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# IMPROVEMENT IN THE GEOTECHNICAL PROPERTIES OF SEDIMENTS DEPOSITED IN THE BRAHMAPUTRA RIVER USING BENTONITE

**Binita Devi[1], Darshana Choudhury[2], Dimpy Kalita[3], Tanushree Maitra[4], Dipankar Deka[5]**

[1]*Assistant Professor, Department of Civil Engineering, Girijananda Chowdhury Institute of Management and Technology, Guwahati, Assam, India*

[2,3,4,5]*Student, Department of Civil Engineering, Girijananda Chowdhury Institute of Management and Technology, Guwahati, Assam, India*

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**Abstract -** *The mighty river Brahmaputra has always witnessed a heavy flow which is attributed not only due to its geographical location and climate but also due to the heavy deposits of the sediments on its beds. Excavating the sediments and using them for for construction purpose after proper stabilization (whenever needed) will be both economical as well as efficient. The increased spread of the deposit not only obstructs the flow of the river forward, but also deflects its flow path in the lateral direction. The result is that flooding and bank erosion are causing extensive damage overall. However, if such sediments are excavated, this will not only prevents the aforementioned outcome, but can also be used as a stable and durable construction material using bentonite as an admixture. Sediment characteristics are investigated in depth using a series of tests and methods like wet sieve analysis, specific gravity, standard proctor test, CBR test to obtain the required standard quality of the material. Brahmaputra soil was collected from Hatisila stretch of Guwahati situated on the Chandrapur-Narengi road on the bank of the Brahmaputra river bearing latitude 26°21΄North and longitude 91° 87'East in the Kamrup district of Assam.The collected sample was non-plastic with little clay content.*

**Key words:** Sediments, Stabilization, Bentonite

## 1.INTRODUCTION

Rivers and streams are the vessels of the globe through which the blood of the earth, that is, the water flows to maintain the planet. The Brahmaputra is one of the major rivers in the world which flows through a large part of Assam. In Assam, it stretches from Kobo in the extreme east, run through Guwahati to Dhubri at the extreme west. Throughout its course in Assam it covers a total basin area of 5, 80,000 km$^2$ and a drainage area of 70,634 km$^2$ (As per Department of WaterResources, Government of Assam).The mighty Brahmaputra river has been coined as the 'Life Line' of Assam, its people and culture. Despite being the Life Line, every year it is prone to natural disaster like flood and erosion during monsoon period. Due to this the banks are often eroded and these eroded soils are deposited along its sides causing tremendous ill effects. The silty and sandy nature of the river bank makes the bank line unstable creating a condition conducive to bank erosion. Riverbank erosion relies on a number of interrelated geotechnical factors such as characteristics of flow, composition of bank materials, sediment deposit characteristics, etc. Deposits with weak geotechnical properties only create enormous or adverse conditions for the living beings in its vicinity also reducing discharging capacity of the river and rise in water level.

It is thus necessary to excavate the deposited sediments and to find an economical as well as effective use for them which might as well bring down flood havoc. Given that the sediments are silty and sandy it is necessary to adopt methods to improve its engineering properties so that they can be adopted for construction purposes.

## 1.1 Soil Stabilization

The term soil stabilization means the improvement of the stability or bearing capacity of the soil by the use of controlled compaction, proportioning or by the addition of suitable admixture or stabilizer. Soil stabilization deals with the physical, physico-chemical and chemical methods to make the stabilized soil serve its purpose as construction material. It alters or preserves one or more soil properties to improve the engineering characteristics and performance of the soil. The underlying soil decides the life of any construction project. Unstable soil could easily hinder this goal and therefore the process of soil stabilization is necessary which possesses important objectives i.e., increase the bearing capacity of the soil and its resistance to weathering conditions.

## 2. MATERIALS USED

For the purpose of the study the soil was collected from Hatisila, Panikhaiti stretch of Guwahati situated on the Chandrapur-Narengi road on the bank of Brahmaputra river bearing latitude 26°21' North and longitude 91°87' East in the Kamrup district of Assam. Bentonite was used as a stabilizing material in the analysis. The color is cream to greyish white and has a slightly earthy smell and is available in very fine powdered state. It remains insoluble in water and organic solvents.

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## 3. RESULTS AND DISCUSSIONS

### 3.1 Wet sieve analysis

The sediment collected contains 95% fines and hence the result indicates that the soil is finely grained.

### 3.2 Specific Gravity Test

The value of specific gravity obtained from the test result is between 2.70 to 2.80. It reveals that the soil is expansive in nature which is prone to large volume change when there is an increase or decrease in water content. Thus the soil needs improvement in order to be used as construction material.

### 3.3 Liquid Limit Test

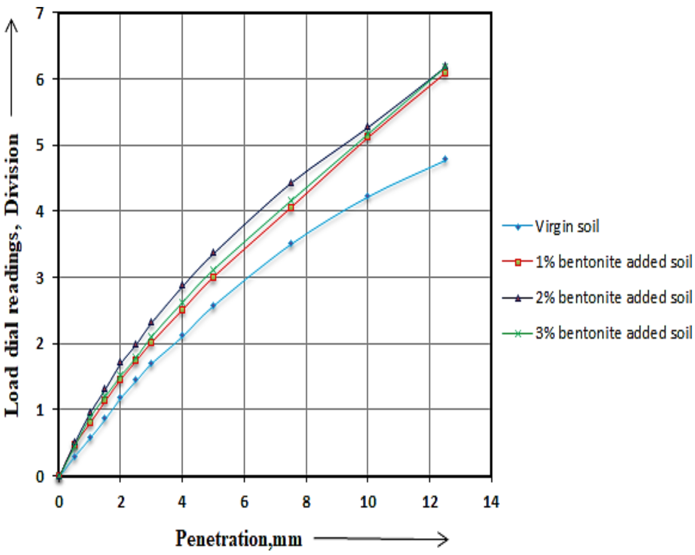


**Fig 3.1 Liquid Limit Comparison Curve**

From liquid limit curves, in case of virgin soil, the liquid limit is 30.15%. It increases with the increase in percentage addition of bentonite. When 1% bentonite was added to the soil, the liquid limit is increased by 5.85% (36%) and it is further increased by 7.05% (37.2%) when 2% bentonite was added to the soil with respect to virgin soil. Liquid limit shows slight % decrease when 3 % bentonite was added to the soil, it is increased by 1.58% (31.82%) with respect to virgin soil.

### 3.4 Standard Proctor Test

The maximum dry density of virgin soil is 1.537 g/cc. After addition of 1% bentonite to the soil, the dry density is increased by 0.012 g/cc, further addition of 2% bentonite to the soil MDD is increased by 0.039 g/cc. When 3% bentonite is added to the soil there is slight decrease with increase of MDD in compare to 2% bentonite. It is increased by 0.023 g/cc. Similarly, OMC is also increased at 1% and 2% bentonite and decreased at 3%.

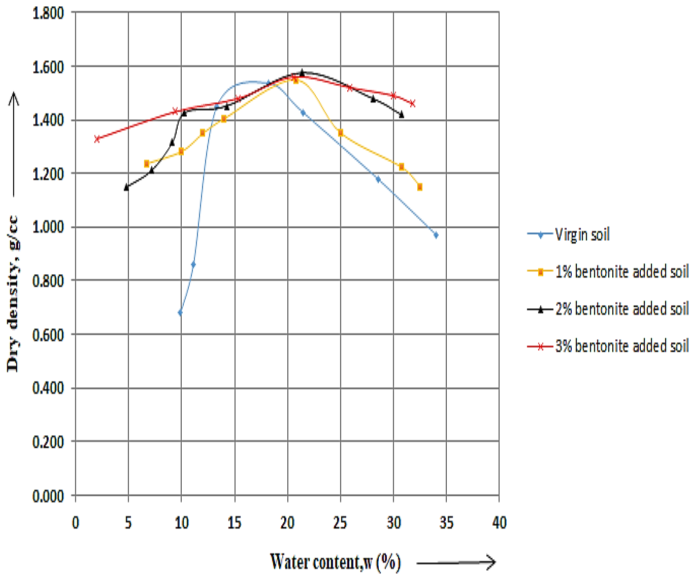


**Fig 3.2 Variation in OMC and MDD for virgin and bentonite added soil**

### 3.5 California Bearing Ratio (CBR)

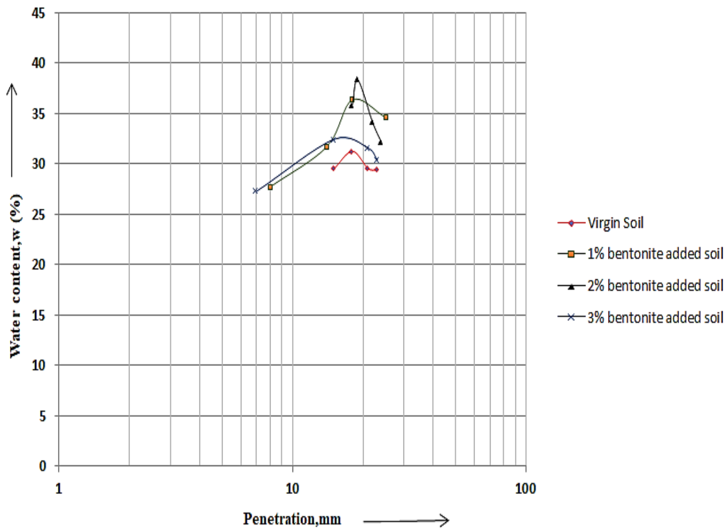


**Fig 4.3 Variation in CBR for virgin and bentonite added soil**

The maximum CBR Value of virgin soil is 12.55%. After addition of 1% bentonite to the soil the CBR value is increased 14.64%, further addition of 2% bentonite to the soil CBR value is increased 16.40%. When 3% bentonite is added to the soil there is slight decrease with increase of CBR Value in compare to 2% bentonite. It is increased 15.18%. Thus, the maximum CBR Value is obtained at 2% bentonite addition to the soil sample (16.40%).

## 4.CONCLUSION

The virgin soil on its own is inadequate for use in construction. However, improved changes were observed on addition of Bentonite to the soil. The percentage increment in liquid limit was found to be 7.05 % due to 2% bentonite addition. The maximum OMC and MDD observed at 2% bentonite addition are 21.42% and 1.576 g/cc. Overall the percentage increment in OMC and MDD was found to be 3.24 % and 2.54 % on 2% bentonite addition.The addition of bentonite up to 2% resulted in increase in the CBR and thereafter the CBR value decreased on addition of 3% bentonite. The maximum CBR value of 16.40% was observed at 2% bentonite.Thus, the best improvement was shown on addition of 2% bentonite to the soil sample which can be recommended as the optimum quantity of bentonite required to bring about improvement to the Brahmaputra silt to be used as sub-base in construction works.

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