

# MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Gwalior, Madhya Pradesh – 474005



A MINI -PROJECT REPORT

ON

## **“DESIGN OF FLEXIBLE PAVEMENT USING CALCIUM BASED BENTONITE SOIL”**

Submitted by

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**Department of Civil Engineering**  
**Madhav Institute of Technology & Science (2022)**  
**CERTIFICATE**



Madhav Institute of Technology & Science  
Gwalior

This is to certify that the project entitled “**DESIGN OF FLEXIBLE PAVEMENT USING CALCIUM BASED BENTONITE SOIL** ” presented by the students of group- in incomplete satisfaction of the necessity of the recompense of Bachelor of Technology degree in Civil Engineering at Madhav Institute of Technology & Science, Gwalior is a genuine work completed by the students under my watch and direction.

To the best of my insight, the matter epitomized in the theory has not been submitted to any other college/Institute for the recompense of any Degree or Diploma

Under the Guidance of-

**Guide Name:**

Department of Civil Engineering

Dr. M.K. Trivedi  
Head of Department  
Department of Civil Engineering

Date: 04/05/2022

## ACKNOWLEDGEMENT



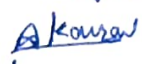





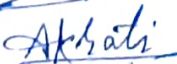
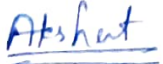
It offers us a great pleasure to thank and offer appreciation to each and every one of those people who have specifically or by implication helped us through the course of this study. This undertaking would have never been finished without the commitment of those individuals.

Unfortunately, the long list of acknowledgement, regardless of how extensive is constantly fragmented and lacking. To be sure this page of notice should never have the capacity to touch the generousness of the individuals who tendered their assistance to us.

As a matter of first importance I wish to express my profound feeling of appreciation and obligation to **Dr. CHAYAN GUPTA** Department of Civil Engineering – MITS, Gwalior for appointing me the undertaking " **DESIGN OF FLEXIBLE PAVEMENT USING CALCIUM BASED BENTONITE SOIL** " and for his motivating direction, helpful feedback and significant proposal all through this venture. We also want to extend our appreciation to every one of our companions and senior understudies who have constantly empowered and bolstered us in doing this work. We want to thank all the individuals from Department of Civil Engineering who have dependably been agreeable with us.

Last however not the slightest we want to thank the writers of different examination articles and books that we alluded throughout this undertaking.

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- 3. Objectives of Study**
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# **PROBLEM STATEMENT:**

Design of flexible pavement using calcium based bentonite soil.

## **MAIN BODY:**

### **1. INTRODUCTION:**

#### **COMPACTION TEST**

In geotechnical engineering, soil compaction is the process in which a stress applied to a soil causes densification as air is displaced from the pores between the soil grains. It is an instantaneous process and always takes place in partially saturated soil (three phase system). The Proctor compaction test is a laboratory method of experimentally determining the optimal moisture content at which a given soil type will become most dense and achieve its maximum dry density.

#### **CBR TEST**

CBR test is generally carried out in the laboratory on a prepared soil specimen placed in test mould using a motorised testing machine under controlled conditions. CBR test may also be carried out in the field for the evaluation of in-place strength of the prepared subgrade.

## **2. OBJECTIVES OF STUDY:**

Design of flexible pavement using calcium based bentonite soil.

## **3. PROCEDURE FOLLOWED:**

### **COMPACTION TEST**

1. Take a representative oven-dried sample, approximately 5 kg in the given pan. Thoroughly mix the sample with sufficient water to dampen it with approximate water content of 4-6 %.
2. Weigh the proctor mould without base plate and collar. Fix the collar and base plate. Place the soil in the Proctor mould and compact it in 3 layers giving 25 blows per layer with the 2.5 kg rammer falling through. The blows shall be distributed uniformly over the surface of each layer.
3. Remove the collar; trim the compacted soil even with the top of mould using a straight edge and weigh.
4. Divide the weight of the compacted specimen by 944 cc and record the result as the bulk density bulk.
5. Remove the sample from mould and slice vertically through and obtain a small sample for water content.
6. Thoroughly break up the remainder of the material until it will pass a no.4 sieve as judged by the eye. Add water in sufficient amounts to

increase the moisture content of the soil sample by one or two percentage points and repeat the above procedure for each increment of water added. Continue this series of determination until there is either a decrease or no change in the wet unit weight of the compacted soil.

### **CBR TEST**

1. Take 5 kg of soil sample passing through 20mm IS sieve.
2. Weigh the soil sample retained on 20mm sieve.
3. Add the measured quantity of water taken to the soil sample. Mix it thoroughly.
4. Place the spacer disc over the base plate and place coarse filter paper on spacer disc.
5. Fill 1/5<sup>th</sup> of mould 5 times and compact each layer with 56 blows of hammer.
6. Invert the mould, then place the filter paper in the setup below the mould and place surcharge weight on the mould.
7. Place the mould in position long with plungers then apply load.
8. Note down the proving ring reading for every 0.5mm increase in penetration.
9. Determine the load and axial load values.
10. Draw penetration v/s axial load graph.
11. Determine the value of CBR at 2.5 and 5 mm penetration.

## **4. RESULTS & CONCLUSION:**

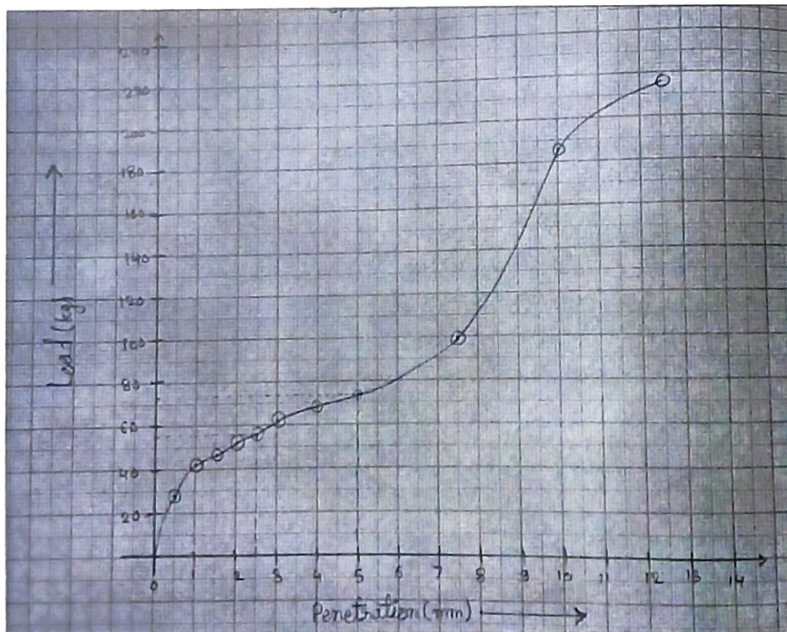
## COMPACTION TEST:

Optimum moisture content (OMC) of the soil = **27%**\_\_

## CBR TEST:

S.No.	Penetration (mm)	Proof ring reading (div)	Calibration factor	Load (kg)
1	0.6	21	1.235	27.195
2	1.0	31	1.235	40.145
3	1.5	36	1.235	46.620
4	2.0	40	1.235	51.800
5	2.5	43	1.235	55.685
6	3.0	48	1.235	62.360
7	4.0	53	1.235	68.635
8	5.0	57	1.235	73.815
9	7.5	81	1.226	<del>73.815</del> 93.306
10	10.0	152	1.226	186.252
11	12.5	174	1.240	215.760

- CBR value corresponding to 2.5mm penetration =  $\frac{55.685}{13.70} \times 100 = 4.06\%$
- CBR value corresponding to 5mm penetration =  $\frac{73.815}{20.55} \times 100 = 3.59\%$
- CBR value of the soil = **4.06%**



## REFERENCES

- 1) <https://smfe-iiith.vlabs.ac.in/exp/compaction-test/index.html>
- 2) [http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk\\_labs\\_29012020/Transportation\\_Engineering\\_Lab/labs/exp4/theory.html](http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs_29012020/Transportation_Engineering_Lab/labs/exp4/theory.html)