Research Article CODEN: IJPAKY Impact Factor: 4.226 ISSN: 2319-507X
A. I. Dhatrak, IJPRET, 2016; Volume 4 (11): 1-9 IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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DESIGN OF MODEL FLEXIBLE PAVEMENT FOR RURAL AREA DEVELOPMENT OF AMRAVATI REGION

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Accepted Date: 04/05/2016; Published Date: 01/07/2016

Abstract: - Village Roads and Other District Roads are comes under the Rural Roads. Rural area development program is carried by Ministry of State Government i.e. Rural Development Department of Government of Maharashtra. Rural Area development is very important aspect in point view of development state, since the rural area is raw material source. Since Rural Area are mainly provides source of food, Cotton, milk, vegetables and raw material for industry. Due to insufficient rural roads, efficiency of service provider of rural area is not proper. There is tremendous gap between requirement and availability of roads. Hence in the present study, model flexible pavement for rural area development was designed, to reduce the gap between rural and urban area, and an attempt was made to design effective model flexible pavement with clayey soil as subgrade for Amravati region.

Keywords: Clayey Soil, CBR test, IRC: 37 -2001, IRC: 20 SP -2002.

PAPER-QR CODE

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How to Cite This Article:

A. I. Dhatrak, IJPRET, 2016; Volume 4 (11): 1-9

INTRODUCTION

Amravati district region is part of State of Maharashtra of India. Location of Amravati is north latitude 23º 32' to 21º 46' Deg and East Longitude 76º37' to 78º 27'Deg. Total area of amravati district is 12235 sqm-km, in which 1571.74 sqm-km is forest area and 10801 sqm-km agriculture area. Amravati district is built up with1992 villages with 845 Grampanchayat. It is distributed in14 talulka for development purpose. It is mostly covered with clayey soil. Village Roads and Other District Roads are comes under the Rural Roads. Rural area development program is carried by Ministry of State Government i.e. Rural Development Department of Government of Maharashtra. Rural Area development is very important aspect in point of view of development of state, since the rural area is raw material source. Rural area are mainly provides source of food, Cotton, milk, vegetables and raw material for industry. Due to shortage rural roads, efficiency of service provider of rural area is not sufficient. There is developing gap between requirement and availability of roads. Hence in the present study, model flexible pavement for rural area development was designed, to reduce the gap between rural and urban area, and an attempt was made to design effective model flexible pavement with clayey soil as subgrade for amravati region. This project is based on the experimental work, which is included routine test on clayey soil, unsoaked CBR test and soaked CBR test. Also model flexible Pavement was designed using IRC: 37-2001 (Guidelines for Design of Flexible Pavement), and IRC: SP 20-2002 (Rural Roads Manual).

MATERIAL AND METHODOLOGY

1. Soil

The Soil used, in these investigations was obtained from the premises of Govt. Engineering College, Amravati. The properties of soil were determined by standard test procedures and tabulated as per provision of IS codes of practice. The routine tests were done for characterization of soil.

2. Methodology

A laboratory test was performed to determine the compaction characteristic, strength characteristic and stress strain. Laboratory CBR tests were performed to calculate unsoaked and soaked CBR value. Model Flexible Pavement was designed using IRC: 37-2001 'Guidelines for Design Of Flexible Pavement', and IRC: SP 20-2002 'Rural Roads Manual' on the basis 4 day soaked CBR value. Design traffic 90 CVPD taken, which is obtained from traffic volume data of

Sawardi to Jalaka Shapur VR-3 Talula-Tiwsa District-Amravati .Traffic volume dada for Village road is collected from Z.P.W.D Amravati.

TEST RESULTS AND DISSCUSSIONS

1. Index Properties of the Soil

The properties of the clay soil were determined by standard test procedure and tabulated in Table 1

Table 1: Index Properties of Soil

Sr No	Property	Values
1	Specific Gravity of Soil (%)	2.67
2	Liquid Limit (%)	54.32
3	Plastic Limit (%)	27.21
4	Shrinkage Limit (%)	13.00
5	Plasticity Index (%)	27.11
6	Gravel (%)	1.40
7	Sand (%)	18.60
8	Silt and Clay (%)	80.00
9	IS Classification	CH
10	Maximum Dry Density (kN/m3)	16.00
11	Optimum Moisture Content (%)	19.60

2. Compaction Properties

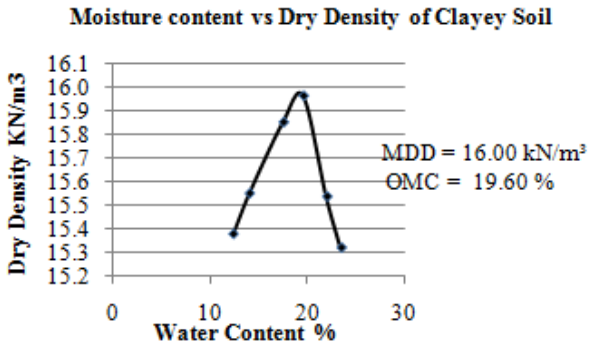

Figure 2. Moisture Content Vs Dry Density Relationships for Clayey Soil

The maximum dry density and optimum moisture contents of the Clayey Soil are reported in the Table 2. The moisture content vs dry density relationships of the clayey are shown from Figure 2.

Table 2: MDD & OMC at different plastic strip content randomly mixed in soil.

Plastic Content (%)	OMC (%)	MDD (kN/m³)
Clayey Soil CH	19.60	16.00

3. California Bearing Ratio (CBR)

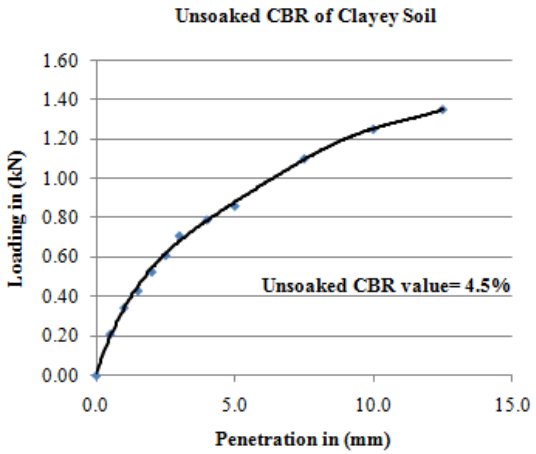

Figure 3. Unsoaked CBR of Clayey Soil

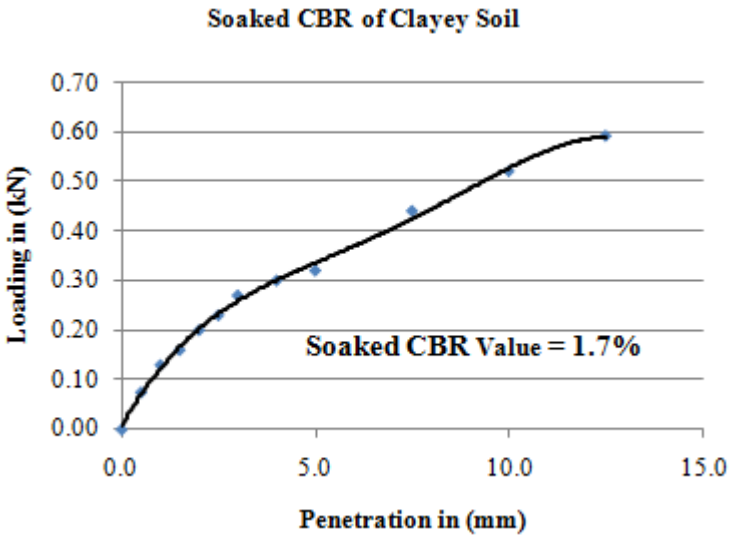

Figure 4. Soaked CBR of Clayey Soil

The laboratory unsoaked and soaked CBR tests were performed with clayey soil at OMC. Table 3 shows the result of CBR tests of clayey soil As per IRC-37, flexible pavement should be design at 4 day soaked CBR value. Therefore for present study, 1.7% soaked CBR value was used for design flexible pavement with clayey soil as subgrade. The load- penetration curves obtained from the CBR tests for clayey are shown in Figure 3 and 4.

Table 3: CBR Values for Clayey Soil Type Subgrade Strata

Type of Subgrade Strata	MDD (kN/m3)	OMC (%)	UNSOAKED (%)	SOAKED (%)
Clayey Soil	16.0	19.6	4.5	1.7

DESIGN OF MODEL FLEXIBLE PAVEMENT FOR CONSTRUCTION OF A NEW RURAL ROAD (VR)

As per Recommended values by IRC: 37-2001 and IRC: 20 SP -2002 Rural Road was designed as below. Soaked CBR value of clayey soil as subgrade is 1.7%, for design purpose 2.0% is taken as per IRC: 37-2001. (Clause 3.4.6.4, Table2, Page Number – 19)

Recommended and assume suitable Data:

i. Traffic growth rate, r = 7.5% = 0.075 in decimal.

ii. Design life Period n = 15 Yr

iii. Vehicle damage Factor, F = 1.5

iv. Distribution of Commercial traffic over the carriage way D = 1

v. Number of commercial vehicles as per last count, P = 90 CVPD

CVPD data is collected from Z.P.W.D Amravati from traffic Survey report of

Swaradi to Jalaka Hirapur road VR-31.

vi. Number of Year between the last count and completion of Construction, x = 0 Yr

vii. Single lane Road

Solution:

Soaked CBR value of clayey soil as subgrade is 1.7%, for design purpose 2.0% is taken as per IRC: 37-2001. (Clause 3.4.6.4, Table2, Page Number – 19)

$A= P (1 + r)^x= 90 (1 + 0.075)^0 = 90$ CVPD , D=1, F=1.5, r = 0.075 , n = 15.

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

$N= \{365 x [(1 + 0.075)^{15}-1] / 0.075\}x 90 x 1x 1.5$

$N = 1.28698421 x 10^6$ CVPD.

N = 1.2869 msa.

N = 1.3 msa.

Total pavement thickness for CBR 2% and traffic 1.3 msa is obtained **680mm** as per IRC: 37-2001(Fig1. page number-8.) And pavement compositions can be obtained by interpolation from Pavement Design Catalogue as per IRC: 37 – 2001(PLATE-1, Page Number-21). Hence

(a) Bituminous surfacing

Wearing course = 20 mm PC –Premix Carpet.

Binder Course = 15 mm BM – Bituminous Macadam.

(b) Granular base = 225 mm WBM

(c) Granular sub-base = 440 mm granular material of CBR not less than 30 %

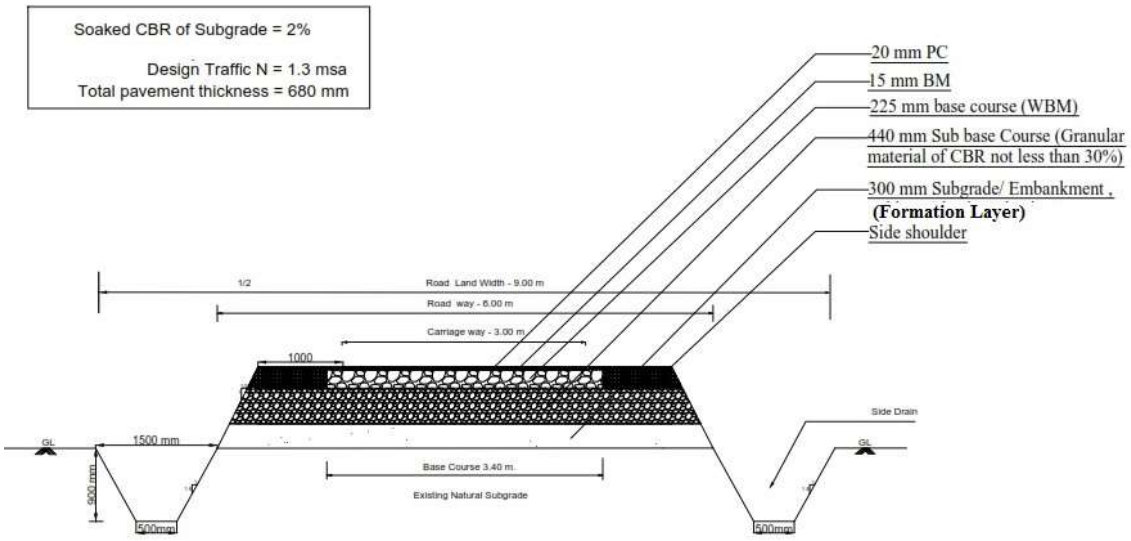

Figure5. Cross Section of Model Flexible Pavement for village road with clayey soil as subgrade for Amravati Region

Figure 6 Shows cross section of Model Flexible Pavement for village road with clayey soil as subgrade for Amravati region.

NOTE: As per IRC:37 -2001 Clause 4.2.3.7 Where the wearing surface adopted is open graded premix carpet of thickness up to 25 mm , the thickness of surfacing should not be counted towards the total thickness of the pavement as such surfacing will be purely for wearing and will not add to the structural capacity of the pavement.

CONCLUSION

The present study has shown quite encouraging results and following important conclusion can be drawn from the study

1. The laboratory unsoaked and soaked CBR value clayey subgrade are found 4.5 and 1.7% respectively

2. Total pavement thickness for CBR 2% and traffic 1.3 msa from IRC: 37-2001 chart1 are found **680 mm.**

3. Pavement compositions can be obtained by interpolation from Pavement Design Catalogue (IRC: 37 - 2001).Hence Pavement Compositions for studied model flexible pavement are presented below.

(a) Bituminous surfacing

Wearing course = 20 mm PC –Premix Carpet.

Binder Course = 15 mm BM – Bituminous Macadam.

(b) Granular base = 225 mm WBM

(c) Granular sub-base = 440 mm granular material of CBR not less than 30 %

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