

# Use of Blast Furnance Slag as a Filler Material in Rural Road Construction

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**Abstract**— These Accumulation of unmanaged industrial solid waste especially in developing countries has resulted in increased environmental concern. Recycling of such wastes as a sustainable construction material appears to be viable solution not only to pollution problem but also an economical option to design of rural road. The present investigation was carried out to propose the use of Blast furnace slag as a filler material in rural road construction. BFS is a by-product generated during manufacturing of pig iron and steel. Waste processed BFS were used in filling material by dry process to get modified mix in different compositions that were added to the raw material at different levels to develop waste create BFS from this study we came to know that the blast furnace slag an industrial solid waste is very useful material use as filling material in rural road construction.

**Index Terms**— BFS (Blast furnace slag) .

## 1 INTRODUCTION

TODAY, the growth in various types of industries together with population growth has resulted in enormous increase in production of various types of waste material World over. The creation and disposal of non-decaying waste material such as Blast furnace slag, fly ash, steel slag etc. have been posing problems in the developed as well as developing countries.

Several million tons of iron and steel are being produced in our country by the various steel plants. The production of steel is, however, always associated with other wastes like, fly ash, flue dust, blast furnace slag etc. The generation, handling and safe disposal of these wastes is now a grave concern in the country. Road construction is one such sector where it can be utilized in bulk. Large amount of Blast furnace slag are produced in country from construction like railway, tunnel, road, and building construction. Blast furnace slag has become a serious problem especially in urban area in terms of its misuse it's dumping in the dustbins, clogging of drains, reduced soil fertility and aesthetic problems etc.

Investigations in India and other countries have revealed that properties of filling material can be improved to meet requirements of pavement. Blast furnace slag is fulfilling the filling material properties. So, the use of the BFS as a filling material in rural road construction and replace the quantity of aggregate in Rural Road Construction. In Chhattisgarh Blast furnace slag used as a filling material in many road construction like Bhilai sector area, Raigarh etc

The non-metallic product, consisting essentially of silicates and alumina silicates of calcium and of other bases that is developed in a molten condition simultaneously with iron in a blast furnace.

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## 2 MATERIAL

### 2.1 Blast Furnance Slag

In the production of iron, iron ore, iron scrap, fluxes are charged into a blast furnace along with coke for fuel. The coke is combusted to produce CO, which reduces the iron ore to a molten iron product. This molten iron can be cast into iron products, but is most often used as a feedstock for steel production. The non-metallic product, consisting essentially of silicates and alumina silicates of calcium and of other bases that is developed in a molten condition simultaneously with iron in a blast furnace.

Different forms of slag product are produced depending on the method used to cool the molten slag. This product include are Air-Cooled Blast Furnance Slag, Expanded or Foamed Slag, Pelletized Slag and Granulated Blast Furnance Slag.

1. Air-cooled blast-furnance slag is the material resulting from solidification of molten blast-furnance slag under atmospheric conditions; subsequent cooling may be accelerated by application of water to the solidified surface.
2. Expanded blast-furnance slag is the lightweight, cellular material obtained by controlled processing of molten blast furnace slag with water, or water and other agents, such as steam or compressed air, or both.
3. Blast-furnance slag of glassy granular material.



Fig No 1: Blast Furnance Slag

## 2.2 Properties

**Physical properties:** List some typical physical properties of air-cooled blast furnace slag.

S.No.	Properties	Air cooled blast furnace slag
1.	Specific gravity	2.0-2.5
2.	Compact unit weight(kg/m <sup>3</sup> )	1120-1360
3.	Absorption (%)	1-6

Table no. 1: Physical properties of Slag

**Chemical Properties:** List some typical chemical properties of air-cooled blast furnace slag.

S.No.	Constituent	Quantity
1.	Sio <sub>2</sub>	35.28%
2.	FeO	0.48%
3.	Al <sub>2</sub> O <sub>3</sub>	18.93%
4.	TiO <sub>2</sub>	0.41%
5.	CaO	33.08%
6.	MgO	9.76%
7.	K <sub>2</sub> O	0.61%

Table no. 2: Chemical Properties of Slag

**Mechanical Properties:** List some typical mechanical properties of air cooled blast furnace slag.

S.No.	Property	Value
1.	Los angle abrasion	35%-45%
2.	Angle of internal friction	40-45
3.	Hardness	5-6

Table no. 3: Mechanical Properties of Slag

## 3 METHODS OF EXPERIMENT

### 3.1 Tests Performed on the aggregate

Various tests were performed to check our hypothesis that whether we can use 'Air cooled Blast Furnace Slag' for our constructional purpose. Various tests for strength calculation, etc... for the quality of the construction is very crucial. This section of the report shows the details about those tests given below:

- 1) Impact Test
- 2) Water Absorption Test
- 3) Los Angles Abrasion test
- 4) Crushing value

## 4 COMPARISON RESULTS AND DISCUSSION

### 4.1 Comparison between Aggregate and Blast Furnace Slag

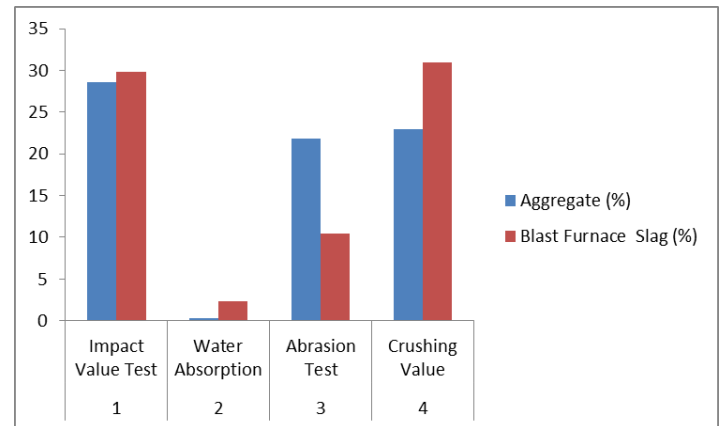
We have compared aggregate and air cooled blast furnace slag in our transportation lab at college by using Los Angeles Abrasion Apparatus, Impact Testing Machine and Oven (at

100°C to 110°C). The following table describes the comparison.

S.No.	Test Performance	Aggregate (%)	Blast Furnace Slag (%)
1.	Impact Value Test	28.61	29.80
2.	Water Absorption	0.3	2.3
3.	Abrasion Test	21.82	10.48
4.	Crushing Value	22.98	30.96

Table no 4: Comparative Result of Laboratories Test

Fig No 2: Graphical Comparison of Result



## 5 CONCLUSION

After the entire test performed it is concluded that;

- Since slag is fails in abrasion test it can't be used in the surface course. Hence it can be used in the base course and sub-base course in road construction.
- It is can be used in the rural road or village road. It is eco-friendly because we are doing waste management.
- That's available in the form of as a waste product.
- It is found in large chunks that mean we can use it for both coarse aggregate and fine aggregate (after breaking).
- Blast furnace slag as a low cost material used in rural road construction. So the cost of road is decreased.
- Blast furnace slag used in road construction and also used in leveling of ground.
- Water absorption capacity is best as compared to other filler material so material compacted easily.

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