A Compatibility Study on Different Types of Cement and Plasticizer

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Abstract— It has long been a concrete technologist's dream to discover method of making concrete at the lowest possible water/cement ratio while maintaining a high workability. To a considerable extent this dream has been fulfilled with the advent of super plasticizers. It has added a new dimension to the application of admixtures with regards to production of high strength and flow able concretes. It is now possible to produce concrete with compressive strength of the order of 90Mpa (90 N/mm^2). In the wake of energy conservation policy and diminishing supplies of high quality raw materials, there is a need to use marginal quality cements and aggregates for the production of concrete. In such instances the use of plasticizers/super plasticizers permits the production of concrete at low water/ cement ratios. We have taken ultra tech opc cement & coromandal ppc cement to find the compatibility by adding perma plast (plasticizer). The water cement ratio was maintained as 0.40 &0.45 for OPC & PPC respectively. To study the effect of these PP on various properties of concrete. The dosage of plasticizers/super plasticizers was measured as 1.5% for Perma plast for OPC & 1.3% for PPC by the weight of cement.

Key words: High Workability, Compatibility, Perma Plast (PP), Optimum Ratio, Marsh Cone Test

I. INTRODUCTION

The strength of concrete depends on a large extension the water cement ratio. The compressive strength of concrete increases with decrease in water / cement ratio. To help reduce the water cement ratio chemical admixtures are helpful. These chemical admixtures help to increase the workability of concrete and in turn help to reduce the water content. The expectation of the contractors is to keep the workability of concrete at a desirable level and at the same time to increase the compressive strength of concrete. Many companies which manufacture different chemical admixtures such as water reducers claim that by using their water reducers the compressive strength of concrete could be enhanced considerably. Hence in this study different water reducers are selected and added to concrete in different dosage and their performance to increase the compressive strength of concrete is studied. Thus many waste materials of today become the useful by products of tomorrow. It is the particular role of plasticizers/super plasticizers, which is very importance for us here in Pakistan, because of our poor economy and less developed industrial base. Besides, the addition of plasticizers/super plasticizers to produces concrete with less cement but normal strength and workability is another application, which has received more attention.

In this research program one types of super plasticizer (Perma Plast) of polymer has been used.

II. MATERIALS PERMA PLAST (PLASTICIZER)

A. DESCRIPTION

Perma Plast is water reducing super plasticizer for concrete. It is a product based upon refined Kngo suipho nates.

B. PRIMARY USES

1. To increase workability.
2. To Increase compressive strength.
3. To effect cement economies.
4. For hot weather concreting.

C. TYPICAL APPLICATIONS

1. In pre-stressed concrete.
2. In areas of congested reinforcement where high workability is beneficial.
3. In pre-cast concrete manufacture
4. In concrete brick and block manufacture.
5. In hot weather concreting to extend workability.

D. ADVANTAGES

1) Increase workability - Significantly improves the workability therefore ease of placing.
2) Improves the cohesive properties of the concrete helping to reduce segregation and bleeding.
3) Reduces water demand – Allows water reduction in the region of 10% to be achieved while maintaining workability, thereby increasing strength, durability and impermeability.
4) Enables economies in the mix designs to be achieved, therefore saving cement

E. ACTION

Perma Plast is a powerful plasticizer which disperses and deflocculates the cement particles within a concrete mix. It can be used to improve workability, without the addition of extra water, or to allow reductions in free water content of the concrete mix.

F. DOSAGE

Field trials should be conducted to determine the optimum addition rates of Perma Plast. A dosage range of 100 cc to 280 cc per 50 Kgs of cement is recommended as an initial starting point.

G. PROPERTIES

Typical properties of Perma Plast are as follows:

1) Colour: Dark brown/black Liquid
2) Specific gravity: 1.20 at 25°C
3) All Entrapment: 1 % maximum dependent on grading of sand and water content.
4) Chloride Content: Nil
5) Nitrate Content: Nil

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6) Freezing Point: 0°C. can be reconstituted if stirred after thawing
7) Flashpoint: None

H. COMPOSITION

A liquid admixture based upon refined lingosulphonates.

I. CAUTION

Over-dosages of Perma Plast will result in the following:

1) Retardation of initial set.
2) Increase in air entrainment.
3) Increase in workability. Provided concrete is properly cured, the ultimate strength of the concrete will not be adversely affected and will generally be higher than that of normal concrete.

J. COMPATIBILITY

Perma Plast can be used with all types of Portland cement including Sulphate resisting. For use with other special cements, contact your nearest Perma technical Office, or distributor. Perma Plast should not be premixed with other admixtures. In other admixtures are to be used in concrete containing Perma Plast they must be dispensed separately.

K. HEALTH AND SAFETY

Perms Plast is not a health hazard or fire risk. Spillages should be washed immediately to avoid possibilities of slipping.

1) ULTRA TECH OPC 53 GRADE CEMENT

1	Appearance	Free-flowing powder
2	Color	Grey
3	Water Demand (%)	35-38
4	Pre-wetting of Surface	Yes
5	Consistency	Very good
6	Brushability	Very good
7	Touch Dry*	40-60 minutes
8	Hard Dry*	24 hours
9	Pot life*	2 hours
10	Chalking (qualitative)	None
11	Wet-scuff resistance (qualitative)	Very good
12	Curing	Self curing at std. lab conditions*
13	Tensile adhesion After 10 days std. conditions (N/mm2) After 28 days std. conditions (N/mm2)	 1.54 1.73
14	Water absorption by Karsten Tube (30 minutes)	0.05ml
15	Crack-over-bridging ability	0.5mm
16	Water impermeability test	>=7.0 Bar

Table. 1: Properties of Cement

2) COROMANDAL KING PPC CEMENT PROPERTIES

1) Strength increases as time passes.
2) High durability concrete - protects from corrosion, coastal attack and extreme temperature.
3) Ideal cement for resisting aggressive environments like chemical, chloride and sulphate attack.
4) Best suited for high performance concrete.
5) High fineness - suited for plastering and finishing works.
6) Low heat of hydration - Ideal for mass concrete pours and machine foundations
7) Equivalent to 53 grade cement.

III. VARIOUS TESTS

A. Marsh cone test

B. Slump cone test

From which we have selected the marsh cone test for Experimental Program.

A. MARSH CONE TEST

The Marsh cone test is a simple approach to get some data about cement pastes rheological behaviour. It has already been used in cement based materials mix design in order to define the super-plasticizer saturation point, i.e. the dosage beyond which the flow time does not decrease appreciably. Marsh cone test is easy to perform and seems to give better results. The test assembly is portable. making it handy at the site. Also it requires small quantity of materials. In the Marsh cone test, cement slurry is prepared and its flow ability is checked. In concrete it is the cement paste that influences flow ability.

It is observed that paste theology model is useful to the SCC mix design. Although, the quantity of aggregates, its shape and texture etc. will have some influence, it is the paste that will have greater influence. The presence of aggregate will make the test more complex and often erratic. The use of paste/slurry alone will make the test simple, consistent and indicative of the fluidity effect of Super plasticizer with the cement.

Fig. 1: Marsh Cone Setup

B. MARSH CONE TEST APPARATUS:

Marsh cone is a conical brass vessel, (Funnel shaped) with a smooth aperture diameter of 8 mm at the bottom. It hold son a stand with container below it. The apparatus is shown in Fig. 1, Stop Watch is needed to record the flow time (T) to empty the cone.

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C. PROCEDURE

Perma Plast			
OPC Dosage %	Time(sec)	PPC Dosage%	Time(sec)
1.0	25.00	1.0	22.09
1.1	23.47	1.1	20.38
1.2	22.78	1.2	19.07
1.3	20.90	1.3	18.34
1.4	20.22	1.4	19.25
1.5	17.54	1.5	-
1.6	18.60	1.6	-

Table. 2: Result of Marsh Cone Test

Take @ 2 kg cement, proposed to be used for the project. Take 800 ml of water (W/C 0.40% for OPC & 0.45% for PPC) and 1% Super plasticizer by weight of cement to make slurry of @ 1 liter. Mix them thoroughly in a mechanical mixer (Hobart mixer is preferable) for two minutes. Hand mixing may not give consistent results because of unavoidable lump formation which blocks the aperture. If hand mixing is done, the slurry should be sieved through 1.18 sieves to exclude lumps. Take one liter slurry and pour it into marsh cone duly closing the aperture. Start stop watch and simultaneously open the aperture. Find out the time taken in seconds, for complete flow out of the slurry. The time in seconds is called the "Marsh Cone Time". The procedure is repeated gradually increasing the percentages of Super plasticizers in the steps of 0.1%. Similar testing is carried out for all the Super plasticizers, (SP1, SP2& SP3) and the results were analyzed to get the value of optimized doses.

IV. CONCLUSION

From marsh cone test the compatibility has found out that adding 1.5 % perma plast by volume of cement is compatible with ultra tech OPC 53 grade cement & 1.3 % perma plast by volume of cement is compatible with coromandal king PPC cement.

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