Volume : 2 | Issue : 6 | June 2013 • ISSN No 2277 - 8160

Research Paper | Engineering

# Comparative Study of Flexible Pavement Design : a Case Study of Bhavnagar - Dholera Highway (Nh-8E) in Gujarat, India

**Mr Sandeep D. Khorasiya** M.E scholar

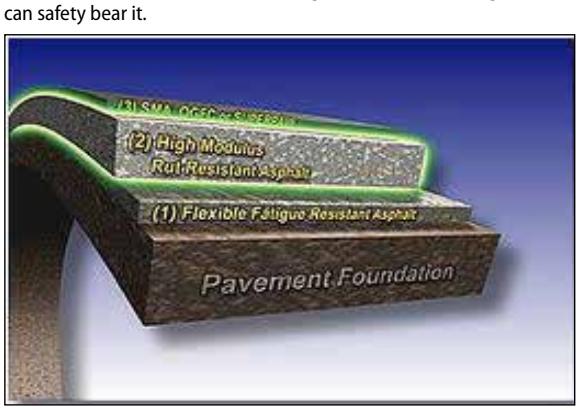
**ABSTRACT**

*The Aim of this paper is compare different types of flexible pavement design to in various condition. In this study an attempt is made to compare the IRC method of flexible pavement design using M-EPDG in terms of its design concepts and structural adequacy. It was seen that the IRC design over estimates the design requirements for all the distress types except AC layer rutting. A redesign was done to rectify this problem and the design was optimized.*

**KEYWORDS:**

## I INTRODUCTION

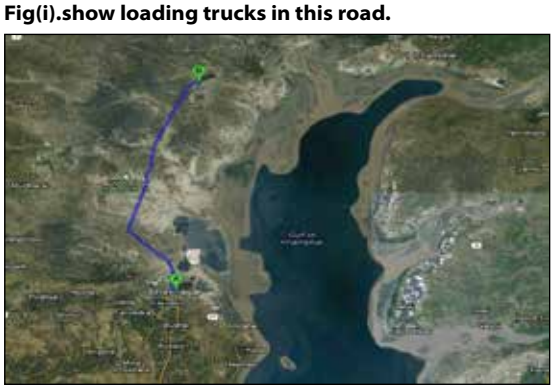
A highway pavement is designed to support the wheel loads imposed on it from traffic moving over it. Additional stresses are also imposed by changes in the environment. It should be strong enough to resist the stresses imposed on it and it should be thick enough to distribute the external loads on the earthen sub grade, so that the sub grade itself can safety bear it.




## A. IMPORTANCE OF STUDY AREA

- Connecting road of National Highway – 8 E at Bhavnagar.
- The Ahmedabad-Dholera industrial region lies within 100 km from the Dedicated Freight Corridor (DFC) in Central Gujarat
- Traffic to Alang braking ship yard which is Asia's largest ship yard is connected to this Highway.
- Pipavav port is connected with this Highway.
- For the Military and Navy purpose this Coastal Highway is very important.
- Connecting road to Kalpsar Project for sweet water.

**Fig(i).show loading trucks in this road.**



Alang is a census town in Bhavnagar district in the Indian state of Gujarat. In the past three decades, its beaches have become a major worldwide centre for ship breaking

## MARINE SALVAGE INDUSTRY

The shipyards at Alang recycle approximately half of all ships salvaged around the world. The yards are located on the Gulf of Khambat, 50 kilometres southeast of Bhavnagar.

## FUTURE

Japan and the Gujarat government have joined hands to upgrade the existing Alang shipyard. The two parties have signed a Memorandum of Understanding, which focuses on technology transfer and financial assistance from Japan to assist in the upgrading of operations at Alang to meet international standards. This is a part of the Delhi Mumbai Industrial Corridor, a larger partnership between the Japanese and Gujarati governments. Under this plan, Japan will address the environmental implications of ship breaking in Alang, as well as devising a marketing strategy. The project is to be carried out as a public-private partnership. The project's aim is to make this shipyard the largest International Maritime Organization-compliant ship recycling yard in the world.

In future about 10 to 15 years after a kalpsar yojana and dholera Dedicated Freight Corridor (DFC) in Central Gujarat to affect this road.

## PIPAVAV PORT

Port Pipavav, India's first port in the private sector, is a port on the West Coast of India for containers, bulk and liquid cargo. Its lead promoter is APM Terminals, one of the largest container terminal operators in the world. The services include pilotage/towage, cargo handling and logistics support. Port Pipavav is located in Saurashtra, Gujarat, at a distance of 90 km South of Amreli, 15 km South of Rajula and 140 km South West of Bhavnagar. The port handles both bulk, container and liquid cargo

The northwest market generates 60 % market of India and Gujarat itself major cargo generating state.

## Dholera

Dholera is a town in Gujarat, India. Dholera is an ancient port-city in Gulf of Khambhat, 30 km. from Dhandhuka village of Ahmedabad district. One of the original six temples built by Swaminarayan is located here.

Dholera Metro City Dholera is in proximity with the coastal line. It is covered by water faces on three sides, namely, on the east face by Gulf of Khambhat, on the north side by Bavaliari creek and on southern side by Sonaria creekProximity to Ahmedabad has provided Dholera a strong locational advantage with a vibrant manufacturing base and investment scenario.

Strategically located, the Ahmedabad-Dholera industrial region lies within 100 km from the Dedicated Freight Corridor (DFC) in Central Gujarat

National Highway 8 connects the Dholera Special Investment Region with Ahmedabad, Bhavnagar and Mumbai. Dholera itself has good connectivity with National Highway (NH) 8 (Anand) and 8A (Bagodra), augmenting Bagodra -Bhavnagar, Bagodra- Surendranagar- Radhanpur.

- To show in fig (i),(ii),(iii) it is the heavy traffic loading.
- Shrinkage creates crakes in subgrade in dry session.
- Consolidation creates uneven pavement in dry session.
- Due to heavy traffic and also two lane road this is the reason behind accidents.
- Heavy traffic of Multi Axle vehicles due to pipavav port,Alang Ship Yard, Connecting road to NH-8 E at Bhavnagar, Short Route for Ahmedabad , Proposed Kalpsar Project and Dahej Ferry Service.
- For the purpose of Navy and military it may not allowed to close this highway for a single day also.

**Scope of the work:-**

- To study the different method AASHTO and IRC-37(2001) of flexible pavement design.
- To choice the best suited method of given case study for flexible pavement design.
- To study the effect of applied flexible pavement methods on existing pavement on case study.
- To study the comparison of different methods (IRC-37(2001) & AASHTO) of flexible pavement.

**Objectives :-**

The key objectives of the proposed study are as under

- To study the IRC- 37(2001) and AASHTO flexible pavement design methods.
- To define problem in case study area.
- To assess the improvement in suitable choice of flexible pavement design methods.
- To Redesign the pavement of study area.
- To Compare the methodology suggested in IRC-37(2001) and AASHTO .

## II. REVIEW OF LITERATURE

In this study an attempt is made to evaluate and compare the IRC method of flexible pavement design using M-EPDG in terms of its design concepts and structural adequacy. It was seen that the IRC design over estimates the design requirements for all the distress types except AC layer rutting. A redesign was done to rectify this problem and the design was optimized and conclude that an IRC design for the study stretch was done. Using that as the trial design, analysis was done in M-EPDG software for evaluating the IRC design. It was found that the IRC section is safe for all the distresses except that for the AC layer rutting. Even though it passed the design AC rutting limit of 0.25 in, it failed for the reliability criteria. The desired reliability level of 90% could not be met with. The reliability attained was only 80.79%. There is an under design in this case. So the IRC section should be redesigned. All other distresses are within the specified limits. The AC surface down cracking, thermal fracture and permanent deformation for total pavement has a predicted reliability level of 99.99 %, 99.999% and 99.99% respectively. The reliability level desired was 90% only. There is an over design in this case.

## III. LABORATORY TEST

Experimental setup has done in three step

i) Collection of Test sample
ii) Establish in soil properties
iii) Results and Interpretation

Following laboratory tests have been carried out as per IS: 2720. The tests were carried out both on[5]

**(i) California Bearing Ratio Test**

As per IS 2720 Part 31-1990,

## IV. LABORATORY TEST RESULT

As per indian standard laboratory test was carried out in a laboratory below result i got between most sensitive section on dholera bhavnagar highway from chainage 133/00 to 160/00

**C.B.R test Result**

| Sr. No. | Location Km | CBR Value % | Sr. No. | Location Km | CBR Value % |
|---|---|---|---|---|---|
| 1 | 133 | 2 | 15 | 147 | 2.5 |
| 2 | 134 | 3.2 | 16 | 148 | 3.8 |
| 3 | 135 | 4 | 17 | 149 | 4 |
| 4 | 136 | 2 | 18 | 150 | 2.8 |
| 5 | 137 | 2.2 | 19 | 151 | 3.8 |
| 6 | 138 | 2.9 | 20 | 152 | 2.9 |
| 7 | 139 | 3.9 | 21 | 153 | 3.2 |
| 8 | 140 | 2.9 | 22 | 154 | 3.9 |
| 9 | 141 | 3.4 | 23 | 155 | 2.5 |
| 10 | 142 | 2.6 | 24 | 156 | 2.5 |
| 11 | 143 | 3.4 | 25 | 157 | 3.4 |
| 12 | 144 | 3.8 | 26 | 158 | 3.1 |
| 13 | 145 | 2.6 | 27 | 159 | 2.8 |
| 14 | 146 | 3.5 | 28 | 160 | 3.1 |

As we can see lowest value of C.B.R is 2% at chainage 133/00 and 136/00

According to IRC-37-2001 (page no 29)

At 2% C.B.R and Load (In m.s.a) is between 10-150 required thickness of layer is 950mm ,In case study area traffic is around 100 m.s.a(Source by Road and Buiding Department, Bhavnagar)

| | | TRAFFIC VOLUME | | | PCU | | | |
|---|---|---|---|---|---|---|---|---|
| Sr No. | Vehicle type | Near dholera (direction dholera to bhanagar) | Near nari chowkdi (direction bhanagar to dholera) | pcu factor | Near dholera (direction dholera to bhanagar) | Near nari chowkdi (direction bhanagar to dholera) | Total No. of vehicle | Total No. of PCU |
| 1 | 2 wheelers | 1071 | 663 | 0.5 | 535 | 332 | 1734 | 867 |
| 2 | 3 wheelers | 711 | 243 | 1 | 711 | 243 | 954 | 954 |
| 3 | Passenger car | 3963 | 2232 | 1 | 3963 | 2232 | 6195 | 6195 |
| 4 | Mini bus | 170 | 93 | 2 | 340 | 186 | 263 | 526 |
| 5 | Standard bus | 1049 | 715 | 3 | 3146 | 2146 | 1764 | 5291 |
| 6 | LCV | 422 | 351 | 1.5 | 1202 | 527 | 1153 | 1729 |
| 7 | 2-Axle | 956 | 1189 | 3 | 7826 | 4148 | 3991 | 11974 |
| 8 | 3-Axle | 1967 | 1378 | 4.5 | 15726 | 9351 | 5573 | 25077 |
| 9 | MAV | 244 | 269 | 6 | 3354 | 1615 | 828 | 4969 |
| 10 | Ag.Tr.without Trailor | 151 | 56 | 1.5 | 226 | 84 | 207 | 310 |
| 11 | Ag.Tr.with Trailor | 101 | 26 | 2 | 201 | 51 | 126 | 252 |
| | Total | 14680 | 8109 | | 37232 | 20914 | 22789 | 58146 |

**Traffic volume count survey as per IRC-37(2001).**

- P.C.U.= 58146 (Based on traffic volume count survey)
- C.V.D.= 14007 (Based on traffic volume count survey)
- n= 15 year road life
- Initial traffic after completion of construction A=14007
- Annual growth rate r=0.10(consider a future traffic)
- Vehicle damage factor standard axle per cv
- Lane distribution factor D=0.75(Double lane single carriageway)
- Put the all value in equation
- $N=\frac{365x[(1+r)^{n}-1)]}{r}$ xAxDxF
- After that input the data and calculation the value are comes out 168msa.
- So design this road for 168msa

Total depth is 1000mm(as per IRC-37 1984)
BC=50mm
DBM=215mm
Base=250mm
Sub-base=485mm

Now this data apply in AASHTO method.
AASHTO method Total depth =30inches
(As per AASHTO 1993)

## V. CONCLUSION

From above anlysis and calculate design is prefer a AASHTO method for because it is provide 750mm thickness as compare to IRC it is provide a 1000mmthickness for pavement so IRC is economical.

**VI. FUTURE SCOPE**

In future it is required to adopt AASHTO,AUSTRONODS method for heavy traffic loading road to flexible pavement design.

**REFERENCES**

[1] Highway Engineering byDr.L.R.kadiyali | [2] www.wikipedia.com | [3] Design problems In Highway construction in black cotton soil,R&D of road department,Guntur,India | [4] Indian Road Congress manual | [5] IRC-37(1984) | [6] Traffic survey Report by Road and Buidling Department,Bhavnagar,Gujarat,India. | [7]AASHTO-1993 |