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THE IMPORTANCE OF ADMIXTURES ON FUNCTIONING OF READY MIXED CONCRETE PLANTS

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ABSTRACT

In these days the more research is focusing on workability rather than strength, keeping in view of Ready Mixed Concrete (RMC) plants. More people are opting for RMC than site mixing due to congestion of sites for storage of Materials, environmental, economical problems. However, the major trouble to the RMC plants is loss if workability due to traffic delays and high ambient temperatures. Super plasticizers will be so vital and emerging solution for smooth functioning of RMC plant in this regard. In the present study focusing on influence of admixtures and ambient temperature on fresh properties of concrete were briefly reviewed. An experimental study was observed on slump retention capacity of concrete with Concrete Additive and chemical (CAC) and DON construction chemical (DON) Admixture. The effect of ambient temperature was also observed. At high ambient temperature rate of loss of slum retention was high and Poly carboxylic ether based admixture (DON) was shown good performance at high ambient temperature.

Keywords: *Ready mixed concrete, Slump retention, ambient temperature, effect of admixtures.*

I. INTRODUCTION

The country developments lots depending on infra structure. Concrete, as a quick preparing and placing material within a reasonable cost, gives its maximum contribution to development of infrastructure. These days, as the constructions of structures are increases, due to advantages of concrete, demand of concrete also increases. However, lack of space at the construction sites causes difficulty in preparing quality concrete at construction site and also facing so many environmental problems. Consequently, the Ready Mixed concrete plants were established to supply the concrete according to needs of construction. 85% of people are opting for RMC than site mixing due to mechanized mixing gives uniform mixing comfortable placing, avoids work site confusions more importantly economy[1,2,3]. Initially the RMC was started in metropolitan cites, however at present it reached to major cities. In near future it may reach to all tier I &II cities (urban and sub urban areas) [4]. The presence of heavy traffic causes greatest stumbling block for functioning of RMC plant, by losing of workability after reaching the site. This problem will increases in summer due high temperature[5]. It is very difficult for RMC plants to maintain required workability up to construction site. If the more water is added to improve the workability, it will affect the strength may also causes the bleeding and segregation.

With regard to above mentioned problems, the researchers are focusing on workability of concrete by incorporating different admixtures. At present super plasticizers are using so abundantly to enhance workability of concrete without losing the strength and quality. Super plasticizers are improved version of plasticizers, was prepared during the period of 1960-1970 and it can reduce the water up to 30%[6].Generally, there are four main categories of superplasticizer: sulfonated melamineformaldehyde condensates, sulfonated naphthaleneformaldehyde condensaes, modified lignosulfonates and others such as sulfonic- acid esters and carbohydrate esters. High Performance Concrete (HPC) is defined as a concrete meeting special combination of performance and uniform characteristics that cannot always be achieved routinely using conventional constituents, and normal mixing, placing and curing practices [7].

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Influence of Admixtures on RMC

The introduction of chemical admixtures had making concrete industry to be so dynamic. It playing vital role in sustains of Ready mixed concrete. Indeed, today the growth of RMC increasing because of admixtures. One of the major obstacles for RMC was traffic delays and ambient temperature, because of which concrete will lose the plasticity; this can be overcome by the admixtures. At elevated ambient temperature, low humidity, under solar radiation or exposed to the wind, when the concrete is prepared, will be deteriorate the quality of fresh properties and hardened concrete.

Tarek UddinMohammed et.al were reported that, the Sulfonated naphthalene polymer-based super plasticizer and Second-generation polycarboxylic ether- based admixture were shown best performance of workability and strength. The compressive strength was increasing with the dosage of admixture as recommended by manufactures. Chilled water was given more workability than plain water with little bit of loss early strength[5]. Evangeline.K et.al was reported that among the three super plasticizers Sulphonated Naphthalene Formaldehyde (SNF), Polycarboxylate Ether (PCE) and Modified Polycarboxylate Ether (MPCE), PCE and MPCE was shown better performance of workability and also economic than SNF super plasticizer[4]. Sadaqat Ullah Khan Et.al was categorised mineral admixture in to chemically active and micro filler. The micro filler will increase the workability demands less water than chemically active admixtures[8].

Influence of Temperature

Victor Sampebulu was studied on hot whether properties of fresh concrete with similar conditions of RMC truck agitator. With the 3 components of concrete materials, he brought the concrete temperature about 20^{o}C, 30^{o}C, 35^{o}C. He reported that rapid rate of slump loss can be done, when ambient temperature and high concrete temperature is there. The slump loss while agitation stage was high at 30min moderate in remaining times[9]. Saleh A. Al-Saleh et.al reported that higher temperature of fresh concrete will cause the high rate of hydration loss consequently, accelerate the setting time. It will be greatly impact on transportation of concrete[10] ACI Committee 305 indicate that precautions to remedy plastic shrinkage should be taken if the evaporation rate approaches 1 kg/m^2/h, this rate is estimated from the ACI 305 nomograph[11].

II. EXPERIMENTAL INVESTIGATION

The experimental study was done in a one of the RMC plant in Hyderabad and functioning of RMC plant was investigated. In order to maintain the slump till the construction site, admixture will use to retain the slump. The slump retention capacity of concrete with 2 types of admixture dosage was selected as a part of study. The details of admixture were given below.

In the experimental part, all basic tests of materials were done. The M20 grade of concrete with slump of 110mm (CAC) & 80mm (DON) was designed. Slump cone test was performed for all trail mixes and slump value, room temperature and concrete Temperature were also observed. For CAC admixture trails, the concrete mix designed for 100mm slump, and dosage of admixture is 0.62% of weight of cement. For DON admixture trail, concrete was designed for 80mm slump. The dosage of admixture was 0.4% of weight of cement

Materials Used:

Cement

Ordinary Portland cement 53 grad (Bharathi Cement) which having 2% of fineness, 32% of Normal consistency, 40minutes of initial setting time and 3.15 of specific gravity was used for concrete mix trail.

Fine aggregate

River sand which having the zone II characteristics, 2.4 of fineness modulus and specific gravity of 2.65 was used as fine aggregate.

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Coarse aggregate
Crushed angular aggregates which having the 20mm maximum size of aggregate with fineness modulus 7.6 and specific gravity 2.8 as the coarse aggregate.

Super Plasterers
Concrete Additive and chemical and DON construction products chemical admixtures was used in the mix to retain the slump.

Table 1: Description about the super plasticizers

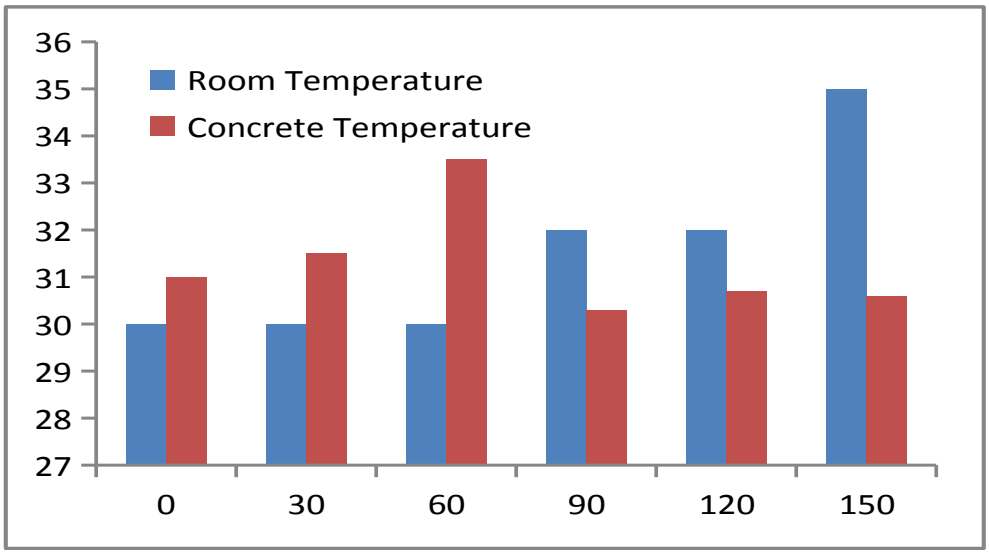
Super Plasticizer	**Base Material**	**Specific gravity**	**Dosage (% of cement)**
Concrete Additive and chemical (CAC)	Sulphonated Naphthalene Formaldehyde	1.18	0.6
Don construction chemical (DON)	poly carboxylic ether	1.19	0.5

III. RESULTS AND DISCUSSIONS

Slump retention capacity testTrail mixes with CAC admixture
Trial 1

Table 2: Trail1 mix slump value along with room and concrete Temperatures

S. No	Slump value (mm)	Room Temperature (ºC)	Concrete Temperature (ºC)	time
1	collapse	30	31	9:20AM
2	180	30	31.5	9:50AM
3	160	30	33.5	10:20AM
4	150	32	30.3	10:50AM
5	140	32	30.7	11:20AM
6	115	35	30.6	11:50AM

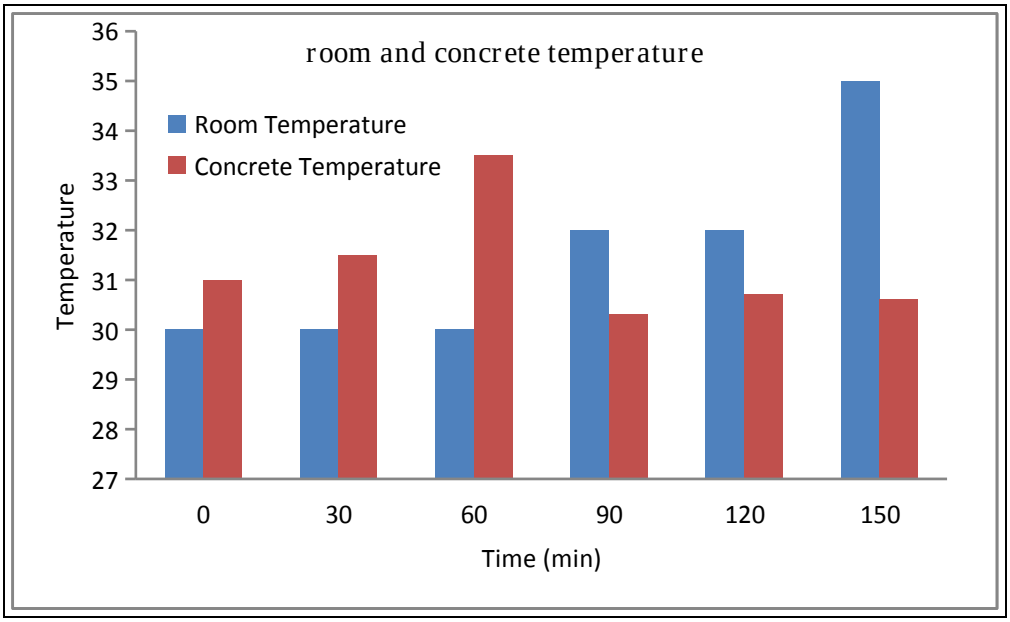


Graph 1: Room and concrete Temperature with respect time after mixing of concrete

Trial 2

Table3:Trail2 mix slump value along with room and concrete Temperatures

S. No	Slump value (mm)	Room Temperature (ºC)	Concrete Temperature (ºC)	time
1	collapse	30	31	11:30Am
2	Collapse	30	31.5	12:00PM
3	180	30	33.5	12:30PM
4	165	32	30.3	1:00PM
5	143	32	30.7	1:30PM
6	120	35	30.6	2:00PM



Graph 2: Room and concrete Temperature with respect time after mixing of concrete for trail 2 mix

Trail 3

Table 4:Trail1 mix slump value along with room and concrete Temperatures

S. No	Slump value (mm)	Room Temperature (ºC)	Concrete Temperature (ºC)	time
1	Collapse	30	31	11:30Am
2	190	30	31.5	12:00PM
3	173	30	33.5	12:30PM
4	150	32	30.3	1:00PM
5	131	32	30.7	1:30PM
6	108	35	30.6	2:00PM

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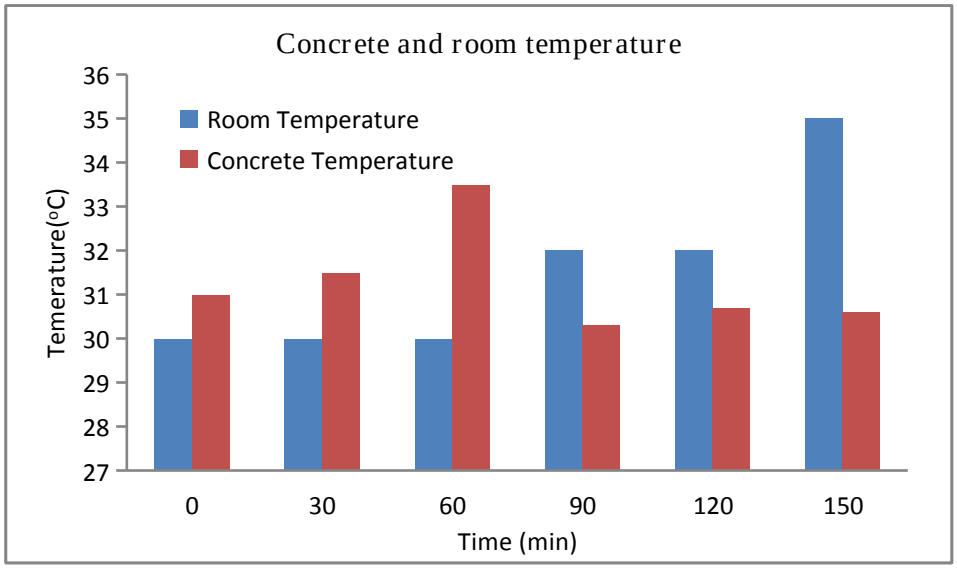
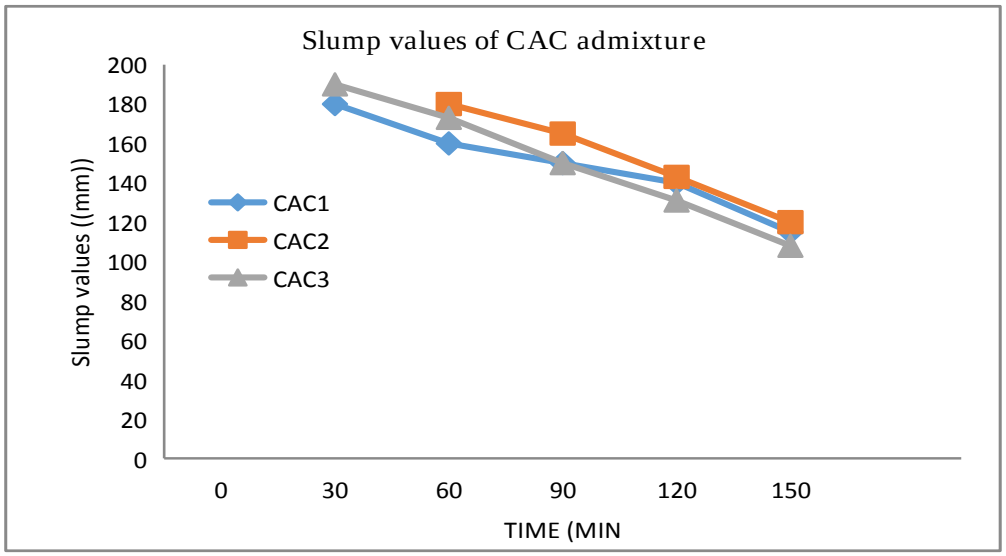


Graph 3: Room and concrete Temperature with respect time after mixing of concrete for trail 3 mix



Graph 4: The values of slump with respect to time for CAC admixture

Trail mixes with DON construction products

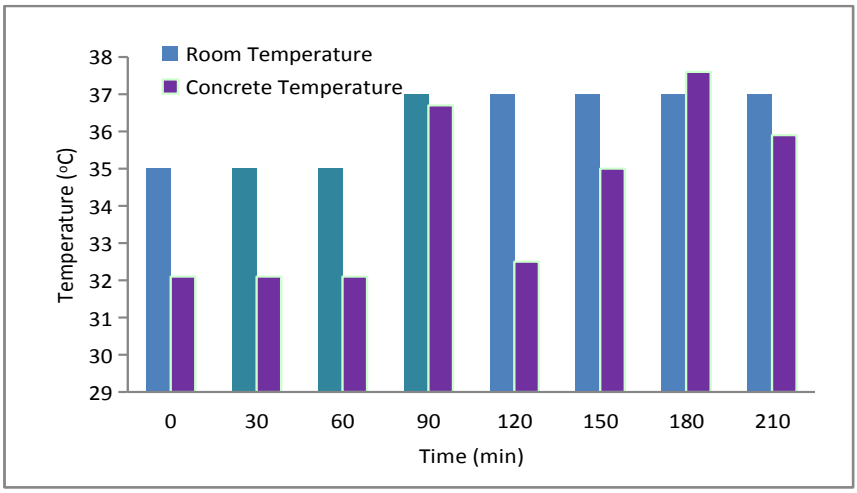
For this trail, concrete was designed for 80mm slump. The dosage of admixture was 0.4% of weight of cement.

Trial mix 4

Table 5:Trail4 mix slump value along with room and concrete Temperatures

S. No	Slump value (mm)	Room Temperature (ºC)	Concrete Temperature (ºC)	time
1	collapse	35	32.1	12:30PM
2	Collapse	35	32.1	1:00PM
3	Collapse	35	32.1	1:30 PM
4	180	37	36.7	2:00 PM

5	170	37	32.5	2:30 PM
6	150	37	35	3:00 PM
7	140	37	37.6	3:30 PM
8	80	37	35.9	4:00 PM

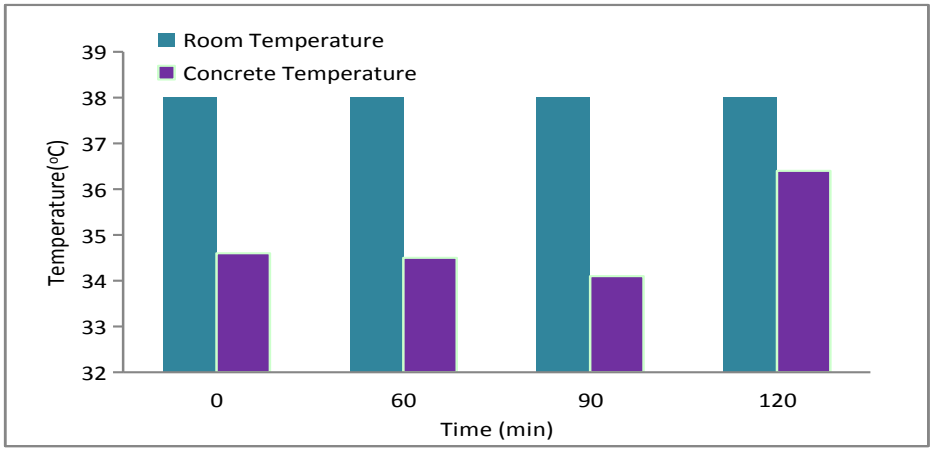


Graph 5: Room and concrete Temperature with respect time after mixing of concrete for trail 4 mix

Trail mix5

Table 6: Trail 5 mix slump value along with room and concrete Temperatures

S. No	Slump value (mm)	Room Temperature (°C)	Concrete Temperature (°C)	time
1	collapse	38	34.6	1:15 PM
2	160	38	34.5	2:15 PM
3	150	38	34.1	2:45 PM
4	80	38	36.4	3:15 PM



Graph 6: Room and concrete Temperature with respect time after mixing of concrete for trail 5 mix

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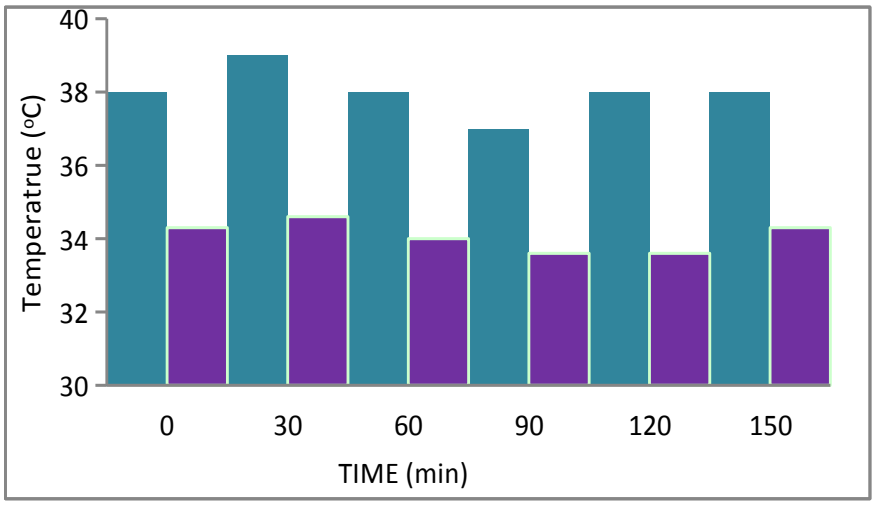
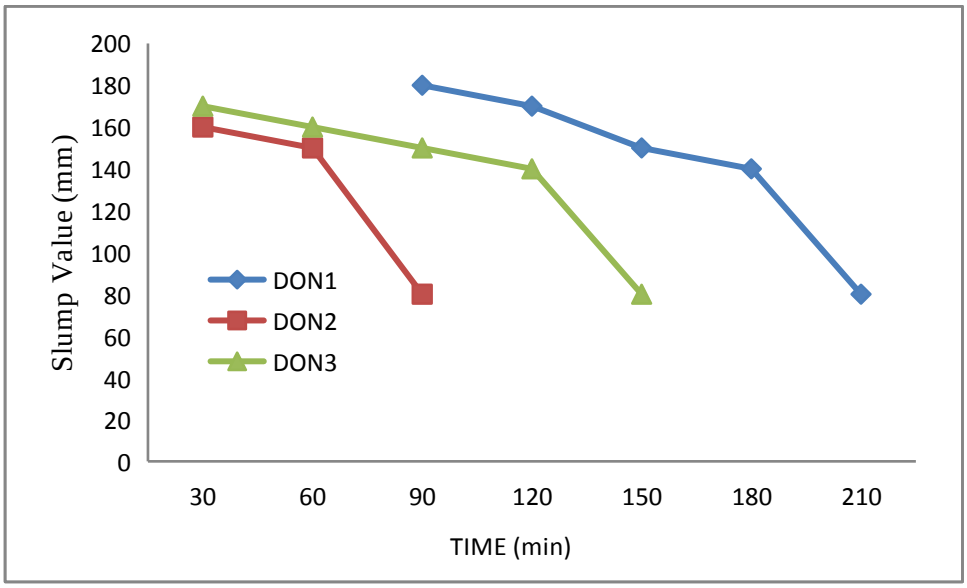
Trail mix 6

Table 7: Trail 6 mix slump value along with room and concrete Temperatures

S. No	Slump value (mm)	Room Temperature(°C)	Concrete Temperature(°C)	time
1	180	38	34.3	11:50A M
2	170	39	34.6	12:20 PM
3	160	38	34	12:50 PM
4	150	37	33.6	1:20 PM
5	140	38	33.6	1:50PM
6	80	38	34.3	2:50PM



Graph 7: Room and concrete Temperature with respect time after mixing of concrete for trail 6 mix



Graph 8: The values of slump with respect to time for DON admixture

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All the trail mixes except trail mixes 7,8 were shown a collapsable slump initial slump test. For CAC admixture design slump was reached with **2 and ½ hour** and concrete temperature fall within range of 30 ºC to31 ºC. For DON admixture, design slump was reached at **4 and ½ hours** after mixing of concrete. All the results from slump test was tabulated.

IV. CONCLUSION

1. Because of summer the room temperature and concrete temperature were so high.
2. For trail1,2 and3 were done by 0.62% of weight of cement of CAC super plasticizer, was reached the design slump of 120mm at end of 2and ½ hour. Without any loss of strength.
3. The trial 4,5 and 6 were done by 0.40% of weight of cement of DON chemical admixture and was reached the design slump of 80mm at end of 3and ½ hours . It can be up to 4 and ½ hours.
4. The DON admixtures gives up to 4and ½ hours slump retention capacity at lower dosage.
5. By comparing the both CAC and DON admixtures DON admixtures was shown a better performance in terms of slum retention capacity even at high ambient and concrete temperature.
6. In trail mix 5, the design slump value reached within 2 hours due to high ambient temperature mid day of summer.
7. Average rate of loss of slump for every 30min is 10% irrespective of admixture.
8. For DON chemical admixture retains slump same as CAC admixture even at the high ambient temperature.
9. From above test results it shown that the admixtures playing crucial role in dispatching the concrete without losing the workability and Quality.

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