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Study on Flowable Concrete from Marsh Cone Test

Asst. Prof. R.Vinodhkumar, Asst. Prof. P.Vinodhkumar, Asst. Prof. E.Senthil Kumar
Department of Civil Engineering, Meenakshi College of Engineering, Chennai

***Abstract* – In order to satisfy various performance requirements of concrete, admixtures are being used in concrete. The active constituent of concrete is cement paste and largely it determines the performance of concrete. Thus the compatibility of superplasticizer on both Portland Pozzolana Cement and Ordinary Portland cement is studied by performing Marsh Cone Test. Thus the optimum dosage of the superplasticizer is found. The water cement ratio was varied from 0.6 to 0.35 and the amount of admixtures i.e. the super-plasticizers are varied from 0 to 2%, to make a comparative analysis on the effect of admixture.**

***Keywords* – Admixtures, Flowable concrete, MCT, OPC, PPC and SNF.**

I. INTRODUCTION

Compatibility of the admixture with the cement refers to the effect on water reduction, plasticity, setting time acceleration or retardation, etc. Marsh cone test is used to formulate the optimum dose of particular admixture to the cement. In concrete mix design the superplasticizer dosage are fixed based on the composition of the paste with the maximum fluidity for a given water/cement ratio and a given chemical admixture/cement ratio. Cement superplasticizer interaction in concrete is a complex blend of chemical and physical mechanisms that are interdependent. The complicated nature of the problem prevents the development of simple solutions to address the field related issues of application of chemical admixtures. One such solution is to perform Marsh Cone Test on Cement Admixture sample.

II. MATERIALS USED

1. **Cement:** Commercially available Portland Pozzolana Cement (PPC) and Ordinary Portland Cement (OPC) of 53 grades were used.
2. **Superplasticizer - Sulfonated Naphthalene Formaldehyde (SNF):** This admixture improves concrete mix by dispersing cement particles and thus improves their workability and compressive flexural strength. This acts as a high range water reducer, suitable to make high flowing concrete, precast and reinforced concrete.

III.TEST CONDUCTED – Marsh Cone Test

The Marsh cone test (MCT) is used to define the saturation point, i.e. the dosage beyond which the flow time does not decrease appreciably. When the cone is filled with measured quantity of fluid, the nozzle is opened and the fluid is allowed to flow freely. The time needed for measured quantity of material to flow out is recorded as Marsh cone time. The saturation point is defined as the chemical admixture dosage beyond which the flow time dose not decrease appreciably. The dose at which the Marsh cone time is lowest is called the saturation point. The dose is the optimum dose for that brand of cement and admixture (plasticizer or superplasticizer) for that w/c ratio.

Fig .1. SNF and Marsh cone Apparatus.

IV. METHODOLOGY

1. Water cement ratio is taken as 0.6 to 0.35 decreasing by a range of 0.05 and admixture dose was increased with a range of 0.2%.

V. OBSERVATIONS

Table –I: Flow Time for OPC with Different Water Cement Ratio.

S. NO	% OF ADMIXTURE	TIME TAKEN FOR DIFFERENT WATER CEMENT RATIO					
		0.6	0.55	0.5	0.45	0.4	0.35
1	0	5.5	5.67	7.14	16.08	70	NO FLOW
2	0.2	5.21	5.17	7.02	8.38	12.98	68.25
3	0.4	5.15	5.43	6.38	8.12	12.06	45.55
4	0.6	5.13	5.35	5.42	7.81	10.24	33.61
5	0.8	5.14	5.18	5.5	6.8	9.18	30.98
6	1	5.12	5.15	5.51	6.8	8.5	29.04
7	1.2	5.12	5.17	5.5	6.81	8.22	27.76
8	1.4	5.13	5.91	5.46	6.76	7.92	25.02
9	1.6	5.12	5.98	5.47	6.74	7.57	25.61
10	1.8	5.13	5.01	5.45	6.81	7.32	25.01
11	2	5.12	4.96	5.43	6.74	7.36	25.14

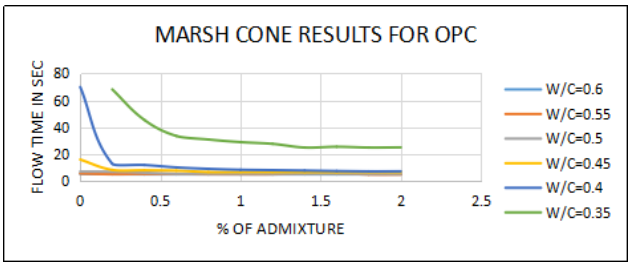

Fig. 2 Graph of flow time for OPC with different water cement ratio.

Table –II: Flow Time for PPC with Different Water Cement Ratio

S. NO	% OF ADMIXTURE	TIME TAKEN FOR DIFFERENT WATER CEMENT RATIO					
		0.6	0.55	0.5	0.45	0.4	0.35
1	0	5.78	6.95	10.95	55.2	NO FLOW	NO FLOW
2	0.2	5.43	5.92	7.27	9.93	14.21	542.35
3	0.4	5.27	5.55	6.71	8.93	14	44.85
4	0.6	5.13	5.45	6.75	8.52	13.86	36.37
5	0.8	5.06	5.88	6.66	7.71	13.72	31.5
6	1	5.13	5.41	6.58	7.65	13.53	29.14
7	1.2	5.06	5.39	6.24	7.62	13.13	28.66
8	1.4	5.12	5.38	6.1	7.52	13.08	23.35
9	1.6	5.07	5.37	6.12	7.51	13.09	23.1
10	1.8	5.08	5.4	6.13	7.48	13.11	22.14
11	2	5.09	5.41	6.18	7.48	13.15	21.16

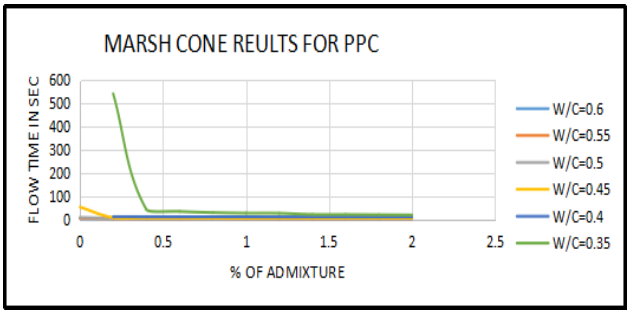

Fig .3 Graph of flow time for PPC with different water cement ratio.

VI. ANALYSIS

Saturation points are considered as the optimum dosage of admixture for the specific water cement ratio of the cement slurry.

1. For OPC the saturated point is determined to be 0.45% and 1.45% for the water cement ratio of 0.6 and 0.35 respectively.
2. For PPC the saturated point is determined to be 0.6% and 1.4% for the water cement ratio of 0.6 and 0.35 respectively.

VII. CONCLUSIONS

1. Optimum dose of chemical admixture varies with the type of the chemical admixtures as well as type of cement and w/c ratio.
2. The optimum dosage of admixture uniformly increases with the decrease in water cement ratio for both OPC as well as PPC.
3. Flow of the cement paste does not takes at the water cement ratio of 0.35 for OPC, but in PPC flow does not takes place at water cement ratio 0.4 itself.
4. When the water cement ratio is the same, higher dosage of admixture is required for PPC in comparison with OPC.
5. Sulphonated napthaline formaldehyde (SNF) gives a good flow time to the cement slurry. The SNF can be used in construction of tunnels, self-compacting concrete and other concretes which requires more setting time.

REFERENCES

[1]. Compatibility of Cement and Water Reducers with Mineral Admixtures, Leny Thomas and Dr. Elson John.
[2]. Study of the Admixture-cement Compatibility for the Economic Production of Special Concretes, Anshuman Dogra1 and Richa Bhardwaj.
[3]. Investigation on the Compatibility of Cement Paste with SNF and PCE based Superplasticizers, P. R. Kannan Rajkumar, P. T. Ravichandran, J. K. Ravi and L. Krishnaraj.
[4]. Performance and Compatibility of Phosphonate-Based Superplasticizers for Concrete, Luigi Coppola, Sergio Lorenzi, Patricia Kara and Stefano Garlati.
[5]. Effect of superplasticizers compatibility on the workability, early age strength and stiffening characteristics of OPC, PPC, and PSC pastes and mortar S.M.Maheshwarappa.