# SOIL STABILIZATION USING WASTE DEMOLISHED BRICKS

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Abstract: Soil stabilization is the manner of enhancing the distinctive kind of engineering residences of the soil. It may be performed through the use of controlled compaction, proportioning and the addition of appropriate specific forms of admixtures and stabilizers. Stabilization of soil can be finished the usage of many distinctive materials, mainly via merchandise in order that it turns into economical. We have stabilized our soil pattern via the use of waste demolished bricks with a view to boom the houses of soil. Stabilization is very necessary for diverse creation works like street pavement and foundation. The challenge evaluates the effects of waste demolished bricks on some primary engineering houses of soil i. E., liquid limit, compaction of soil, direct shear take a look at and California bearing ratio of soil. The percentage of waste demolished brick used varies from 10% to 30%. The properties like California Bearing Ratio (CBR), Optimum Moisture Content (OMC) values etc. have been studied in this project. The maximum dry density (MDD), California Bearing ratio (CBR) increase with increase in demolished bricks, percentage while Most dry density (mdd) of soil reduced with increase in the share of demolished bricks. The liquid limit, most dry density (mdd) of the soil decreased and the california bearing ratio(cbr) expanded with an increase in demolished bricks. The goal of this work is to estimate the effect of demolished bricks on a few geotechnical residences of soil, with a view to decide the suitability of demolished bricks to be used as a modifier or stabilizer in the treatment of soil for similarly work.

**Introduction:** A soil mass is a 3 segment device which includes solid particles (referred to as soil grains), water and air. The void space among the soil grains is filled partially with water and partly with air. However, if we take a dry soil mass, the voids are filled completely with water. In case of a perfectly saturated soil, the voids are stuffed completely with water. In general, the soil mass has three constituent which do not occupy separate spaces bur are blended together forming a complex material (in fig below) the properties of which depend upon the relative constituents, their arrangement and a variety of other factors. Soil is used as a creation material for roads, dams, canals, pavements, as a fill behind retaining partitions and many others. It might be perfect to discover a soil at a specific website to be nice for the intended use as it exists in nature but regrettably, this type of component is of rare incidence. So it's far very crucial for the engineer to recognize about the volume to which soil residences may be progressed or to think about different alternatives for the construction of intended structure on to be had site.

If suitable soil conditions are encountered at the proposed site, one of the following alternatives may resort to

(i) Bypass the unsuitable soil by means of deep foundations.

(ii) Remove the bad soil & either treat it to improve and/or replace it

(iii) Redesign the structure and its foundations.

(iv) Treatment in situ soil to improve its properties.

Stabilization of soil is powerful technique for enhancing the residences of soil and overall performance of pavement device. The goal of any stabilization method used is to growth power and stiffness of the soil, enhance its workability, constructability and reduce the demolished brick index, as a result enhancing the burden bearing ability of a sub-grade to aid pavement and foundation. Soil stabilization may be applied on roadways, parking areas, site development projects, airports and plenty of other conditions in which sub-soils are not suitable for production. Stabilization can be used to deal with a huge variety of sub-grade materials, various from expansive clays to granular materials. This technique is performed the usage of a extensive kind of components, which includes lime, fly-ash, and portland cement. Other cloth by means of-merchandise utilized in stabilization include lime-kiln dirt (lkd) and cement-kiln dust (ckd). There are many stabilization methods using different stabilization agents to improve the soil properties.

**Benefits of soil stabilization-**

- Increasing bearing capacity of foundation soil.
- Increasing shear strength of soil.
- Higher Resistance (R) value.
- Reduction in Demolished brickity.
- Reduction of pavement thickness.
- Reducing permeability of soil
- Improving the natural soil for construction of highway and airfields.
- Controlling the grading of soil and aggregate in construction of base and sub-base of highway and airfield.
- Aids compaction.

**Experimental Methodology:** The demolished bricks & Soil are mixed fully on dry weight foundation in the best required proportions. There are exclusive check sieve analysis, liquid restrict, compaction, california bearing ratio test were carried out in laboratory as in line with is code requirements.

**SIEVE ANALYSIS**

- Sieve analysis is a practice or method used to assess the particle length distribution (also called gradation) of a granular cloth.
- The scale distribution is frequently of crucial significance to the way the cloth plays in use. A sieve evaluation can be done on any type of non-organic or organic granular materials along with sands, crushed rock, clays, granite, feldspars, coal and soil, a huge variety of manufactured powders, grain and seeds, all the way down to a minimal length depending on the exact method. Being this sort of easy method of particle sizing, it might be the most not unusual

- This test is performed to determine the share of different grain sizes contained within a soil. The mechanical or sieve analysis is carried out to decide the distribution of the coarser, large-sized particles, and the hydrometer method is used to determine the distribution of the finer particles.

**Liquid limit via cone penetration method**

- The liquid limit is described as the minimal moisture content material at which a soil will waft upon utility of a very small shearing force. When a soil becomes a viscous fluid, the soil will start to drift below its own weight and very small amount of electricity input, as proven in photo at the right. The liquid limit is on the whole utilized by civil and geotechnical engineers as a bodily property of a soil. The liquid restriction lets in engineers to classify soils into their programs. As an instance one soil can also have applications in sub-bases of roads, wherein every other soil can be higher desirable for foundations of buildings.
- The liquid limit is the empirically hooked up moisture content at which a soil passes from the liquid nation to plastic nation. It offers an average of classifying a soil, specially whilst plastic restrict is likewise known.

**OPTIMUM MOISTURE CONTENT (OMC)**

This test is executed to decide the maximum dry density and the most appropriate moisture content material of soil the usage of heavy compaction as per IS: 2720 (Part 8) – 1983. By using different techniques of proctor test the value of optimum moisture content and maximum dry density is calculated. By calculating the maximum dry density after performing the test, a graph is plotted among most dry density and water content material. The peak of the curve gives the optimum moisture content. Optimum moisture content is the content of water at which we get the maximum compaction. In order to perform the CBR test optimum moisture content was one of the desired parameter needed such that maximum density can be achieved i.e. the soil should be fully compacted. While doing some tests optimum moisture content has to be added. Tests cannot be conducted without knowing the optimum moisture content of the soil.

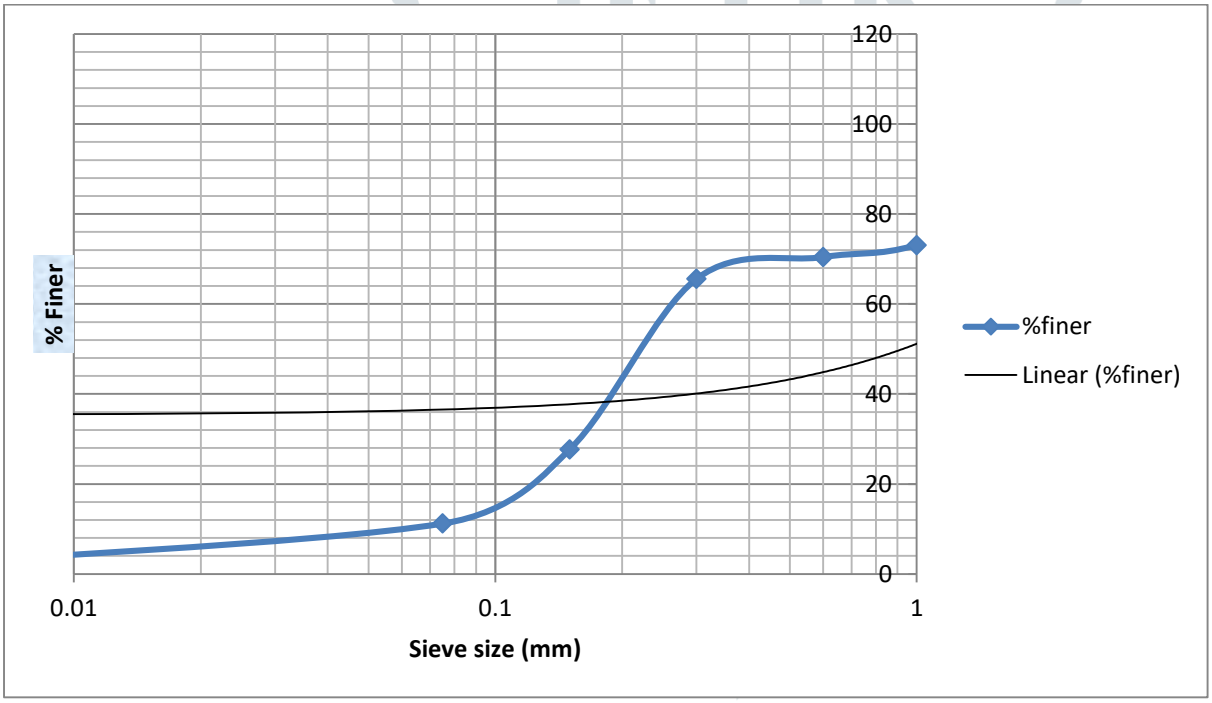
**California bearing ratio test**

This technique covers the laboratory dedication of the California bearing ratio (CBR) of a stabilized soil in compliance with british requirements. The precept is to decide the connection between force and penetration when a cylindrical plunger of a widespread pass-sectional vicinity is made to penetrate the soil at a given fee. At sure values of penetration the ratio of the implemented force to a popular pressure, expressed as a percentage, is described as the California Bearing Ratio (CBR).

**Results:**

**Sieve Analysis: Table 1- Sieve analysis of soil sample**

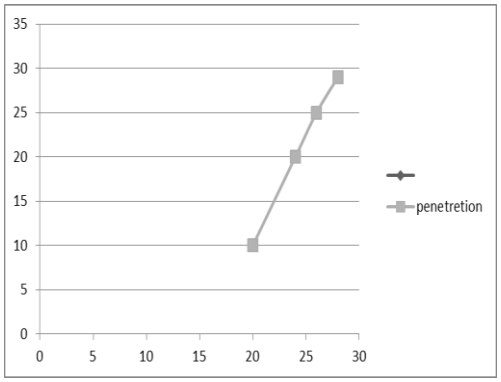
| sieve size | weight retained | Cummulative wt | %weight retained | % finer |
|---|---|---|---|---|
| 4.75mm | 49.3 | 49.3 | 4.75 | 76 |
| 2.36mm | 98.2 | 147.5 | 14.21 | 57.2 |
| 2mm | 132.02 | 279.52 | 26.93 | 48 |
| 1.18mm | 27.59 | 307.12 | 29.59 | 47 |
| 1mm | 50.33 | 357.44 | 34.45 | 43 |
| 425microns | 393.35 | 750.79 | 72.35 | 38 |
| 212microns | 170.9 | 921.69 | 88.82 | 19.1 |
| 75microns | 116 | 1037.69 | 100 | 26.1 |
| sum | 1037.69 | | | |




Based on the test results from the sieve analysis, the value of Cu obtained from the analysis is 4.14 whereas value of Cc is 1.36. It has also been noted that more than 50% of the soil is passing through 4.75mm which means that the soil is fine-grained soil. Also the liquid limit of the soil 50% and less which means the soil is of low compressibility. If the demolished brick limit of the soil can be determined, Atterberg's line has an equation Ip=0.73(w1-20). It has been noticed that the soil has properties of SW-SC.

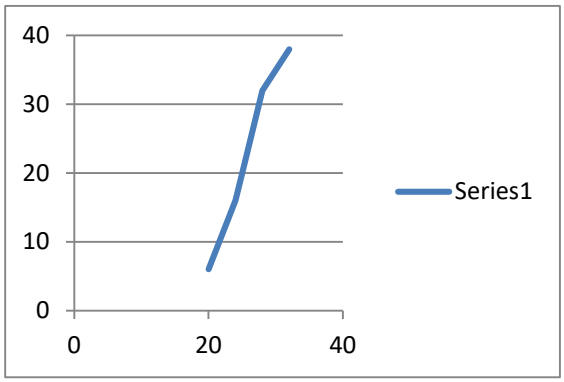
## LIQUID LIMIT

**Fig1**: Liquid limit of simple soil



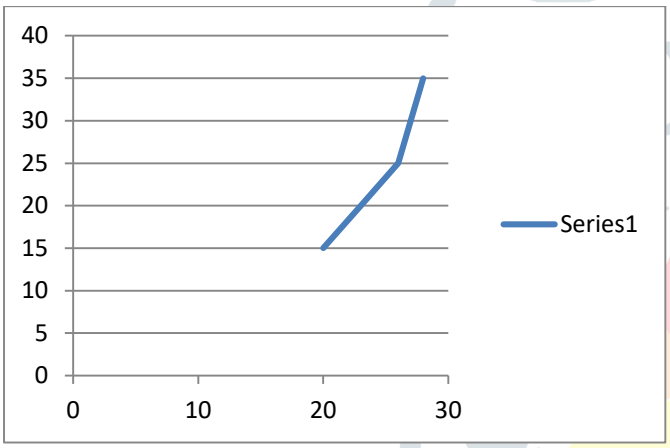

The liquid limit thus obtained is 24%

Fig 2: liquid limit for soil + 10% demolished brick




The liquid limit thus obtained is 25%.

Fig 3: liquid limit data for soil + 20 % demolished brick

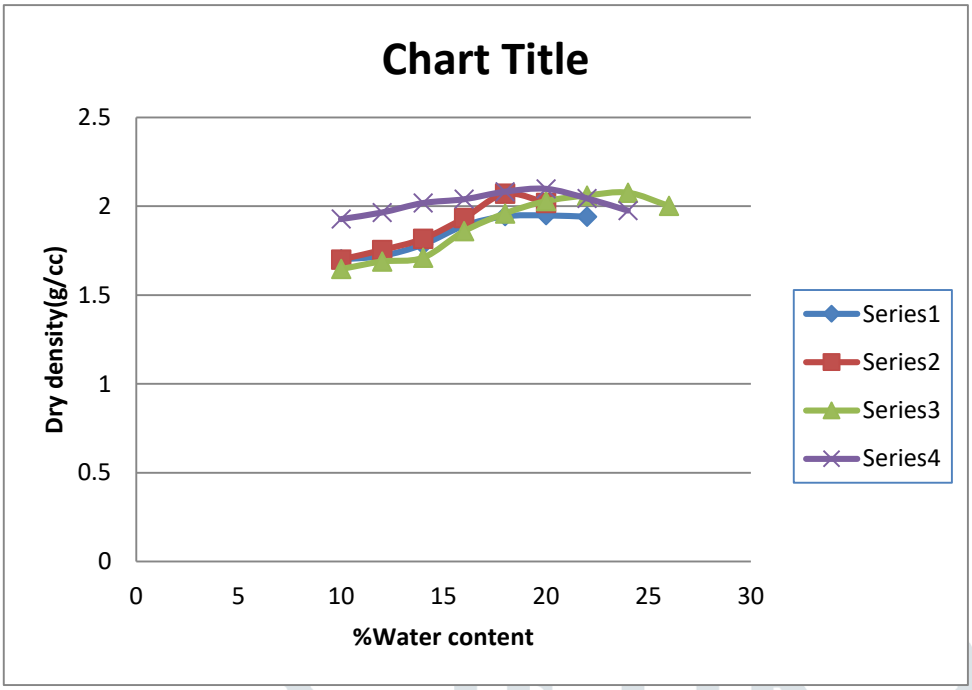



Liquid limit thus obtained is 23%

## OPTIMUM MOISTURE CONTENT (OMC)

The following figure shows the comparisons of dry density and optimum moisture content for different proportion of Demolished brick. Dry density was increased with increasing of Demolished brick proportion and optimum moisture content was decreased with increasing of Demolished brick.

Fig 4 : OMC for SOIL + DEMOLISHED BRICK




**Series 1……Soil + 20% demolished brick**

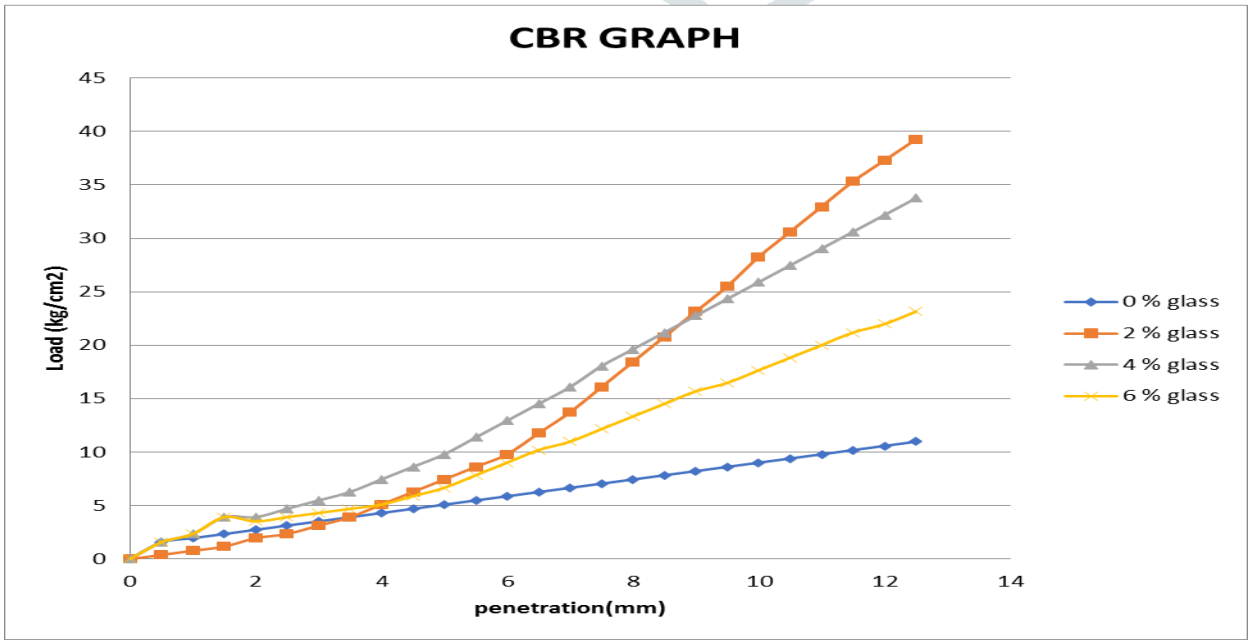
**Series 2……Soil +0% demolished brick**

**Series 3……Soil +10 % demolished brick**

**Series 4……Soil + 30% demolished brick**

**CBR**

The following figures show the comparison of unconfined compressive strength values at optimum moisture content for soil with demolished brick. There was increase in California bearing ration with addition of demolished brick. It was maximum at 20% Demolished brick.



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