A Study on the Fine Aggregates Replacement Materials in Self Compacting Concrete

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ABSTRACT

In the current situation, the lack of natural sand has become a concern for the construction industry, resulting in new generation sand known as M-sand or Manufacture sand or Artificial Sand after much work by the developed technology. The artificial sand is created in sizes and shapes identical to N-sand or Natural Sand by crushing rocks and DEGRADATION OF NATURAL RESOURCES (FINE AGGREGATES AND COARSE AGGREGATES) [1]. In contemporary times, one of the most important developments in concrete engineering is the manufacture of a concrete form that achieves compaction through the action of its own weight. Due to the need for methods and processes to increase efficiency, in the 1980s, Japan created the so-called self-compacting concrete (SCC) [2]. To achieve the desired deformability of the SCCs, the quantity of coarse aggregates must be decreased and the amount of cement paste increased [3]. Compared to natural sand, manufactured sand has some distinctive characteristics in gradation of grain, particle size, surface composition, mineral structure, especially in the content of stone powder stones. Self-Compacting Concrete (SCC) is an advanced concrete that does not require putting and compacting movement. It can flow under its own weight, fill formwork fully and achieve complete compaction, even in the presence of congested reinforcement [13]. This survey aims at describing the various fine aggregate replacement materials and their properties.

[5]. There have also been many environmental problems caused by sand mining, such as the depletion of river beds, the reduction in surface water levels in waterways [6]. High fines content was reported in the MS and significant effects of elevated fine content were noted on mortar and concrete workability. Therefore, higher amounts of water are needed for concrete with manufactured sand (CMS) to achieve similar workability for the same mixing ratio as for natural sand concrete [7].

FINE AGGREGATE REPLACEMENT MATERIALS

SCC blend of 30 percent wollastonite micro-fiber as a replacement for fine aggregates provides better power and possibilities of repair compared to existing SCC or standard concrete mix [2]. Partial sawdust replacement reduces the concrete making cost. As the amount of sawdust increases, the water absorption improved. To achieve better result, replace sawdust with fine aggregate by 10% [3]. Triple blend SCC enhances its flowability properties. As a result, with Fly ash as an intermediate cemented material and GGBS as a ternary cemented material in SCC, stronger rheological characteristics of SCC can be obtained [4]. Granite Cutting Waste (GCW) incorporation has also influenced the fresh qualities of the compounds of the SCC. Increased movement of water concentration and absorption of custom granite SCC compounds have been modified to produce up to 40 percent of GCW compared to the SCC regulate combination [5]. Fine aggregate was replaced to waste glass in six weight ratios varying from 0 to 50 percent. Fresh findings show that the characteristics of flow-ability were improved as the waste glass was integrated into the volume of the paste. SCC can be manufactured as a regular fine aggregate with waste glass [6]. For SCC applications, the use of MS with a high calcareous quary fines has been treated. The experimental results show that the quality of the C60 MS-SCC with a fines content of 7% is excellent compared to that of the C60 NS-SCC [7]. It is possible to obtain SCC by means of a combined replacement of cement kiln dust and marble powder that satisfies the parameters for fresh concrete properties. When marble powder increases, the slump flow of SCC is also increased [1].

MIX PROPORTIONS

The development of the concrete mix is based on IS 10262:2009 [3]. Mixes were structured in accordance with the Absolute Volume Method, after extensive trials design mixes were arrived. Triple Blend Self Compacting Concrete (TSC) mix contains cement, fly ash and GGBS in the same proportions: M-sand and Pond ash as FA in the 50:50 ratio and CSC mix with cement and fly ash in the 70:30 ratio of cement and M-sand and Pond ash as FA in the 50:50 ratio [4]. The rotary drum type mixer was used to mix all components of SCC mixtures. Fresh property testing of SCC mixtures was carried out before pouring into test moulds. Both cast samples were then left in room temperature moulds for one day and demolished then put in water until the testing period on the next day [5]. Mixtures self-compact ability was achieved by increasing the dosage of admixture [7]. The cement-free binder was made using Ipoh's GBFS (Malaysia). The coarse aggregates were grounded granite minerals with a maximum size of 10 mm and a specific gravity of 2.66 in saturated surface-dry (SSD) states. A combined alkaline NaOH and Na2SiO3 solution were used in this test. NaOH pellets (99 percent purity) are diluted for at least one hour with distilled water to neutralize the impact of impurities to acquire the activator solution. Regardless of the combination, the weight ratio of Na2SiO3 to NaOH was held at 2.5, and the fine aggregate weight ratio to GBFS was 2.125. The mechanical characteristics of this mixture include
prepared SCGPC concrete mix were tested using crucial workability tests [8]. The concept of the mix model can therefore be reworded as follows: ‘mechanisms for the selection of applicable materials and the determination of their relative quantities for the production of economic concrete with some of these minimum properties, remarkable workability, strength and durability. Usually the final mix must be designed by a series of test and error manufacturing processes. The components used vary, and the properties of the materials may not be quantitatively estimated accurately. The optimum combinations of ingredients were estimated according to the relationships identified [9]. All SCC mixtures’ mix design is based on the development method of the Okamura SCC mix (Edamatsu et al. 2003) [10].

**FRESH CONCRETE PROPERTIES**

The findings of fresh concrete products indicate that with an increase in paste size, the slump flow increases [12]. For the control mix, the basic flow ability requirements as specified in the EFNARC specifications (EFNARC 2005) for SCC are met. In this monitoring blend, 7.5 percent of silica fume partly replaces the ordinary Portland cement and no substitutions are made for fine and coarse aggregate. The quantitative and qualitative results showed that the required fresh properties consistent with the EFNARC limits of SCGC are obtained by all concrete mixes (EFNARC 2002). The suggested samples of SCGC’s slump flow, T50, L-box and V-funnel values showed that replacing the spent garnet for the river sand might increase the workability of the concrete. SCGC’s slump flow was found to increase as much as 29 percent relative to the control when the volume of the mixture was increased to 100 percent in the concrete mix. The standard fresh GPC was less coherent and workable than the spent garnet GPC [8].

**COMPRESSIVE STRENGTH**

It can be described as the total axial load resistance of a concrete [13]. Standard create is the compression measuring tool used to test the cube samples. The computer is fitted with a control valve to control the load speed. Until cube checking, the plates are wiped. The cube samples are removed from the healing tank after the necessary healing time and washed to wash off the surface water. The bearing surfaces are positioned on the smooth surface of the sample. When the natural fine aggregate is replaced by M-sand for about 75%, there is an improvement in the compressive strength of this mix. Furthermore, the compressive strength achieved the top worth for the 50% substitution of M-sand [11].

**FLEXURAL STRENGTH**

It is observed that, when natural fine aggregate is replaced by M-sand the flexural strength is increased in the SCC mixes. The flexural strength rises steadily by 50 per cent with a substitution of M-sand [11].

**CONCLUSION:**

Due to small particle size and more surface area, SCC with mineral admixture showed satisfactory results in workability. Adding cement kiln powder and marble powder had a positive impact on the workability [1]. Wollastonite micro-fiber is a desirable component to be used in self-compacting concrete as its use improves the cohesiveness and flowability of concrete [2]. Replace the sawdust with a fine aggregate by 10% to achieve better results [3]. Modified granite SCC blends with sufficient fresh and hardened characteristics it is possible to use dense structural reinforcement. The use of GCW in SCC will help to make concrete products sustainable [5]. Spent garnet replacement level of 25% showed optimal results in terms of both flow capacity and mechanical properties [8]. Both mineral and chemical admixtures are often used to enhance HWC conditions by providing solid bonding and enhancing concrete properties in fresh and hardened states [9]. The substitution of fine natural aggregate with M-sand enhances the compressive strength of SCC mixtures to eliminate up to 50% [11]. Therefore the conclusion from the above study shows that the partial replacement of fine aggregates in scc by m sand plays a vital role. The role of m sand in scc pays way for high workability, strength parameters and durability.

**REFERENCES:**


