

# Analysis of Soil Stabilization by Utilizing Iron Mineral by Products (Steel Slag)

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## I. INTRODUCTION

Soil adjustment is that term wherein engineering properties of soil are changed with the assistance of another material and improve the designing properties of soil. Need of soil adjustment is a result of greater structures, overwhelming versatility, railroad tracks and poor quality nature of soil and so forth. All things considered if soil surface isn't sufficient with the goal that will be reason for mishap. In present because of progress in modern territories just as progress in their wastages and their wastages can be utilized as stabilizer admixture. To improve quality of soil, add a few admixtures so as to improve the designing properties of soil. There are numerous admixture are generally utilized as stabilizer like fly powder, cement, lime, slag, stone residue and so forth.

Iron ore are rocks and minerals from which metal iron can be economically extracted. The ores are commonly rich in iron oxides and vary in coloration from darkish gray, vibrant yellow, or deep purple to rusty red. Iron ore is the raw material used to make pig iron, that is one of the primary uncooked materials to make steel.

## II. LITERATURE REVIEW

**Shubham More , Apekshah Lokhande (2018)** In modern days , the disposal problem of industrial waste is rapidly increasing. Such, hazardous waste is affecting the environment as well as land. The overall program was conducted in 2 phase. In first phase all necessary test such as

## ABSTRACT

The huge measure of modern waste as expanded step by step and transfer turns into an intense issue. it is important to use the steel slag waste. Steel slag is a result gotten from steel industry. It is created as a buildup during the generation of steel. Due to the high transfer cost as a waste material and the general positive highlights of steel slag, it has been pronounced a valuable development material. The measure of age is around 24 lacs mt for every year from various steel ventures in the india. The growing needs for fully furnished highways in the developed countries has led engineers to search for the durable cost effective measure for roadway construction. The basic necessity for suitable base course for roads is an important aspect in construction. The paper aims at utilizing the common waste materials for the improvement of roads. One such material that was analyzed in the paper for the execution of road work is the steel slag which is furnished in tones in the steel factories across the country. The use of the material is found to have improved the sub grade properties of soil to a good extent.

**KEYWORDS:** Steel slag, Soil stabilization, Specific gravity, Liquid limit, Plastic limit, Plasticity index, Optimum moisture content, Maximum dry density, Standard proctor, CBR.

Atterberg limit, CBR and standard proctor compaction test on plain soil were being performed to analyse the maximum dry density and optimum moisture content. And in second phase the black cotton soil was mixed with 5%,10%,15%,20% of steel slag.

**Vishal Dilip Khatate, Dinesh Subhash Gavande (2017),** The modern development in the use of highly developed composites in the upgrading of soil is growing on the basis of specific necessities and national desires. The necessitate of well-organized and strengthening techniques of Provided soil has led to studies and development of more recent substances for development. Commonly for black cotton soil which have high swelling and shrinkage dispositions, needs brilliant deal of focus for stabilization. Different strategies are existing for stabilization of black cotton soil. Here as a similarly steps towards the modern fabric to be used for stabilization, the look at goings-on to apply commercial waste material like Electric Arc Furnace Dust (EAFD) iron dust and dolime first-class for the soil upgrading.

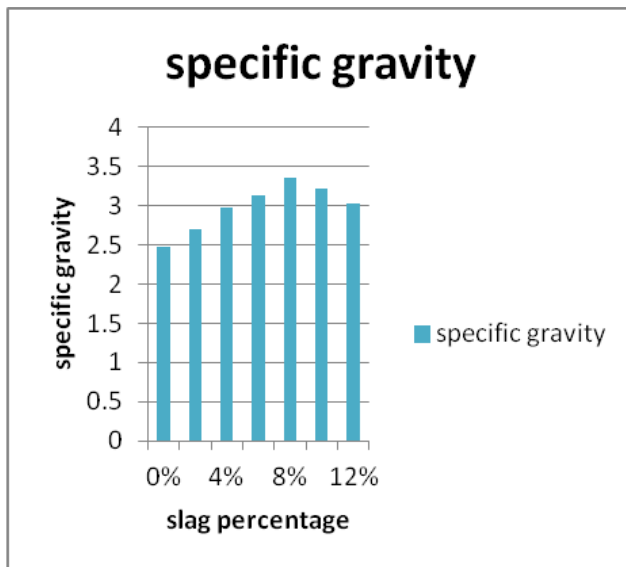
**Saurabh Kumar, Ved Parkash, Vishal Kumar (2016)** In present time, engineers must face dissimilar kinds of issues like assemble heavy shape, heavy mobility. But a few places on this planet soil have bad engineering properties like horrible workability, low bearing capability and sturdy compressibility. So in arrange to get better the energy of soil,

insert a few stabilizers. The aim of this look at is to get better the engineering houses of clayey soil using metal slag. Specimens are ready to know the residences of soil with percent of four%, eight%, 12%, sixteen% and 20% metallic slag combination permitted through 180 micron and three hundred micron sieve. Standard proctor take a look at, unconfined compressive energy, liquid limit and plastic limit tests are done to take a look at compressive electricity, Maximum dry density (MDD) and greatest moisture content (OMC) of soil aggregate.

**III. EXPERIMENTAL RESULTS**

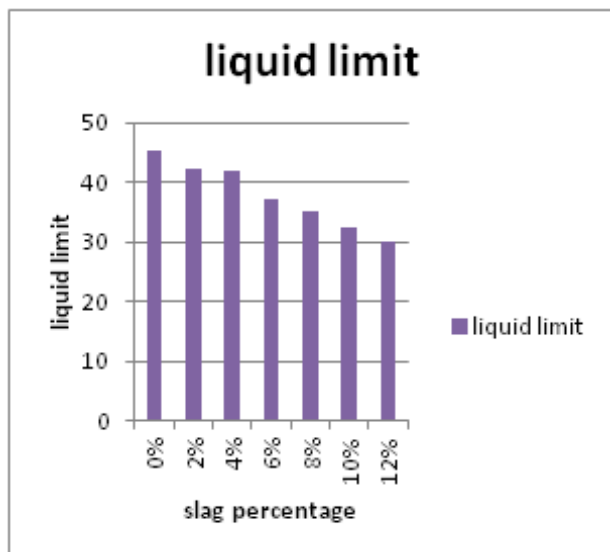
**1. SPECIFIC GRAVITY**

The specific gravity at 0% slag was found to be 2.47 and its value kept on increasing upto 8% slag which was observed as 3.36 and then it gradually decreased to 3.22 and 3.03 at 10% and 12% slag respectively. So the optimum value of slag use for attainment of highest specific gravity is 8% in the soil.



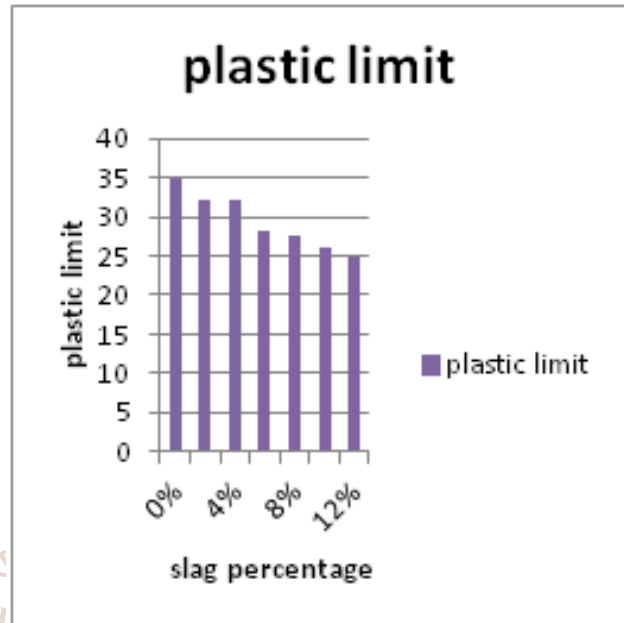
**2. LIQUID LIMIT**

The value percentage of liquid limit kept on decreasing with the increase in slag percentage from 45.2% at 0 percent slag to 29.92% at 12 percent slag. This is obvious of the fact that soil becomes dense on the addition of slag hence a natural decrease in liquid limit of soil.



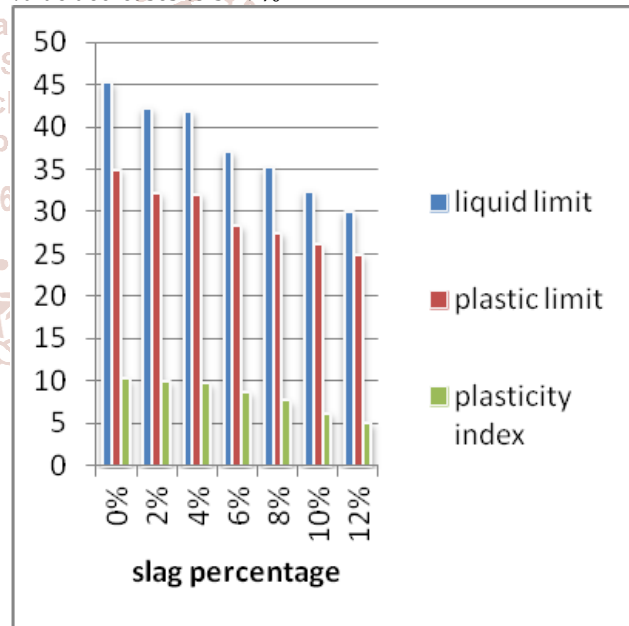
**3. PLASTIC LIMIT**

Plastic limit, at 0% slag the value is 34.94% and at 12% its value decreases to 24.41%. The decreasing value confirm the reduction of plasticity and increase of density of soil and hence the soil stabilized.



**4. PLASTICITY INDEX**

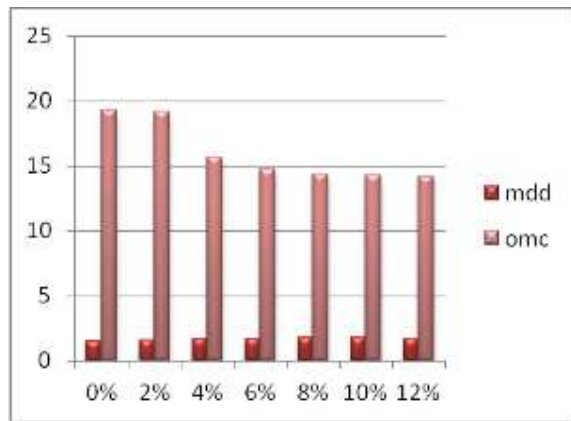
Plasticity index, at 0% slag the value is 9.32% and at 12% its value decreases to 5.79%.



**5. PROCTOR COMPACTION TEST**

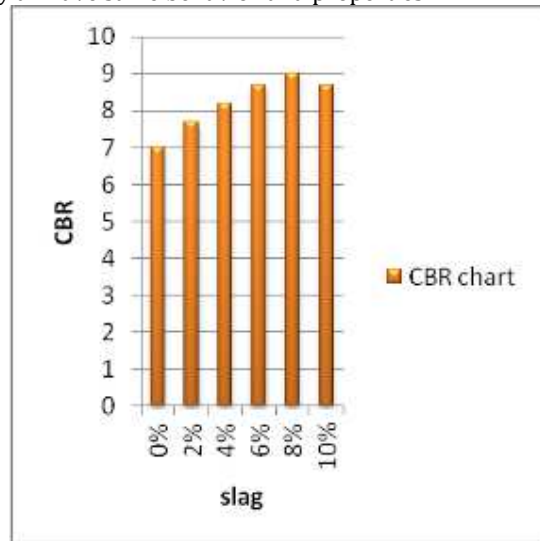
The optimum moisture content OMC kept on decreasing all the way through with the value of 19.26% at 0% slag and 14.15% at 12% slag, the analysis above 12% was not conducted due to thought that it would be impractical to use such a large quantities of slag in subgrade keeping in view cost-availability-workability factor.

The maximum dry density of the fresh sample was observed as 1.51 and with the increase percentage of slag the dry density was found to be 1.72 at 12%. Since OMC decreased with in slag percentage, it was inevitable that MDD would hike up.



## 6. CBR TEST

CBR value were not uniform in any case, the fresh sample of soil showed 7% CBR value, the value increased to 7.7%, 8.2%, 8.7% and 9% at 2%, 4%, 6%, 8% slag respectively. It then showed decreasing trend with the value of 8.7% at 10% slag. Hence the percentage of slag to be used was confirmed at 8% for the alluvial soil in the area cause they all have same behavior and properties.



## IV. FUTURE SCOPE OF STUDY

The growing needs of furnished highways in developing countries has led to the conclusions to use the cheaper, readily available, and strong stabilizing agents. India is fast growing in economic sectors due to the ever increasing industries and increase in number of foreign investors. To back these sectors the approachability is an important aspect that governs the proper running of the units at the desired pace and customer demands to achieve the optimum feasibility. The road and road conditions are the basic links in the economical development of the nation and conditions of the roads are improved to the desired effect by the stabilization techniques mentioned in the paper.

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