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TESTING OF EXISTING PAVEMENT MATERIALS OF NH – 12 FOR THE FORMULATION OF IMPROVEMENTMETHODS FOR HIGHWAY DEVELOPMENT

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ABSTRACT

Expansion of existing 2 lanes to 4 lanes highway including service road with different type of structures like flyovers, bridges, underpasses (VUP, PUP, CUP etc.) and toll plaza. The pavement design of the Highway Road,Materials Used in structures, project information, company information and department information and Testing of the Materials Used.

Highway which includes main carriage way, existing two lanes to Four lane, drainage and service road etc. and bridges which includes minor bridges and major bridges, underpasses which includes VUP (vehicular underpass), PUP (pedestrian underpass), CUP (cattle underpass) etc. and toll plaza and their concept of construction and the design, planning and layout are mentioned in this report

***Keywords*:*VPU, PUP, CUP, Pavement, Toll plaza*.**

I. INTRODUCTION

The stretch of the Highway pavement which is a part of the Project of extension to Four lanes of existing Two lanes for Kota-Jhalawar (Kota-Mandana) Road section of National Highway (NH) No.12 in the state of Rajasthan on Built Operate and Transfer (BOT) basis. In this project we studied design, construction methods and difficulties faced in construction of the flexible pavement. Survey, traffic forecast and design of flexible pavement using IRC: 37 has been completed.

And after that construction aspects and use of various construction methodology and machineries have been studied in detail. Construction aspects include the use of various Materials, Machines, and Manpower. Also, Quality Assurance (QA) & Quality Control (QC), aspects incorporated in the construction procedure have been studied and these are included in the project report. Testing of various materials is carried out for Quality Assurance and Quality Control of the flexible pavement.

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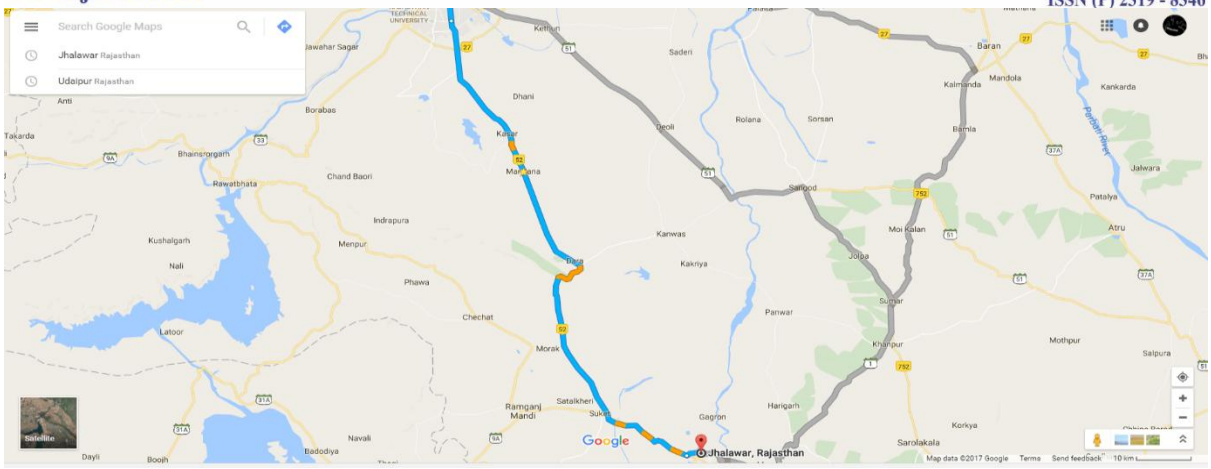

Fig.1: Project road Map

The two-lane to four-lane national highway project between Kota and Teendhar in Jhalawar was announced in 2009, mainly to reduce the time and cost of travel between Kota – Teendhar (Jhalawar) and to boost trade in Hindaun region of Rajasthan. NHAI proposed a four-lane highway stretch of 88.09 km on NH-12 under NHDP Phase III on Design, Build, Finance, Operate and Transfer (DBFOT) basis in BOT (Toll) mode of delivery.

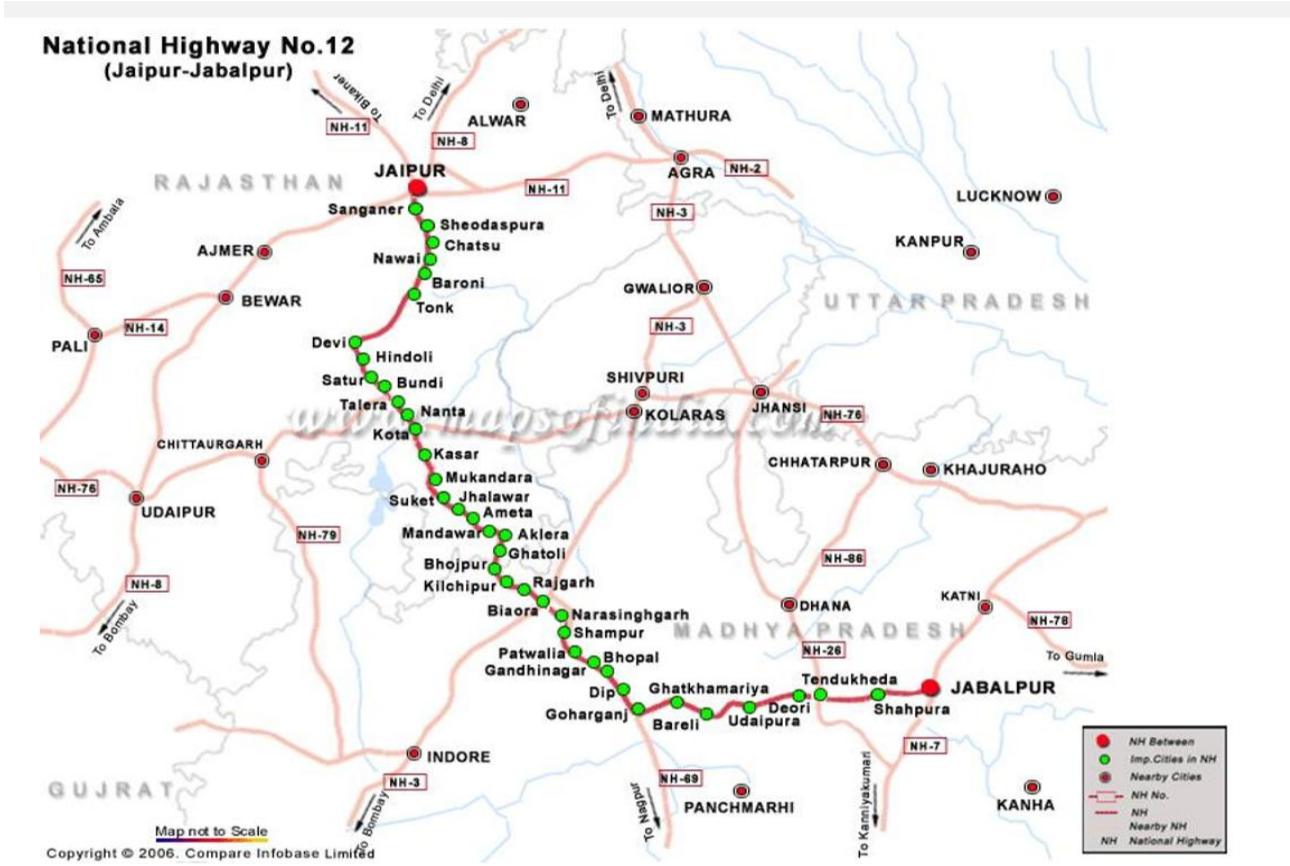

Fig.2. Project Road Map

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II. OBJECTIVES OF THE PROJECT

- The main goal of this study is to get an insight of the design and construction aspects and problems faced in the expansion/widening of roads. To evaluate the various tasks, methodologies which are undertaken for the design and construction of a Highway pavement.
- To study how to achieve a sound and economical engineering design considering the various factors viz. climate; quality of local materials, construction technology, environmental conditions etc.
- To study the complex design process considering realistic assessment of subgrade strength, traffic loads & traffic projection, environmental factors and several other factors.
- To study thegeneral design procedure based on the design of new pavement structure done as per IRC: 37(Guidelines for the design of flexible pavements). It includes study of the various design parameters.
- To study the Impact of use of Construction machinery on the construction schedule. Examining of critical aspects of soil and material testing. To study impact on environmental aspects due to highway construction.
- To study the various steps taken for completion of the work within estimated budget and time and also maintaining the quality of work as per required specifications.

III. METHODOLOGY

The detailed data and information related to the design and construction methodology of the projects of Four lanes of existing two lanes of the Kota – Jhalawar National Highway that are necessary to carry out the study have been provided by the Monte Carlo Constructions Pvt Ltd.

The works includes construction of following: -

1. Road Works Viz: Site Clearance, Survey, Earthwork, Sub Base & Base Course, and Bituminous Works.
2. Drainage & Protective Work
3. Traffic Signs, Markings and Road Accessories
4. Miscellaneous and Maintenance of Roads

The methodology includes the use of various equipment's to carry out the various procedures such as the Site clearance, Earthwork, bituminous works etc. as per the required specifications.

Table.1: List of tests carried out

List of Test carried out for Soils and Aggregate	
Sr. No.	**Description**
A. Soil & Borrow Area	
1	Natural Moisture Content
2	Sieve Analysis of Granular Material
3	Free Swell Index
4	Atterberg's Limit
5	Modified Compaction Test
6	California Bearing Ratio
B. Granular material	

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1	Sieve Analysis
2	Atterberg limit
3	Ten percent fine value Test
4	Modified Proctor Test
5	California bearing ratio Test
C. Aggregates	
1	Water Absorption
2	Flakiness Index & Elongation Index
3	Aggregate Impact Value
4	Specific gravity test

IV. MAJOR CONSTRUCTION ACTIVTIES

The construction work of four lane highway from Kota to Jhalawar includes following major areas:

- Construction of Flexible Pavement
- Construction of Major bridges
- Construction of Rail Over Bridges (ROBs)
- Construction of Culverts

V.CONSTRUCTION OF FLEXIBLE PAVEMENT

(1)Total new construction

(2) Widening of one side (Eccentric widening)

(3) Widening on both side (Concentric widening)

V. TEST

Fine Aggregate Report

This is with reference to above; we have received the sample of Sand for sieve analysis for Zone classification, Relative density. The test conducted as per I.S. 2386 part I and results of the same areas under:

SAMPLE TAKEN: 1000 gm.

Table.2: Sieve Analysis

Sieve Size	Wt. of Soil Retained	Weight of Soil retained (%)	Cumulative % mass retained	% of passing	Limit as per I.S. – 383 ZONE – II
4.75	104	10.4	10.4	89.6	90-100
2.36	81	8.1	18.5	81.5	75-100
1.18	216	21.6	40.1	59.9	55-90

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600µ	224	22.4	62.5	37.5	35-59
300µ	242	24.2	86.7	13.3	8-30
150µ	88	8.8	95.5	4.5	0-10
PAN	28				
Total	983				

Table.3: GRADATION TEST (Sand)

Sr.no	Description	Result	I.S Requirement as per I.S 383
1	Zone classification: The above sample falls in	Zone –II	--
2	Fineness Modulus	3.14	--
3	Uniformity co-efficient from the semi log graph Cu = D60/D10	2.340	--
4	C0 = D30 2 / (D10 x D60)	0.833	--
5	Bulk Density in gm/cc	1.520	--
6	Specific Gravity	2.578	--

Table.4: OTHER PROPERTIES

Name of Work	**Four Laning of Kota– Mandana– Dara – Jhalawar Road from km 0.000 to km 88.900 of NH – 12**				
SIEVE ANALYSIS OF GRANULAR MATERIAL					
IS: 2720 (Part: 28)					
Type of Sample	**Granular**				
Total Wt. Of the sample: 30015 g					
I.S. Sieve Size	**Weight Retained**	**Percentage Retained**	**Cumulative % Retained**	**% Passing**	**Specification Limit**
75 mm	Nil	Nil	Nil 100	100	100
26.5 mm	7920	26.39	26.39	73.61	55 - 75
4.75 mm	14005	46.66	73.05	26.95	10 - 30
75 µ	` 6995	23.31	96.36	3.64	< 10 %

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Table.5: SIEVE ANALYSIS OF GRANULAR MATERIAL

Sr. No	No. of Blows / Penetration	Con No.	Wt. of can gm W_1	Wt. of can & wet Soil. gm W_2	Wt. of can & dry Soil. gm W_3	Wt. of water (W_2-W_3)	Wt. of Dry Soil gm (W_3-W_1)	Moisture content % $\frac{(W_2-W_3)}{(W_3-W_1)}$X 100
1	18	10	22.30	46.84	43.32	3.52	21.02	16.74
2	21	23	26.15	51.52	46.98	4.54	20.83	21.79
3	23	13	24.81	55.98	50.02	5.96	25.21	23.64
4	26	14	28.50	59.10	52.83	6.27	24.33	25.77

LIQUID LIMIT AND PLASTICITY INDEX: (I.S: 2720 part – v)

LIQUID LIMIT: 18.80%

PLASTIC LIMIT: %

PLASTICITY INDEX: N.P.

CBR Test:

CBR (Penetration At 2.5mm): 26.95 %

CBR (Penetration At. 5.0mm): 32.09 %

Hence CBR For Tested Sample: 32.09 %

No. of Layer – 5

No. Blows – 56 per Layer

Volume of Mould – 2250 cc

Surcharge Weight Used = 5000 gm

Table.6: California Bearing Ratio Test (IS: 2720 (PART – XVI)

Fraction		Sample Weight taken (A) Gm	Wt. Retained on flakiness gauge (B) gm	Wt. Passing flakiness gauge (A–B) gm	Wt. Taken (B)	Wt. Passing elongation (C) gm	Wt. Retained on elongation (B – C)
Passing IS Sieve, Mm	Retained IS Sieve mm						
1	2	3	4	5	6	7	8
40	31.5	742	667	75	667	627	40
31.5	25	946	885	61	885	820	65
25	20	390	345	45	345	310	35
20	16	300	273	27	273	244	29
16	12.5	497	412	85	412	363	49

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12.5	10	485	399	86	399	298	101
10	6.3	434	296	138	296	216	80
Total		3794		517	3277		399

ELONGATION & FLAKINESS INDEX: (I.S. 2386 (Part – I))

Flakiness Index $\frac{\Sigma \text{ Column 5}}{\Sigma \text{ Column 3}} \times 100 = \frac{517}{3794} \times 100 = 13.63\%$

Elongation Index = $\frac{\Sigma \text{ Column 8}}{\Sigma \text{ Column 6}} \times 100 = \frac{399}{3277} \times 100 = 12.81\%$

FI + EI = 13.63 + 12.18 = 25.81%

Table.7: ELONGATION & FLAKINESS INDEX

I.S. 2386 (Part – I)

DESCRIPTION	SAMPLE – 1	SAMPLE – 2
Total Weight of oven dry sample passing 12.5 mm sieve and retained on 10 mm Sieve (W1),gm	342	356
Weight of portion passing 2.36 mm sieve, (W2)gm	60	57.5
Weight of portion retained 2.36 mm sieve, (W3)gm	282	298.5
Aggregate Impact Value = (W2/W1)x100 %	17.54	16.15
Aggregate Impact Mean Value = (1+2) / 2 %	Average 16.85	
Acceptance Criteria Specified: 30% Max.		

Table.8: Water Absorption Test I.S. 2386 (Part – III)

Sr.no	Description	Unit	Test
A	**Weight of Saturated Surface Dry Sample (After 24 hrs. immersed in water)**	**gm**	**600**
B	**Weight of Saturated Surface Dry Sample (After 24 hrs. dried in oven)**	**gm**	**594.5**
C	**Water Absorption (A – B) / B * 100**	**%**	**0.925**
Name of Sample: 18 MM **Source: Kota** **Initial weight of Sample taken: 600 grams**			

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VI. CONCLUSIONS

The project on construction of four lane highway between Kota and Jhalawar has been quite challenging and informative. The project is very good for learning various aspects of actual design and construction of flexible pavement. During project work various aspects of flexible pavement have been covered viz. type of survey, traffic forecast, selection of design parameters, construction methodology, material investigation survey and material testing etc. During site project team got opportunity to visit actual construction and interaction with project implementation agencies. Also, problem faced during the actual project implementation have been gathered along with the project specific problem solution. Overall this Industry Defined Project remains quite fruitful. Learning from various phases of this project will be highly useful for the future work in this area.

VII. FUTURE SCOPE OF WORK

- Quantify and characterize the loadings of the various vehicles that uses the current facility.
- Investigate and evaluate the potential of suitable pavement alternatives for a cost-effective alternative to accommodate the present and future traffic loads on the road
- Evaluate the potential advantages and disadvantages of pavement alternatives
- Carry out life cycle cost analysis on the various pavement alternatives to determine the most promising alternative
- Design proposal of a suitable access road based on the most promising pavement alternative
- Selection is limited to the most feasible alternatives considered
- Use of the AASHTO 1993 & AASHTO 2002 Guides for the Design of Pavement structures
- Pavement distress is based on cracking and rutting predictions as computed from the pavement responses using the WinJULEA software

VIII. REFERRENCES

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