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COMPATIBILITY AND EFFICIENCY OF NEW GENERATION SUPERPLASTICIZERS FOR DIFFERENT BRANDS OF CEMENT

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Abstract-In order to meet the performance requirements of the concrete for various infrastructure projects, concrete mixers have to be designed and produced using combinations of different cementitious materials with water and aggregate and chemical admixtures. The active constituent of concrete is cement paste and largely it determines the performance of the cement paste, also setting time acceleration or retardation can be achieved by the use of admixtures. In addition of some particular admixture may develop undesirable interaction between varying ingredients of concrete. Many times, addition of admixture beyond the certain limit may show incompatibility. Multiple brands of cement and admixtures are available in the market, these performance are not same in the concrete for each and every brands of cement and admixtures even if quality and source of other ingredients of concrete if kept same, this has create a lot of confusion among the user about what types or brands of admixtures is used with what type or brand of cement and what should be the optimum dose of admixture. Common problem associated with incompatibility issue in flash setting, delayed setting, rapid slump loss, improper strength gain and cracking, These not only effect the strength of the concrete but also the durability of the structure, hence in this project we studied two different brands of cement (Birla super cement and Maha cement) with two types of admixture (Master Glenium sky 8221 and Master Rheobuild 1126 ND) available in the market is used to find the optimum dosage and efficiency of admixtures, to achieve this marsh cone test has been conducted.

Background

The demand of concrete is increasing day by day in India, as it is a developing country. The increase in demand has come up with number of challenges in concreting like production of higher grade of concrete, retaining the slump of the concrete for higher duration and pumping the concrete at grater height. Efficiently these requirements can be fulfilled by utilization of proper admixture like super plasticizer or new generation super plasticizer available in the market and they are manufactured by number of companies. it is observed in the field that behavior of one brand of admixture is varying with other brand of admixture even through there chemical family are same for a given cement, the same variation is seen when cement brand is changed. It has created lot of dis comfort and confusion in the mind of concrete producer, because it is difficult to maintain the brand of cement and admixture same during the hole construction process. As these materials cannot be procured and stored for as per the whole project requirement, because of lesser expiry period, required huge storage space and higher initial investment.it is general practice at the site to use any of easily available cement and admixture keeping their chemical family same. But this practice having caused lots of problem in concreting not only in terms of strength and durability but also workability. These results into operation problem like chowking of pipe line because of dry, bleeded or segregated concrete. Keeping this in mind in the present study compatibility issues of different brands of cement with different brand of super plasticizing admixture is studied and a small test method is suggested that can even be done a t the site to get the optimum dose , so as to avoid any problem like strength and workability issues at site.

Materials and Methodology

In the present study, two different brands of 53 grade cement and two different chemical admixtures are chosen and the details are given below.

Table 1: different types of cement and admixtures

Types of Cement	Types of Admixture
Birla Cement	Master Glenium sky 8221(CAE)
Maha Cement	Master Rheobuild 1126 ND(CAE)

Physical Properties of Cement

The physical properties of cement were conducted as per IS 8112-1989.

TABLE 2 - PHYSICAL PROPERTIES OF CEMENT

BRANDS OF CEMENT	SPECIFIC GRAVITY	FINENESS OF CEMENT	NORMAL CONSISTENCY IN %	INITIAL SETTING TIME IN MIN
BIRLA SUPER	3	4%	29%	35
MAHA	2.8	7%	30%	40

Optimum Dosage

In the present study "Marsh Cone" was used to find out the optimum dosage or saturation of admixture. The cement paste was made with 2 kg of cement sample and by keeping water cement ratio 0.5 with varying the dosage (0.1, 0.2, 0.3, 0.4…….) of admixture in percentage by weight of cement. The time in seconds required to flow out 1 liter of cement slurry from cone is referred as marsh cone time in seconds. The dose of admixture after which no significant reduction in marsh cone time, that dose of admixture is considered as optimum dose of admixture.

Efficiency

Marsh cone was used to find out the efficiency of admixture. paste was made with 2kg of cement sample and by keeping water cement ratio as 0.6.i.e, 1200gms of water. The marsh cone test was conducted without adding admixtures and marsh cone time is note down. The test was carried out using 1% admixture and 1200gm of water, marsh cone time is note down. Marsh cone test was repeated by using 100gm less water till the marsh cone time comes to the value without adding admixture.

Then the efficiency of the admixture was calculated from the following

$$\text{Efficiency} = \frac{Difference\ in\ water\ content}{Original\ water\ content} \times 100$$

Results and Discussions

Optimum dosage of admixtures for cements

Type of cement: Birla Super Type of Chemical Admixture: MASTER RHEOBUILD 1126 ND

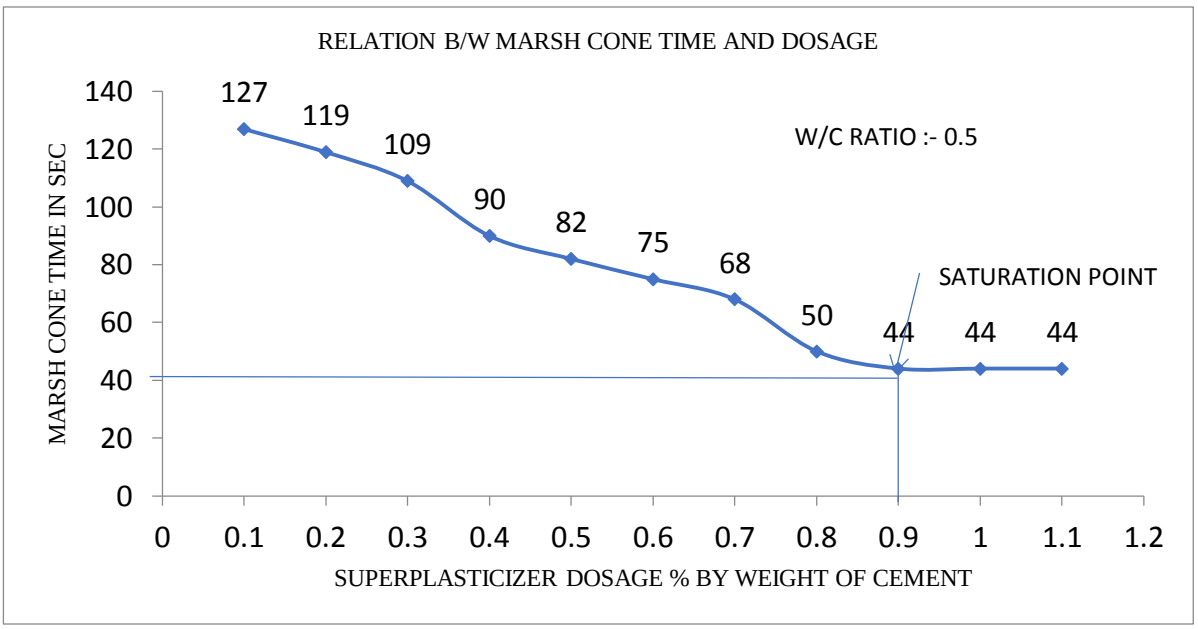

Figure 1 - For Birla Super cement graph b/w marsh cone time and dosage of Master Rheobuild 1126 ND

Type of cement: Birla Super Type of Chemical Admixture: Master Glenium Sky 8221

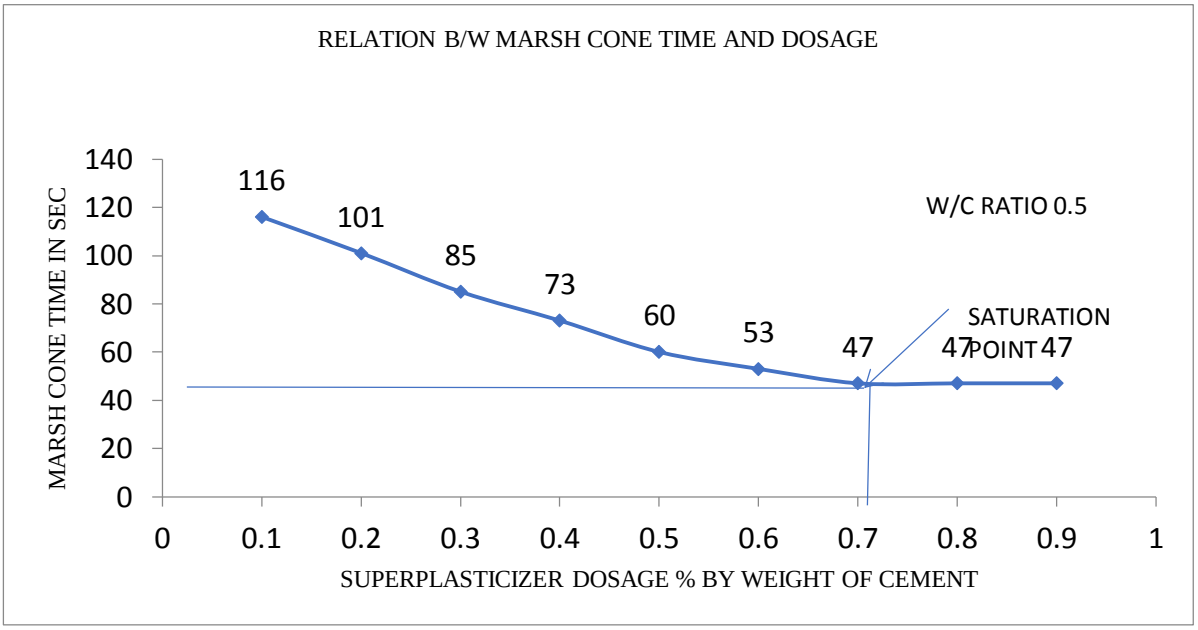

Figure 2 - For Birla super cement graph b/w marsh cone time and dosage of Master Glenium sky 8221

BIRLA CEMENT OPTIMUM DOSAGE

Table 3 - Optimum dosage for Birla cement

SL NO	ADMIXTURES	OPTIMUM DOSAGE % BY WEIGHT OF CEMENT	OPTIMUM DOSAGE QUANTITY IN ML
1	MASTER RHEOBUILD 1126 ND	0.9	18
2	MASTER GLENIUM SKY 8221	0.7	14

From the results of above table3, Master Glenium sky 8221showing better compatibility for Birla super cement.

Type of cement: MAHA Cement, Type of Chemical Admixture: MASTER RHEOBUILD 1126 ND

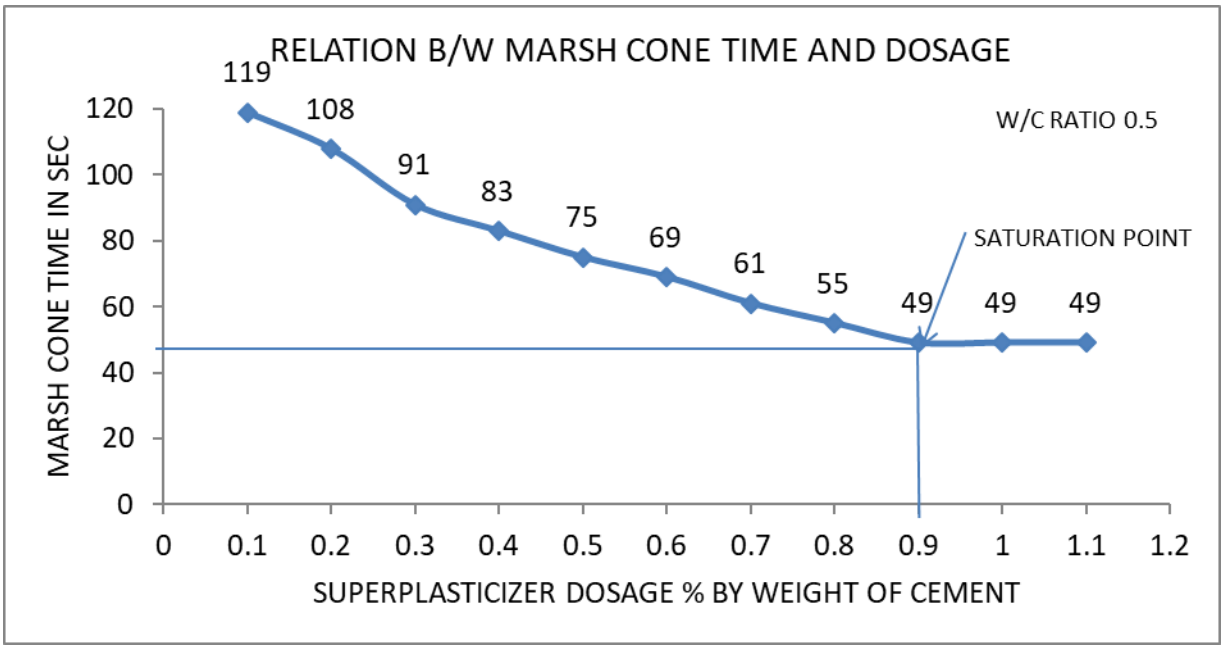

Figure 3 - For MAHA cement graph b/w marsh cone time and dosage of Master Rheobuild 1126 N D

Type of cement: MAHA Cement Type of Chemical Admixture: Master Glenium Sky 8221

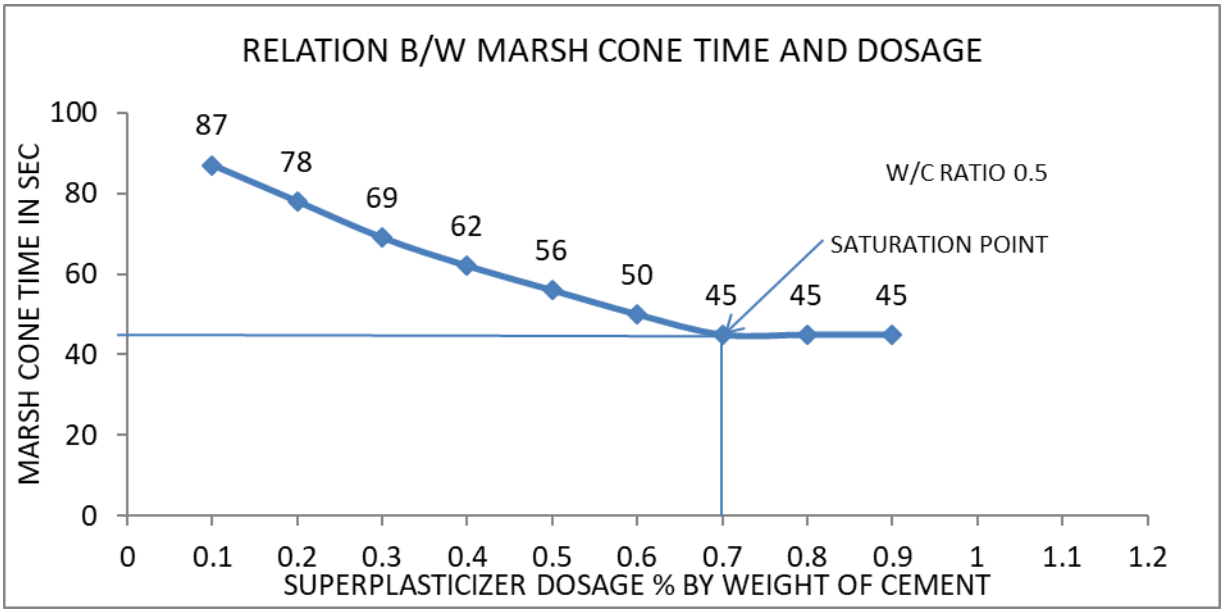

Figure 4 - For MAHA cement graph b/w marsh cone time and dosage of Master Glenium sky 8221

Table 4 - Optimum dosage for MAHA cement

SL NO	ADMIXTURES	OPTIMUM DOSAGE % BY WEIGHT OF CEMENT	OPTIMUM DOSAGE QUANTITY IN ML
1	MASTER RHEOBUILD 1126 ND	0.9	18
2	MASTER GLENIUM SKY 8221	1.2	24

From the results of above table 4, MASTER RHEOBUILD 1126 ND showing better compatibility for MAHA cement

EFFICIENCY OF ADMIXTURE: BIRLA SUPER CEMENT

Table 5 - Efficiency of Master Glenium sky 8221 for Birla super cement

ADMIXTURE	QTY OF CEMENT IN GM	W/C RATIO	QTY OF WATER USED IN GM	DOSAGE OF ADMIXTURE	MARSH CONE TIME IN (SEC)	EFFICIENCY OF ADMIXTURE
MASTER GLENIUM SKY 8221	2000	0.6	1200	0%	46	$\frac{1200-900}{1200}$X100 =24%
	2000	0.6	1200	1%	38	
	2000		1100	1%	41	
	2000		1000	1%	42	
	2000		900	1%	44	

Table 6 - Efficiency of Master Rheobuild 1126 ND for Birla super cement

ADMIXTURE	QTY OF CEMENT IN GM	W/C RATIO	QTY OF WATER USED IN GM	DOSAGE OF ADMIXTURE	MARSH CONE TIME IN (SEC)	EFFICIENCY OF ADMIXTURE
MASTER RHEOBUILD 1126 ND	2000	0.6	1200	0%	46	
	2000	0.6	1200	1%	37	$\frac{1200-900}{1200}$X100
	2000		1100	1%	39	
	2000		1000	1%	43	=25%
	2000		900	1%	46	

From the results of above tables 5&6, MASTER RHEOBUILD 1126 ND showing high efficiency, in terms of reducing the water content for given workability for Birla Super cement.

MAHA CEMENT

Table 7- Efficiency of Master Glenium sky 8221 for Maha cement

ADMIXTURE	QTY OF CEMENT IN GM	W/C RATIO	QTY OF WATER USED IN GM	DOSAGE OF ADMIXTURE	MARSH CONE TIME IN (SEC)	EFFICIENCY OF ADMIXTURE
MASTER GLENIUM SKY 8221	2000	0.6	1200	0%	48	
	2000	0.6	1200	1%	41	$\frac{1200-1000}{1200}$X100
	2000		1100	1%	45	
	2000		1000	1%	48	=16.66%

Table 8 - Efficiency of Master Rheobuild 1126 ND for Maha cement

ADMIXTURE	QTY OF CEMENT IN GM	W/C RATIO	QTY OF WATER USED IN GM	DOSAGE OF ADMIXTURE	MARSH CONE TIME IN (SEC)	EFFICIENCY OF ADMIXTURE
MASTER RHEOBUILD 1126 ND	2000	0.6	1200	0%	43	
	2000	0.6	1200	1%	36	$\frac{1200-900}{1200}$ X100
	2000		1100	1%	38	
	2000		1000	1%	40	=25%
	2000		900	1%	43	

From the results of above tables 7&8, MASTER RHEOBUILD 1126 ND showing high efficiency, in terms of reducing the water content for given workability for Maha cement.

CONCLUSION

1. The optimum dose of chemical admixtures varies with type of chemical admixture and as well as type of cement.
2. For Birla super cement Master Glenium sky 8221 is more reactive than Master Rheiobuild 1126 ND,
3. For Maha cement Master Rheobuild 1126 ND is more reactive than Master Glenium sky 8221.
4. For Birla super cement and Maha cement Master Rheobuild 1126 ND shown higher efficiency than Master Glenium sky 8221.

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