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Effect of Recycled Aggregate and Iron Slag in Concrete Elements

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ABSTRACT

The environment problems are very common in India due to generation of industrial by-products. Due to industrialization enormous by-products are produced and to utilize these by-products is the main challenge faced in India. Due to advancement and the shortages of resources in the materials required for construction process many researches are in progress for the use of waste materials in the concrete technology. Iron slag is one of the industrial by-products from the iron and steel making industries. These Iron slag are materials which does not have a higher scrap value and are considered waste. Concrete wastes from building demolition are dumped and they cannot be recycled. They even pollute the atmosphere and are hard to dispose. In this work, the effect of iron slag and recycled aggregate in the concrete were studied. The compressive strength of the concrete cubes containing Iron slag(20,40,60,80,100%) and recycled aggregate(25,50,75,100%) as partial replacements of fine aggregate and natural coarse aggregate were studied in various exposure conditions of the concrete composite. The results show that the strength of the concrete increases with the addition of iron slag. By adding recycled aggregate in a nominal percentage along with natural coarse aggregate, the strength of the concrete has better strength when compared to conventional concrete mixes and has higher physical properties.

Keywords**--** Recycled aggregate, Iron Slag

I. INTRODUCTION

Concrete is the world's second most consumed material after water, and its widespread use is the basis for urban development. It is estimated that 25 billion tonnes of concrete are manufactured each year. Twice as much concrete is used in construction around the world when compared to the total of all other building materials combined.

The reuse of hardened concrete as aggregate is a proven technology it can be crushed and reused as a partial replacement for natural aggregate in new concrete construction. The hardened concrete can be sourced either from the demolition of concrete structures at the end of their life recycled concrete aggregate, or from leftover fresh concrete which is purposefully left to harden – leftover concrete aggregate. Alternatively fresh concrete which is leftover or surplus to site requirements can be recovered by separating out the wet fines fraction and the coarse aggregate for reuse in concrete manufacture – recovered concrete aggregate. Additionally, waste materials from other industries such as crushed glass can be used as secondary aggregates in concrete. All these processes avoid dumping to landfill whilst conserving natural aggregate resources, and are a better environmental option. The crushed aggregate from either demolition concrete or from hardened leftover concrete are collectively called as Recycled Aggregate. It can be regarded as an alternative coarse aggregate, typically blended with natural coarse aggregate for use in new concrete. The use of 100% recycled coarse aggregate in concrete, unless carefully managed and controlled, is likely to have a negative influence on most concrete properties – compressive strength, modulus of elasticity, shrinkage and creep, particularly for higher strength concrete.

II. LITERATURE REVIEW

Ameri et al. (2012) used the steel slag from Zob-Ahan steel production factory in concrete. He replaced natural aggregates from the steel slag and performed compressive strength tests on samples containing slag ratios of 0, 25, 50, 75 and 100 % and cement contents of concrete 200, 300 and 350 kg/m^3. According to his results, compressive strength improves with the increase in steel slag ratio up to 25% but after that increasing the steel slag ratio above 25% decreases compressive strength. The maximum compressive strength value occurs at 25% slag ratio.

Nadeem and Pofale (2012) reported the operation of granular slag as replacement of natural fine comprehensive in construction applications (Masonry & plastering) In this examination cement mortar mixes 1:3, 1:4, 1:5 & 1:6 by volume were selected for 0, 25, 50, 75 & 100% replacements of natural sand with granular slag for w/c ratios of 0.60, 0.65, 0.70 & 0.correspondingly. The study gave comparative results for mortar flow behaviours, compressive & split tensile strengths, brick mortar crushing & pulls strengths and their co-relations. The study comprises of the experimental results obtained show that partial substitution of ordinary sand by slag gives better results in both the applications i.e. masonry & plastering. The sand replacement from 50 to 75% improved mortar flow properties by 7%, the compressive strength improved by 11 to 15 % for the replacement level from 25 to 75%. At the same time brick mortar crushing & pull strengths improved by 10 to 13% at 50 to 75% replacement levels. The co-relation between mortar compressive/split tensile strengths & brick crushing/pull strengths shows linear dependency on each other's. *Siddique and Kaur (2011)* studied the properties of concrete containing ground granulated blast furnace slag (GGBFS) at elevated temperatures. The compressive strength of concrete mixtures decreased with the increase of GGBFS content at normal temperature (27˚ C) and 350˚C. At room temperature (27˚C), 28-day compressive strength of concrete containing 20%, 40% and 60% GGBFS was respectively 16.8%, 23.9% and 28.5% lower than the control mixture (34.8 MPa). *Al-Akhras (2006)* studied the consequence of metakaolin (MK) substitute of cement on the durability of concrete to sulphate attack. The three metakaolin replacement levels were considered in the study i.e. 5%, 10%, and 15% by weight of cement. The study showed that metakaolin replacement of cement increased the sulphate resistance of concrete. The sulphate resistance of metakaolin concrete improved with increasing the metakaolin substitution level. Concrete containing 10% and 15% metakaolin replacement showed tremendous durability to sulphate attack. The first cracks of plain and metakaolin concrete specimens due to sulphate attack start to come out on the corners of concrete specimens.

III. MATERIALS

3.1CEMENT

Ordinary Portland Cement (OPC) of 43 Grade from a single lot was used throughout the course of the investigation. It was fresh and without any lumps. The physical properties of the cement as determined from various tests conforming to Indian Standard IS: 8112:1989. The specific gravity of cement was found to be 3.15

3.2 FINE AGGREGATE

Natural river sand was used as fine aggregate. The properties of sand were found as per IS: 383-1950. The specific gravity was found to be 2.69.

3.3COARSE AGGREGATE

Coarse aggregate of size 20mm is sieved and used in this work. Fineness modulus was found to be 6.9

3.4 IRON SLAG

Iron slag is from local industry was purchased. Specific gravity was found to be 2.5

3.5 WATER

Portable water free from deleterious materials was used for casting and curing of concrete as per IS: 456-2000 recommendations were used.

3.8Mix Proportion details

M25 grade of concrete were used for this work. Percentage of Iron slag replacement with Fine aggregate where done in 0%, 20%, 40%,60%,80%,100% . Percentage of recycled aggregate was done for 25%,50%,75%,100% with coarse aggregate

IV. TEST RESULTS AND DISCUSSION

Test specimens of size 150 × 150 × 150 mm for compression test were prepared and tested after 28days. Fig 1 and 2 shows average compressive strength with iron slag and recycled aggregate replacement for cement and coarse aggregate respectively

TABLE 1 COMPRESSIVE STRENGTH FOR IRON SLAG REPLACEMENT WITH SAND

S.No	PERCENTAGE OF IRON SLAG REPLACEMENT WITH SAND	7 Days Strength N/mm^2	28 Days Strength N/mm^2
1	0%	16.11	27.87
2	20%	16.44	27.89
3	40%	17.98	28.23
4	60%	18.24	28.57
5	80%	16.32	27.31
6	100%	16.77	26.93

Table 2 COMPRESSIVE STRENGTH OF THE CONCRETE CUBES WITH COARSE AGGREGATE REPLACEMENT WITH RECYCLED AGGREGATE

S.No	% OF COARSE AGGREGATE REPLACEMENT WITH RECYCLED AGGREGATE	7 Days Strength N/mm^2	28 Days Strength N/mm^2
1	0%	16.11	27.87
2	25%	17.66	28.59
3	50%	17.54	28.32
4	75%	15.30	27.59
5	100%	15.43	27.22

V. CONCLUSION

Based on this experimental investigation, the following conclusions were made

Replacement of fine aggregate with iron slag and coarse aggregate with recycled aggregate was found to be partially good. All the percentage showed some variations. Coarse aggregate replacement with recycled aggregate for 25 and 50% was found to be good. Increase of coarse aggregate percentage decreased the strength. Fine aggregate replacement for 40%, 60%,80% with iron slag was found to be good, increase in strength was found when compared to control concrete . Replacement of sand with iron slag for 80% and 100% was found to be less when compared to control concrete. Over all iron slag can be used as a replacement material for fine aggregate and recycled aggregate can be used as a partial replacement of coarse aggregate. Using of iron slag and recycled aggregate is eco friendly.

REFERENCE

[1] Al-Akhras N.M, (2006). "Durability of metakaolin concrete to sulphate attack." Cement and Concrete Research Vol. 36 pp 1727-1734.

[2] Aldea C, M., Young F., Wang K., Shah S. P. (2000). "Effects of curing conditions on properties of concrete using slag replacement." Cement and Concrete Vol. 30 pp 465-472.

[3] Bakhareva T., Sanjayana J.G., Cheng Y.B. (2001) "Sulphate attack on alkali-activated slag concrete." Cement and Concrete Vol. 32 pp 211-216.

[4] Dhir RK, Paine KA, Caliskan S. Use of Recycled Concrete Aggregate in Concrete – Technology Application Document 1. University of Dundee, Scotland, UK.

[5] IS: 10262-1982 (Reaffirmed 2004): Recommended guidelines for concrete mix design, Bureau of Indian Standard, New Delhi-2004.

[6] IS: 2386 (Part I, III)-1963: Methods of Test for Aggregates for Concrete, Bureau of Indian Standard, New Delhi-1963.

[7] IS: 383-1970: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standard, New Delhi-1970

[8] IS 456 -2000: Design of Plain and Reinforced Concrete, Bureau of Indian Standard, New Delhi-2000.

[9] IS: 8112-1989 (Reaffirmed 2005): Specification for 43 Grade Ordinary Portland cement, Bureau of Indian Standard, New Delhi-2005.

[10] Ismail Z.Z., AL-Hashmi E.A. (2007). "Reuse of waste iron as a partial replacement of sand in concrete. "Waste Management Vol. 28 pp 2048-2053.