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## USE OF STEEL SCRAPE IN BITUMEN ROAD PAVEMENT

### URBAN WASTE MANAGEMENT

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**ABSTRACT:** The large amount of industrial wastes as increased year by year and disposal becomes a very serious problem. it is necessary to utilize the steel slag waste affectively with technical development in each field. Commonly murrum soil has been used for construction of all categories of roads in our country. Although murrum is a good construction material, due to scarcity they increase the construction cost at some parts of the country , several types of murrum soils are found to be unsuitable for road construction in view of higher finer fraction and excessive plasticity properties. such as used industrial material like steel slag in construction of road pavement. its disposal causing severe health and environmental hazards in road construction industries is gradually gaining significant importance in India considering the disposal, environmental problems and gradual depletion of natural resources like soil and aggregates. Steel slag is a waste material generated as a by-product during the manufacturing of steel from steel industries. The quantity of generation is around 24 lacs mt per year from (ref.report.crrri-2010) different steel industries in the India. Presently, it has no applications and dumped haphazardly on the costly land available near the plants. to improve its geotechnical engineering properties, the steel slag material was mechanically stabilized with locally available soil in the range of 5 – 15%. Geotechnical parameters of these stabilized mixes were evaluated to investigate their suitability in the construction of different layers of road technical specification of steel slag is developed for utilization in the construction of embankment, sub grade and sub base layer of flexible pavement and also as a binder in upper bituminous mix layer. The quantity of generation of this slag is around 24 lacs MT per year from different steel industries in India. Presently, this steel slag isn't utilized and is dumped near the costly plants. Study was carried out to utilize the slag in different layers of road construction. Technical specification of slag were developed for utilization in the construction of embankment, sub-grade, sub-base, upper layers of road pavement.

**KEY WORDS:** STEEL SCRAPE USE, CRUSH STEEL, SLAG, SOIL, BITUMEN

**I. INTRODUCTION:** The need to recycle the materials in society today has become more important as the demands on our natural resources continue to grow. Two of the main components of the infrastructure are steel and concrete and this is why these two industries have seen a steady increase in demand over the last thirty to forty years. Concrete is a very versatile building material that is used in nearly every aspect of the infrastructure of developed countries. Concrete is comprised of fine and coarse aggregates, which account for 60 to 70% of the concrete, and the remaining components are water and the cement, which is the binding material that solidifies and holds the mixture together. With such a large portion of concrete being comprised of aggregates, this has put an increasing demand on the limited supply of natural aggregates. The use of the steel slag as a replacement of the natural aggregates in concrete could be beneficial to the environment in many ways. Some of the environmental impacts that could be seen from using the slag in concrete would be a reduction in the amount of landfill, reducing the CO<sub>2</sub> produced by equipment during the mining of natural aggregates, and lowering the cost of shipping if there is a steel plant closer to the concrete plant than the location of the natural aggregates. This research focuses on the use of steel slag as a replacement for natural aggregates in concrete pavement applications.

**2 LITERATURE REVIEW:** The ductility of bitumen containing steel slag aggregates firstly increases and then decreases with increase in percentage of steel slag aggregates in the mix. The test results showed a significant scope of use of steel slag, along with the bitumen as a binder. Around 8%-12% of steel slag is mixed to attain the ideal properties of the binder material.

### 3. TESTS

**3.1. DUCTILITY TEST :** The ductility test was carried out for the bitumen and metal slag mix. The percentage of metal slag in the mix was gradually increased and accordingly readings were noted down.



| %OF METAL SLAG | BITUMEN CONTENT (GRAMS) | DUCTILITY (MM) |
|----------------|-------------------------|----------------|
| 4              | 100                     | 57             |
| 8              | 100                     | 96             |
| 12             | 100                     | 98             |
| 16             | 100                     | 61             |
| 20             | 100                     | 43             |

TABLE : 1. DUCTILITY TEST

### 3.2. SOFTENING POINT TEST

Softening point test was conducted for the bitumen mix with 8% and 12% of metal slag. The results obtained were.

| %METAL SLAG | BITUMEN | SOFTENING TEM. |
|-------------|---------|----------------|
| 8%          | 100gm   | 121            |
| 12%         | 100gm   | 127            |

TABLE 1.2 SOFTENING POINT

**3.3. Moisture Absorption Test** To know the voids in slag, moisture absorption test is carried out as per BIS 2386 Part 3 (1997). Moisture absorption value of Steel Slag was obtained as 10%.

### 4. Case study

In a critical stage toward supportability, India has built its very first steel slag street which is one kilometer long 6 path street. The street, situated in Hazira Industrial Area Gujarat's Surat. The street is a brainchild of the Central Road Research Institute (CRRI), the public authority think-tank NITI Aayog, and the Council of Scientific and Industrial Research (CSIR). It has been worked by ArcelorMittal Nippon Steel India Ltd, a main steel maker, and has gotten the sponsorship of the Steel Ministry and the Ministry of Transport. The steel slag street, made from squander material from steel businesses. It is sturdy and costs 30% less expensive than customary streets. Its thickness is 30% less contrasted with regular streets made of black-top, soil, bitumen, and normal totals. The utilization of steel slag additionally makes the street more sturdy. Index Terms: Construction, Solid waste management, Recycling, Steel slag, Industrial waste material, Sustainability etc.

**4.1 INTRODUCTION** Metal is gotten from normal rocks. Mining of the total, prompts the decrease of normal assets. The nations having restricted assets of normal total are remembering to save their regular assets for their group of people yet to come. An enormous area of land is used for the removal of steel slag strong squanders, creating by the steel and iron making ventures. Factors like ecological, financial, specialized and lack of legitimate development material definitely stand out enough to be noticed of scientists towards the steel slag the best option of regular aggregate. The result creates from the dissolving of scratch to deliver steel by an electric circular segment heater (EAF), and through the change of iron to steel by fundamental oxygen heater (BOF). The steel slag acquired from these heater appears as though comparable however the properties might vary in view of the grade of steel delivered and the heater, while the compound organization stays inside the reach. As contrast with electric curve heater, the principle issue with essential oxygen heater is the abundance amount of its free lime and free magnesia contents. Specific ability are expected to deal with it in an appropriate manner to stay away from the volumetric development if not it might result asphalt disappointment. The unpleasant finished surface of steel slag gives high pallet obstruction. The high unambiguous gravity and the legitimate interlocking because of rakishness of steel slag result better soundness and opposition against rutting also.

**5. Conclusion:** the waste steel scrape can be utilized in various with various methods.

**5.1 using steel slag in bitumen road**

By mixing the steel slag up to 5-8% with bitumen per 100 gm. can provide a better strength to the road pavement with eliminating the impact failure.

**5.2 using steel as aggregate in different layers**

The steel waste can be segregated into different sizes and shape an can be used in the sub-base, sub-grade and with the soil layer in the structure of making a road pavement

This way can replace the use of aggregate and to benefit in the use of waste steel that is disposed inappropriately.

**5.3 use of steel by crushing it**

The steel scrape can be crushed into finer particles and mix with the bitumen to an extent of around 12-15% with some additives, this increases the flexibility of pavement, makes it more smoother to be used for the user .



**6. Advantages**

- 1) Proper use of steel scrape
- 2) Reduces the harmful gases released while melting of steel
- 3) Strengthening of bitumen road pavement
- 4) Reduces pavement cost up to 30%

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