Experimental Investigation On Self Compacting Concrete By Using Mineral Additives

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Abstract

Self−compacting concrete is one of "the most revolutionary developments" in concrete research; this concrete is able to flow and to fill the most restacked places of the form work without vibration. There are several methods for testing its properties in the fresh state: the most frequently used are Slump−flow test, L−box, U-box and V−funnel. This work presents properties of self−compacting concrete, mixed with different type's additives: fly ash, micro silica, metakaolin. So we added admixture ac-hypercrete and ac-viscocrete about 0.5% and 0.2% of total cementatious content in every mix thereafter. The compressive strength carried in the compressive testing machine. The additions of fly ash were 20%, 25%, 30% and 35% of concrete. It was seen that increase the percentage of fly ash resulted in the decrease of compressive strength.

Keyword- *Self−compacting concrete, Slump−flow test, L-box, V−funnel fly ash, micro silica*

Introduction

Self-compacting concrete (SCC) is a flowing concrete mixture that is able to consolidate under its own weight. The highly fluid nature of SCC makes it suitable for placing in difficult condition & in selections with congested reinforcement. Use of SCC can help in hearing related damages on the worksite that are induced by vibration of concrete, another advantages of SCC is that the time required to place large section in consider ability reduced. When the construction company in Japan experienced a decline in the availability of skill labour in the 1930's a need for felt for a concrete that could overcome the problem of defective workmanship.

SCC mainly used in highly congested reinforced concrete structure in seismic region and to overcome the problem of storage of skilled labours for the efficient compaction of concrete. Review of literature indicates that durability of SCC largely depends on the type of mineral admixtures.

The application of concrete without vibration in highway bridge construction is not new. For examples, placement of seal concrete, mass concrete and shaft concrete can be successfully placed without vibration. These seal, mass and shaft concretes are generally of lower strength, less than 34.5 MPa and difficult to attain consistent quality. The modern application of self-compacting concrete (SCC) is focused on high performance and more reliable and apcapable quality, dense and uniform surface texture, improved durability, high strength, and faster construction.

By the early 1990's, Japan has to be developed and used SCC that does not require vibration to achieve full compaction. More and more applications of SCC in construction have been reported in Japan. As of the year 2000, the amount of SCC used for prefabricated products (precast members) and ready-mixed concrete (cast-in-place) in Japan was about 400,000 m^3.

Various Types of SCC

To meet the concrete performance requirements the following three types of self-compacting concrete are capable

Powder type of self-compacting concrete: In this proportioned give the self compact capability by reducing the water-powder ratio and provide adequate segregation resistance. Super plasticizer and air entraining admixtures give the required deformability.

Viscosity agent type self-compacting concrete: In this proportioned to provide self-compaction by the use of viscosity modifying admixture to provide segregation resistances. Super plasticizer and air entraining admixture are used for obtaining the desired deformability.

Combination type self-compacting concrete: In this proportioned so as to obtained self-compact capability mainly by reducing the water-powder ratio, as in the powder type, and a viscosity modifying admixture is added to reduce the quality fluctuation of the fresh concrete due to the variation of the surface moisture content of the aggregates and their gradations during the production. This facilitates the production control of the concrete.

Result and Discussion

EFFECT OF FLY ASH

TABLE NO 1 TEST RESULTS OF SCC USING FLY ASH

Percentage of fly ash	**20%**		**25%**		**30%**		**35%**	
Slump flow	5 min	30 min	5 min	30 min	5 min	30 min	5 min	30 min
	685mm	675mm	695mm	685mm	715mm	695mm	690mm	665mm
V-funnel	T0	T5	T0	T5	T0	T5	T0	T5
	12 sec	14 sec	10 sec	12 sec	12 sec	13 sec	12 sec	13 sec
L-box	0.8		0.9		0.7		0.7	
7 days compressive strength	27.8 N/mm^2		23.62 N/mm^2		19.74 N/mm^2		19.45 N/mm^2	
28 days compressive strength	40.46 N/mm^2		38.35 N/mm^2		35.39 N/mm^2		35 N/mm^2	

- Slump flow tests are carried out after 5 minutes and 30 minutes. Slump flow for 30% fly ash was observed to be maximum for both 5 and 30 minutes.
- All the other results were well within the range (Range: 650 mm to 800 mm). The higher the value of slump flow, the greater ability to fill the form work under its own weight
- It can seen here that the time required to flow or the filling ability of concrete through the V-Funnel apparatus is minimum after both 0 and 5 minutes for 25% fly ash concrete mix.
- For concrete mix with fly ash percentage 30% and above the flow time increases indicating segregation. So we add micro silica and metakaolin to improve this workability property.
- Shorter flow time indicate greater flow ability
- Both the 7 days compressive strength and 28 days compressive strength decreases. So further increase in the fly ash percentage stopped after 35% as it give the poorest results and so we add micro silica and metakaolin to develop an efficient self-compacting concrete.
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2 EFFECT OF MICRO SILICA

TABLE NO. 3 TEST RESULTS OF SCC USING MICRO SILICA (35% FLY ASH AS BASE)						
Percentage of micro silica	**4%**		**6%**		**8%**	
Slump Flow	5 min	30 min	5 min	30 min	5 min	30 min
	745mm	710mm	725mm	690mm	705mm	655mm
V-funnel	T0	T5	T0	T5	T0	T5
	10 sec	13 sec	11 sec	14 sec	10 sec	12 sec
L-Box	0.9		0.8		0.9	
7 days Compressive strength	23.58 N/mm^2		28.0 N/mm^2		32.46 N/mm^2	
28 days Compressive strength	38.86 N/mm^2		42.90 N/mm^2		47.93 N/mm^2	

- Slump flow after both 5 minutes and 30 minutes can be seen, it can be seen that the spread diameter for increase of percentage of micro silica is well within limit.
- For increase in micro silica content the flow time required both initially and after 5 minutes is found to be within limit indicating lesser or no segregation at all the concrete mix.
- It can be seen that the blocking ratio as determined in the L-Box apparatus by increasing the percentage of micro silica initially decreased at 6% micro silica content and then again increased at 8% micro silica content giving the all the results within the specified range of 0.8 – 1.0
- It is seen that the compressive strength increases with the increase in the percentage of micro silica up to 8% giving good results for both 7 days compressive strength and 28 days compressive strength as shown.

Conclusion

Following are conclusion are made

- In place of fly ash, micro silica and metakaolin to use rice husk ash, GGBS (Ground Granulated Blast Furnace slag), stone powder or any other materials. In stone powder finely crushed lime stone, dolomite or granite may be used to increase the amount of powder.
- There are various new admixtures available in the market which can be used for improving or developing SCC.
- Fiber reinforced SCC can also be prepared to enhance the flexural strength.
- Mainly steel or polymer fiber may be used for SCC.
- In SCC, ground glass filler can also be used for further work. This filler is usually obtained by finely grinding recycled glass.

References

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