"Experimental Analysis on Mechanical Properties of Concrete Containing welan Gum"

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Abstract— The basis of this concrete is a high content of ultra fines which consists of one or more varieties of mineral and chemical admixtures. An attempt has been made in the investigation reported in this paper to study hardened properties Self Compacting Concrete (M50) .Cubes were cast and tested in compression, and studied their mechanical properties. Compressive Strength is evaluated by replacing Welan Gum Content with Cement by 0.2% to 1% Replacement. By Addition of Welan Gum up to Certain Percentages Gives better Results than normal Concrete under Same Environment And Curing Condition.

Key words: Welan Gum, Self Compacting Concrete, Compressive Strength

I. INTRODUCTION

Self Compacting Concrete (SCC) exceeds the properties and constructability of normal concrete. Normal and special materials are used to make these specially designed concretes that must meet a combination of performance requirements. Special mixing, placing, and curing practices may be needed to produce and handle high performance concrete. Extensive performance tests are usually required to demonstrate compliance with specific project needs. Self Compacting concrete has been primarily used in tunnels, bridges for its strength, durability, and high modulus of elasticity. It has also been used in shotcrete repair, poles, parking garages, Irrigation structures and agricultural applications.

SCC is a concrete, which possess high durability and high strength when compared to conventional concrete. This concrete contains one or more of cementetious materials such as fly ash, Silica fume or Ground granulated blast furnace slag and usually a super plasticizer. The term 'high performance' is somewhat pretentious because the essential feature of this concrete is that its ingredients and proportions are specifically chosen so as to have particularly appropriate properties for the expected use of the structure such as high strength and low permeability.

SCC has been used in various structures all over the world since last three decades. In India, it is about a decade old. Major applications in the constructions are nuclear power plants, ultra high rise buildings, and tall structures. Recently a few infrastructure projects have also seen specific application on SCC. The development of SCC has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. Most of the developments across the world have been supported by continuous improvement of these admixtures. However for better practical applications, behaviour of different structural elements like slabs, beams, columns etc., made of SCC need to be evaluated.

The objective of any mix design method is to determine an appropriate and economical combination of concrete ingredients that can be used for a first trial batch to produce a certain concrete which is close to that can achieve a good balance between various desired properties of concrete at the minimum cost. A mixture proportioning only provides a starting mix design that will have to be more or less modified to meet the desired concrete characteristics. In spite of the fact that mix design is still something of an art, it is unquestionable that some essential scientific principles can be used as a basis for calculations. Mix design of SCC is different from that of usual concrete because of the following reasons,

1) Water-binder ratio is very low.
2) Concrete quite often contains cement replacement materials that drastically change the properties of fresh and hardened concrete.
3) Slump or compaction factor can be adjusted using high range water reducing admixture (HRWRA) without altering water content.

The concrete mixes are designed in the laboratory under ambient conditions, whereas they are placed at sites where they may get exposed to varying humidity and temperature conditions as a result of environmental change. Since, the laboratory and site conditions are differing to a great extent, particularly in the Indian context; the mix design of the SCC gets affected requiring modifications in several variables of the mix such as water-binder ratios, fine-coarse aggregate ratio, and optimum contents of mineral and chemical admixtures. Therefore, it has become necessary to propose a suitable method for proportioning SCC mixes, which will take into account the deviations in environmental conditions in the laboratory as well in the site, by incorporating necessary modifications required for obtaining desired workability and strength properties.

Compared to normally vibrated concrete (NVC), self-compacting concrete (SCC) possesses enhanced qualities and improves productivity and working conditions due to the elimination of compaction. SCC generally has higher powder content than NVC and thus it is necessary to replace some of the cement by additions to achieve an economical and durable concrete. Japan has used self-compacting concrete (SCC) in bridge, building and tunnel construction since the early 1990's. In the last five years, a number of SCC bridges have been constructed in Europe. In the United States, the application of SCC in highway bridge construction is very limited at this time. However, the U.S. precast concrete industry is beginning to apply the technology to architectural concrete. SCC has high potential for wider structural applications in highway bridge construction. The application of concrete without vibration in highway bridge construction is not new. For examples, placement of concrete underwater has been placed without vibration, 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. Modern application of self-compacting concrete (SCC) is focused on high performance. Better and more reliable quality, dense and uniform surface texture, improved durability, high strength, and faster construction.

II. MIX DESIGN

Cement is a fine, grey powder. It is mixed with water and materials such as sand, gravel, and crushed stone to make concrete. The cement and water form a paste that binds the other materials together as the concrete hardens. The ordinary cement contains two basic ingredients namely argillaceous and calcareous. In argillaceous materials clay predominates and in calcareous materials calcium carbonate predominates.

INGREDIENT	% CONTENT
CaO (Lime)	60-67
SiO2 (Silica)	17-25
Al2O3 (Alumina)	3-8
Fe2 O3 (Iron Oxide)	0.5-6
MgO (Magnesia)	0.1-4
Alkalies	0.4-1.3
Sulphur	1-3

Table 1: Chemical Properties of Cement

The sand used for the experimental programme was locally procured and conformed to Indian Standard Specifications IS: 383-1970. The sand was first sieved through 4.75 mm sieve to remove any particles greater than 4.75 mm and then was washed to remove the dust. Properties of the fine aggregate used in the experimental work are tabulated in Table 3.3. The aggregates were sieved through a set of sieves to obtain sieve analysis and the same is presented in Table 3.4. The fine aggregates belonged to grading zone III.

The material which is retained on IS sieve no. 4.75 is termed as a coarse aggregate. The crushed stone is generally used as a coarse aggregate. The nature of work decides the maximum size of the coarse aggregate. Locally available coarse aggregate having the maximum size of 10 mm was used in our work. The aggregates were washed to remove dust and dirt and were dried to surface dry condition. The aggregates were tested as per IS: 383- 1970.

GLENIUM SKY 784 is based on technology on Total Performance Control concept which ensures that ready-mix producers, contractors and engineers get a concrete that is the same high quality as originally specified; starting from the production at the batching plant, to the delivery and application into place and followed by its hardening process. Utilizing rheodynemic concrete thechnology, it provides a concrete mix with exceptional placing characteristics and accelerated cement hydration for early strength development and high- quality concrete.

Mix Proportion Of trial 1 for 1m3 Concrete	
Vol of Concrete (cu.m.)	1
Cement Content (kg)	554.94
Water Content (kg)	194.23
Fine aggregate (kg)	858.38
Kapachi (kg)	361.35
Grit (kg)	499.01
Weight (kg)	2467.9

Table 2: Mix proportion of M50 Grade Concrete

III. RESULT OBTAINED

In this research work welan gum 0.2 to 1% is replaced with cement content and compressive strength is obtained at 7 days 14 days and at 28 days.

Results obtained for M50 grade concrete are as follows,

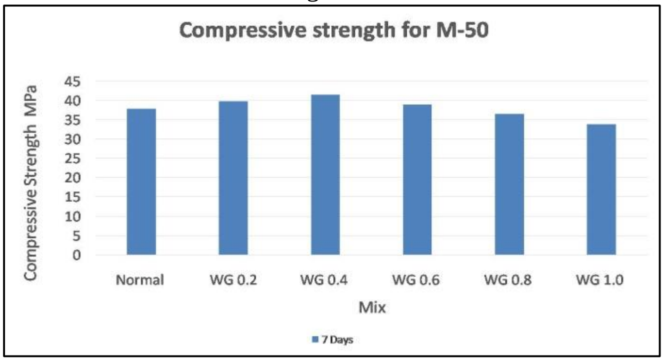

Fig. 1: Compressive Strength at 7 Days

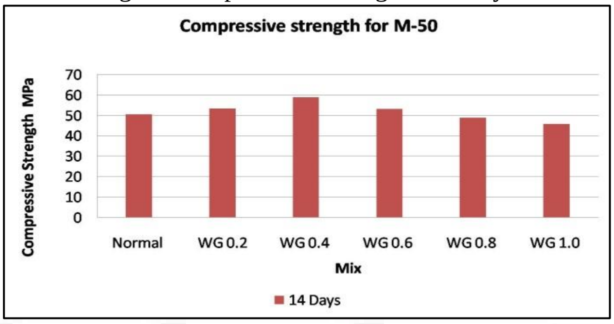

Fig. 2: Compressive Strength at 14 Days

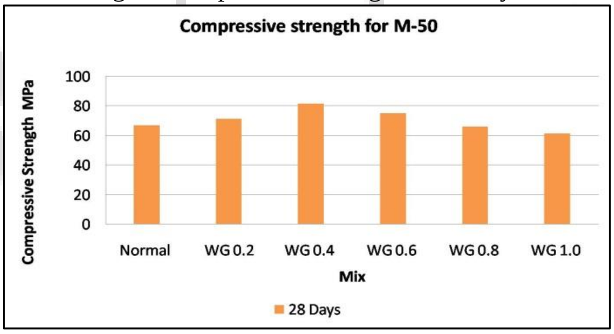

Fig. 3: Compressive Strength at 28 Days

IV. CONCLUSIONS DERIVED

1) By Addition of Welan Gum Rheology is modified.
2) Replacement up to 0.4% Gives Better Compressive Strength of Concrete than Normal concrete.
3) By Increasing Welan gum Content initial Setting Time of concrete decreases.
4) At 14 Days and 28 days 0.4 % Gives optimum dosage of Welan gum.
5) Chances of Segregation and Bleeding can be prevented by using Welan Gum Content up to 1%.

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