadabad, Vadodara and Surat enroute. The Detailed design for upgrading the existing Four lane highway into Six lane highway from Km. 25+000 to Km. 40+000 (15km length) in between Gurgaon and Jaipur has been studied. The design is based on the Specification and Standard given in the "Manual for Six Laning of National Highways, IRC SP: 87-2013" other relevant IRC codes and technical, traffic data was collected to estimate the design traffic volume for use in Pavement design. The Quantity surveying is done to calculate quantities of road construction items like Earth works, Sub-base course, Base course and Bituminous items as indicated in the "Good for Construction" drawing. Estimating is done by multiplying the quantities for each item rates given in "Schedule of Rates", PWD Haryana.

Keywords: *Six Laning, Gurgaon, Jaipur.*

Introduction

The National Highways Authority of India (NHAI) has been entrusted with the development, maintenance and management of such of the highways as entrusted to it by the government. Under National Highway Development Project (NHDP) Phase-V programme, the Govt. has decided to convert some of the existing four lane highways into six lane highways. These projects are to be executed by private entrepreneurs as Design, Built, and Finance & Operation (DBFO) projects. The Institution of Civil Engineers (India) is appointed as the Consultant for preparation of Detail Design for upgrading the existing 4-lane highway to 6-lane partially access control highway for 15 Km Length from Km 25+000 to Km 40+000 in between Gurgaon to Jaipur Section.

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The project highway consists of National Highway i.e. NH 8 (Km 25+000- Km 40+000). The project section on NH 8 passes through Districts Gurgaon in the State of Haryana.

Gurgaon district lies in NCR of Delhi, the Capital of Indian. It is just 10 kms away from Indira Gandhi International Airport, Delhi. The district derived its name from the name of Guru Dronacharya in Mahabharata; the village was given as gurudakshina to him by his students; the Pandavas and hence it came to be known as *Guru-gram,* which in course of time got distorted to Gurgao.n. Thus the district has been existence since the times of Mahabharata. The district is surrounded by Delhi & Rajasthan.

In present time Gurgaon is largest satellite city in IT sector in India. Gurgaon is NH-71 Road connections with amongst North India. The total population of this district is about 15.14 lakhs according to the 2011 census and the population density is 1241.

The manufacture of chemicals and large Industrial motors factory are the chief industries. Wheat, Rice, Groundnut and Rabi are the chief crops grown in the surrounding area.

Results and Discussions

Design Methodology and Design Standard for Structures

The design of new structures shall be based on the following materials and loading:

Materials

(i) Concrete Grade

Grade of concrete in various elements has been kept as follows for moderate conditions of exposure:

All PSC members	M40
All RCC members	M30 for bridges with PSC spans and other major bridges

M30 for minor bridges M20 for culverts

All PCC members	M25 for bridges with PSC spans and major bridges

M15 for minor bridges and culverts

(ii) Reinforcement Steel

High yield strength deformed bar shall be of grade Fe 415/ 500

Mild steel bars shall be of grade Fe240

Exposure Condition

Moderate exposure conditions have been considered while designing various components of all the structures.

Concrete Clear Covers:

For all reinforcement	As per Cl. 304.3 of IRC:21
For prestress cable	As per clause 16 of IRC: 18 duct to outer most fibre

Pre-stressing System

a)	System (Post tensioning)	19K13 multipull strand system of "Freyssinet" or "ISMALCCL" or equivalent
0b)	Cables (Post tensioning)	19K13 cables with strands of 12.7mm nominal dia
c)	High Tensile Steel	(for both post/pre tensioning)
	Strands	Nominal 12.7mm dia 7 ply low relaxation strands conforming to class 2 of IS: 14268- 95
	Area	98.7 sq.mm per strand (nominal cross sectional area)
	Ultimate load	183.71 KN per strand
	Modulus of Elasticity	$1.95x10^5$MPa
d)	Sheathing (Post tensioning)	7Smm OD/90mm OD Bright metal corrugated flexible sheathing for
e)	Friction Coefficient (Post tensioning)	0.25/radian
f)	Wobble Coefficient (Post tensioning)	0.0046/m
g)	Anchorage Slip (Post tensioning)	6mm average
h)	Loss of force due to relaxation	2.5% at 0.7 UTS after 1000 hrs.The final relaxation value for design shall be 3.0 times the 1000 hr. value as per cl. 11.4 of IRC:18-1985.

Stressing shall be carried out simultaneously from both ends. All the strands of a cable shall be stressed in one go. Provisions for 4% emergency cables will be provided. If they are not utilised during construction, they will be pulled out and cable ducts will be grouted and plugged suitably. Access to the super-structure shall be provided to enable maintenance, inspection and future pre-stressing operations.

Structural Steel

Structural steel shall conform to IS:226 with yield stress of 23.6 kg/mm^2

Bearings

Reinforced elastomeric bearings has been proposed for short span simply supported superstructures. Elastomeric bearings shall be designed as per IRC:83 (Part II) and shall conform to Cl.2005 of MOST's Specifications for Road & Bridge Works (4th Revision).

RCC type solid slab superstructures of bridges has been proposed to rest directly on pier/abutment caps with a tar paper in between.

Pot fixed/Pot PTFE sliding bearings has been proposed for long span simply supported superstructures. These bearings shall be designed and supplied by the approved manufacturers. The loads and forces on the bearings shall be calculated to enable the manufacturer to design these bearings and these shall conform to Cl. 2006 of MOST's Specifications for Road & Bridge Works (4th Revision).

Expansion Joints

The following types of Expansion Joints shall be adopted:

(i) Filler type expansion joints

Has been proposed for minor bridges with solid slab superstructures having span lengths not exceeding 10 metres. These type of joints shall conform to Cl. 2605 of MOST's Specifications for Road & Bridge Works (4th Revision).

(ii) Single Strip seal expansion joints

Has been proposed for superstructures having movements up to 80mm (± 40mm).

The strip sea l type expa nsion joints s hall conform to Cl. 2607 of MOST's Specifications for Road and Bridge works (4th Revision).

Conclusions

One of the objectives of RSA is to enhance operational safety. This study has highlighted how the operational efficiency and safety is impacted owing to presence of a large number of un developed major and minor intersections due to ROW constraints, unauthorized gaps in central verge, steep curves with small radius of curves, absence of road signages and road markings and unregulated movement of stray cattles, thereby underlining the importance of RSA. The meager reduction in fatalities after up gradation of roads shows the presence of safety hazards and black spots requiring immediate attention.

Need to make RSA mandatory

Many issues concerning potential risks have been brought forth in this study with suggestion to address the same which goes to serve the objective of RSA. So it is imperative that RSA should be made mandatory for road projects by issuing guidelines and instructions by Road Authorities.

Recommendation for future study

The short coming pointed out above under site inspection is of very serious nature and requires to be attended immediately. Further, it would be interesting to evaluate the impact of implementation of safety measures out of this study as a review of RSA along

with assessment of risk rating.

References

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[3] IRC: 7- 1971Recommended Practice for Numbering Bridges and Culverts (First Revision)
[4] IRC: 18-2000 Design Criteria for Prestressed Concrete Road bridges (Post-Tensioned Concrete) (Third Revision)
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