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# Use Of Steel Slag In Asphalt Road Construction

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**Abstract**: Every year, there are more and more industrial wastes, and disposal has become a major issue. With advancements in technology in every industry, it is imperative to effectively utilize the steel slag waste. In our nation, murram dirt is frequently used for the construction of all types of roadways. Several types of murram soils are discovered to be unsuitable for road construction due to increased finer fraction and excessive plasticity qualities, despite murram being an excellent construction material. However, due to their rarity, they raise construction costs in some sections of the country. such as the steel slag that is a common industrial material that is used to pave roads. In India, the issue is how to dispose of it safely given that the road construction industry has serious health and environmental risks ,environmental issues, waste management, and the progressive loss of natural resources like soil and aggregates. Steel slag is a waste product created by the steel industry as a by-product of the production of steel. The amount of generation from the various steel industry in India (ref. report.crri-2010) is approximately 24 lac mt per year. It currently has no applications and is recklessly dumped on the expensive property next to the plants. The steel slag material was mechanically stabilized with locally available soil in the range of 5 to 15% in order to enhance its geotechnical engineering qualities. To determine whether these stabilized mixes geotechnical characteristics are suitable for use in building.

**Keywords**: Steel slag, Asphalt, ductility test.

## I. INTRODUCTION

The iron and steel slag produced as a byproduct of the production of iron and steel can be roughly divided into blast furnace slag and steel making slag. Slag from blast furnaces that create molten pig iron is recovered through melting and separation. It consists of limestone serving as an auxiliary material, coke ash, and nonferrous elements found in the iron core. It is categorized as either granulated slag or air-cooled slag, depending on the cooling technique utilized.Slag used in the production of steel includes converter slag (basic oxygen furnace slag), which is produced by converters, and electric arc furnace slag, which is produced using steel waste as a raw material. In the current study, solid waste that results from the melting of a mixture of materials, including steel scrap, pig iron, silicon manganese, sponge iron, and AL-shots, is converted into granulated blast furnace slag. According to the CPCB's chemical analysis report (hazardous waste rules, 2008, ref. no. 19), the waste material is neutral and non-hazardous in nature. Around 24 lac MT of this slag are produced annually by various steel companies in India (CRRI, 2010). Currently, this steel slag is dumped close to the expensive plants since it cannot be used. The use of the slag in various road construction layers has been studied. For use in the building of embankments, sub-grade, sub-base, and top layers of road pavement, technical specifications for slag were created.

## II. LITERATURE REVIEW

**Liseran Padilha Thives [1]** The main varieties of pavement require energy to build, and this process emits greenhouse gases that have an adverse effect on the environment. A variety of asphalt combinations, including warm mixtures, cold mixtures, mixtures with rubberized asphalt, and mixtures with recycled asphalt pavement, were evaluated.The primary source of emissions is the fuel used in the burners that heat and dry the aggregates. The amount of moisture in the aggregates is another crucial factor that affects energy consumption.

**Faiza O.A.Khalil [2]** The distinctive features of SSA were evaluated based on an extensive laboratory testing programme to determine its suitability for usage in HMA. The proposed mix designs for HMA were carried out in accordance with Marshall mix design, and four different percentages of SSA (0, 50, 75, and 100%) were used. The findings of the trial showed that SSA had supplanted the mixtures. The improvement in indirect tensile strength, resilient modulus, rutting resistance, fatigue life, creep modulus, and stripping resistance of the AC samples served as a measure of the SSA's effectiveness. The mechanical qualities of the AC mixes were found to be enhanced when up to 75% of the limestone

 

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coarse aggregate was replaced by SSA. The findings also indicated that the 25% replacement was the ideal level of replacement.

**Tuefekci M, Demirbas A** [3] In general, it was determined that the various test results, when compared to Turkish Standards, were within the bounds. Due to a lack of river sand, the use of crushed sand as an aggregate has rapidly increased. As a result, crushed sand concrete research is needed. In this study, the wedge splitting test was used to experimentally explore the fracture properties of crushed limestone sand concrete. The results were then compared to those of crushed granite sand concrete and river sand concrete. Investigations were also done into the concrete made of crushed limestone and sand. It was established that the type of fine aggregate had little effect on the concrete's fracture energy. Additionally, crushed sand concrete had a little higher fracture energy than river sand concrete. The inclusion of very fine sand (VFS) in crushed sand, which tends to increase the cohesiveness between cement paste and aggregate, appears to be the cause of this. Additionally, an increase in concrete strength did not result in a proportionate rise in the fracture energy. The characteristic length of river sand concrete or crushed granite sand concrete was almost identical to that of crushed limestone sand concrete.As concrete's strength grew, the characteristic length significantly dropped.

**Ibrahim M Asi; Faisal I Shalabi** [4] The investigation began by analyzing the steel slag's toxicity and other physical, chemical, and biological characteristics. Then, SSA was used to replace 0%, 25%, 50%, 75%, and 100% of the limestone coarse aggregate in the AC mixes. The improvement in the AC samples' indirect tensile strength, resilient modulus, rutting resistance, fatigue life, creep modulus, and stripping resistance served as a measure of the SSA's effectiveness. The mechanical qualities of the AC mixes were found to be enhanced when up to 75% of the limestone coarse aggregate was replaced by SSA. The findings also indicated that the 25% replacement was the ideal level of replacement.

**Mohd. Rosli Hanin** [5] A byproduct of the steel production is steel slag. It is produced as a byproduct of the steel making process.Steel slag has been classified by the majority of developed countries as a usable construction material rather than an industrial waste due to its high cost of disposal as a waste material and overall favourable characteristics. It is repeatedly recycled as an aggregate for building roads, stabilizing soil, building bases and paving flexible pavement. Despite this, a substantial amount of steel slag produced by the steel industry is still dumped in stockpiles. Because of this, a sizable portion of land is sacrificed for the disposal of this valuable resource. The use of steel slag as an aggregate in the creation of asphalt concrete for the construction of roads has been the subject of extensive investigation.

**Martinho, F.C.G, Picado-Santos, L.G** [6] The study compares typical hot mix asphalt concrete (HMA) with warm-mix asphalt concrete (WMA), assessing water sensitivity, permanent deformation, fatigue, and stiffness modulus. The cost differences (for building only) are also covered. There were created three WMA mixes. 60% of recycled concrete aggregate (RCA) and a stand-alone organic wax were used in the production of One WMA.The other two utilized cellulose fibers and organic wax, one of which contained 35% reclaimed asphalt pavement (RAP), and the other did not contain any further sub-products.

**Hitesh Kumar and Sudhir Verma** [7] Numerous well-known applications of steel slag as aggregate in road construction include granular base and sub base layers, hot mix asphalt, cement concrete mix, anti skid-layer, and hot mix asphalt. The advancement of using steel slag aggregate in dense graded hot mix asphalt is reviewed in this research in several aspects.Road performance can be considerably impacted by the characteristics of steel slag. Regarding its appropriateness in an asphalt mix, the chemical composition, physical characteristics, and mechanical qualities of steel slag have been examined. According to research on asphalt mix design, steel slag asphalt can be created to suit both volumetric and mechanical requirements.

## III. CONCLUSION

One of the foundation components, steel slag (GGBS), produces early initial strength. When combined with asphalt mix, steel slag increases strength and stiffness modulus and helps to keep the pavement from failing. It is possible to lower pavement thickness without sacrificing traction and stability. Possess no discernible impact on shelf life.

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