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Analysis, Design & Construction of National Highway

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Abstract: ***In flexible pavement designs the structures deflects, flexes, under loading. Each layer receives load from the above layer and spreads them out and passes on these layers to below lower layer. Thus the stresses developed will be maximum on to the top layer and minimum to the top of sub grade. In order to take maximum advantage of this property, layers are to be arranged in descending order with highest bearing capacity of material on top and lowest on the bottom. The long-term performance of rigid pavement depends not only on proper pavement design and materials selection, but on good construction practices as well. The construction of a rigid pavement involves many processes including proper preparation of the sub grade and sub base, placing reinforcing bars or dowels, choice and handling of aggregates and other materials, development of concrete mix design, production and transport of the concrete, and placing, finishing, curing and joint sawing the concrete. The Pavement length is about 138kms from Hyderabad to Srisailam Highway Collected all the data required for pavement designing like traffic details, and so on based on which the design is done. In this project we calculate the design criteria using empirical design method and also by using IRC codes. The main objective of this project is to identify the design criteria of flexible pavement & its material characteristics, durability of flexible pavement its strength and design life.***

Keywords: Atterbergs limits, Compaction tests, Cone penetration test, free swellIndex ,CBR& Plate load Test

1. Lab Testing

The following are the test conducted on the national highway are as follows

2. Atterbergs limits

(a) Liquid limit

S.no	Description	Readings		
		Trail1	Trail2	Trail3
1	No of blows	30	35	38
2	Container number	4	5	6
3	Weight of container +wet soil	23.3g	10.40g	21.49g
4	Weight of container +dry soil	20.8g	9.38g	20.50g
5	Weight of water(3)-(4)	2.44g	1.02g	0.99g
6	Weight of container	9.65g	3.09	13.76g
7	Weight of dry soil(4)-(6)	11.2g	5.418g	6.74g
8	Moisture content (5)/(7)	0.21	0.18	0.14
9	Moisture content in %	21%	18%	14%

Liquid limit at 25 blows is 24%

(b)Plastic limit

S. No	Description	Readings	
		Trail1	Trail2
1	Container number	3	2
2	Weight of container +wet soil	**4.73**	**11.69**
3	Weight of container +dry soil	**4.42**	**11.64**
4	Weight of water(3)-(4)	**3.76**	**10.17**
5	Weight of container	**0.66**	**1.47**
6	Weight of dry soil(4)-(6)	**0.46**	**0.03**
7	Moisture content (5)/(7)	**46%**	**30%**

Shrinkage Limit

S.No	*Observations calculations*	*TRAIL1*
1	Mass of empty mercury dish	74.2g
2	Mass of mercury dish with mercury equal to vol of shrinkage dish	361.1g
3	Mass of mercury =2-1	286.9g
4	Mass of empty shrinkage dish V1=(3)/13.6	21.1g
5	Mass of empty shrinkage dish	23.5g
6	Mass of shrinkage dish+wet soil	68.4g
7	Mass of wet soil M1=(6)-(5)	44.9g
8	Mass of shrinkage dish +dry soil	57.3g
9	Mass of dry soil Ms=(8)-(5)	33.8g
10	Mass of mercury dish+ mercury equal in vol of dry pat	304.3g
11	Mass of mercury displaced by dry pat =(10)-(1)	230.1g
12	Vol dry pat V2=(11)/13.6	16.92g
13	Shrinkage limit Ws=(M1-Ms)-(V1-V2)/Ms	20.5%
14	Shrinkage ratoo,SR=Ms/V2*pw	2.0
15	Volumetric shrinkage ,VS=(V1-V2)/V2*100	24.70

The shrinkage limit of the given soil sample is20.5%

Cone Penetration Test

S. No	*Water Content W(%)*	*Depth Of Cone Penetration *(mm)*
1	30	10
2	35	18
3	40	25
4	42	30
5	44	35

If liquid limit =0 to 35 indicates low compressible soil
Liquid limit =35 to 50 indicates medium compressible soil

Liquid limit =≥ 50 indicates high compressible soil
Based on above classification the soil mass is medium compressible

CBR Test:

Dial guage reading	*Penetration (mm)*	*Load*	*Load in KN*	*Pressure in Kg/cm2*
0	0	0	0	0
50	0.5	110	18.7	0.105
100	1.0	240	4.08	0.23
150	1.5	360	61.1	0.35
200	2	455	77.35	0.44
250	2.5	590	100.9	0.57
300	3	740	125.8	0.712
400	4	740	185.3	1.05
500	5	1000	328.75	1.24
750	7.5	1935	481.75	1.86
1000	10	2835	453.3	2.73
1250	12.5	3035	515	2.91

CBR at 2.5 is 7.32
CBR at 5 is 15.9

S. No	Water	Empty mould	Wt of mould +compacted soil(W2)	Weight of compacted soil (w2-w1)	ɤ=W2-W1/V	ɤ/1+w
1	8	2345	4464	2119	2.07	1.92
2	10	2345	4474	2129	2.16	1.93
3	14	2345	4473.5	2128.5	2.16	1.89
4	18	2345	4381	2036	2.07	1.75

Compaction test:

Plate load Test

A plate load test was conducted using a plate of 0.75m*0.75m size, on a uniform deposit of sand and the following data were as follows

S.no	Pressure (Kn/m^2)	Settlement(mm)
1	0	0
2	100	3.0
3	150	3.5
4	250	7.0
5	350	8.75
6	450	14.0625
7	550	22.0
8	650	43.98

3. Conclusion

The quality of any pavement is affected by the materials used for construction. Coming to the sub-grade, soil is the most important material. Here we have seen various tests used for finding the strength of soil, the prominent ones being CBR and plate load test. CBR test assesses the strength of soil, whereas plate load test is used to evaluate its support capability

- As per IS 2720 (part-III -1980) the soil has low swelling potential with LL<50% , PL is with in 0-35% & SL>17%
- Liquid limit =35 to 50 indicates medium compressible soil by cone penetration test
- The soil we have tested is with in its limits & it has low swelling potential.

References

[1] Geotechnical engineering by MANOJ DUTTA & GULATI S.K – Tata MC.GRAWHILL Publishers New Delhi
[2] Principles of Traffic Engineering, Garber &Hoel
[3] Dr. Sandeep Datlaa, PrasantaSahub,c,* 2013, Hyuk-Jae Rohd, Dr. SatishSharmae, " A Comprehensive Analysis of the Association of Highway Traffic with Winter Weather Conditions", Procedia - Social and Behavioral Sciences, 497 – 506
[4] Rakesh Mehara,1 Pradeep Kumar Agarwalb, 2013, "A Systematic Approach for Formulation of A Road Safety Improvement Program in India", Procedia - Social and Behavioral Sciences, 1038 – 1047
[5] Soil mechanics and foundation by B.C.PUNMIA, Ashok Kumar Jain and ARUN Kumar Jain, LAXMI, publications Pvt. Ltd., New Delhi. Soil mechanics and foundation ENGG. By K.R. ARORA, standard Publishers and Distributors, Delhi. Geotechnical engineering by MANOJ DUTTA & GULATI S.K – Tata MC.GRAWHILL Publishers New Delhi.