Impact of Retention of Slump on Growth of Ready Mixed Concrete

A. Nagaraju, P. Sandeep Kumar, M. Meena, S. Vijaya Bhaskar Reddy

Abstract: In these days the Ready Mixed Concrete (RMC) plants were giving a back bone support for construction and concrete industries. As the infrastructure increases, concrete demand also increasing proportionately due to huge benefits of concrete, consequently, number of ready mixed concrete plants were also increase proportionately to supply the concrete according to the demand. Those who are fed up with the site mixing and environmental problem associated with them, they are opting for RMC. The growth of RMC is increasing from metropolitan cities to villages. One of the key factors for the growth of RMC is retention of slump till reach the construction site by using super plasticizer. In the present study, the growth of RMC industry from 1990's in India was presented. An experimental study was done on Slump retention capacity of concrete with fly ash, GGBS and lime Stone powder with 0.4% of admixture dosage.

Keywords : Growth of RMC, slump retention capacity, Super plasticizer, Ready mix concrete

I. INTRODUCTION

These days, as the constructions of structures are increases, due to huge advantages of concrete, demand of concrete also increases. However, lack of space constraints at the construction sites causes difficult to mix concrete. Consequently, the Ready Mixed concrete plants are become the emerging solution. The ready mixed concrete plants are make constructions of high rise buildings, within short space, saves the time of preparation of concrete, with better quality [1]. The Ready mixed concrete plant was stated at 1950's in India. However, in 1987 the first RMC plant was operated and from 1994, the commercial RMC has been growing. Till 2015, 566 RMC companies and 1135 RMC plants producing the 2733171m³ of concrete per month. South India produces almost equal to 45 to 50 Even though India is third largest economy in asia and 6th biggest industrialized nation in the world, however in the field of construction and practices India lags behind among developing countries [2]. A country development lots depending on infra structure and as

everyone knows concrete, is a quick preparing % of the total commercial RMC in India and the commercial RMC Penetration is very high in south India compared to rest of India [3].

I. Basic Concept of RMC

IS: 4926-2003 defines ready mix concrete as concrete mixed in a stationary mixer in a central batching and mixing plant or in a truck mixer and supplied in a fresh condition to the purchaser either at site or into purchasers (vehicle) [4]. There are two main types for production of concrete used in RMC plant. One is central mixed concrete plant and other is dry batch plant. In central mixed concrete plant, all ingredients are poured in fixed mixer, mix about 1min., then poured into truck mounted revolving mixer. By using power consumption evolution, water content was determined. It allows the water adjustments in truck. In dry mixing plant, all ingredients excepting admixture are poured into a buffer, which directly led them into the truck mounted revolving mixer that ensure both mixing and transport. In this delaying of admixture adding is due to estimate the dosage of admixture to get required flow ability. This method allows correcting the errors in water content by adjusting the admixture quantity into the truck. From the both the process, the basis of an annual production is of 40,000 m³ yr⁻¹. The additional mixer in a wet batch concrete plant is a 2 m³ mixer. Technically, it is showed that the addition of a mixer contributes to a better control of water proportion in the mixture [5]. In the case of a centrally mix type, the drum carrying the concrete revolves slowly so as to prevent the mixed concrete from „segregation“ and prevent its stiffening from initial set [6]. High rate of taxation on RMC plants, Land availability to establish RMC plants, Lack of education and training of industrial personnel, customer of RMC, City traffic and high ambient temperature, Long hauls and delivery and pumping ability of concrete pump are the major stumbling blocks for growth of RMC [7, 8].

II. THE GROWTH OF RMC PLANTS

From the year 2000, the growth of RMC plants was increasing. At present 85 % of people opting for RMC. The major hurdles facing the RMC plants were heavy traffic, ambient temperature and pumping ability. However, advent of super plasticizers had a remarkable impact on growth of RMC's by retaining the slump without any setting delays. The cost per cubic meter of concrete will be different for different super plasticizer. For SNF, PCE, MPCE based super plasticizers the cost of concrete will be 5216, 5846 and 5416 respectively [10].

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The growth of RMC plants was raised from the year of 2000. The concrete productions throughout India remarkably increased. In initial days RMC was established in metropolitan cities, then it reaches to urban cites and slowly it reaches to sub-urban cites.

No .of RMC plants in city wise in india

Name of the city	No. of plants (Appoxmately) 2019	No. of plants (Appoxmately) 2014 (Vijay. R . Kulakarni [6])	Growth rate (%)
Hyderabad	49	15	2.27
Mumbai	50	18	1.78
Bangalore	30	25	0.20
Delhi	29	28	0.04
chennai	30	19	0.58
Kolkata	22	9	1.44
Goa	5	3	0.67
coiambatoor	13	4	2.25
Nagpur	12	2	5.00
Pune	49	12	3.08
Mangalore	6	2	2.00
manipal	1	1	0.00
Vizag	10	1	9.00
Vijayawada	7	1	6.00
Hubli	4	1	3.00
cochin	8	4	1.00
surat	10	4	1.50
Vadodara	7	3	1.33
Ahemadabad	11	8	0.38
Mysoor	6	2	2.00
Jaipur	16	3	4.33
Tri city	8	1	7.00
Lucknow	11	3	2.67
Ranchi	9	1	8.00
Raipur	10	1	9.00

II. EXPERIMENTAL INVESTIGATION

The role of Slump retention capacity test in Ready mixed concrete:

In hot climates, at elevated ambient temperature, low humidity and under solar radiation or exposed to the wind, will increase the rate of evaporation of water and decrease the quality of concrete [10]. One of the major struggles of Ready mixed concrete is retention o f slump till construction site. Hence, therefore a accurate prediction has to be done not to lose the concrete mix. The slump test at certain intervals will make good prediction of retention capacity and also required dosage is also known by this test to retain the slump.

Admixture can be add initially or add at certain intervals. It noted that, separation of total SP into two can maintain the slump longer period as compared to the case of high initial slump, however there is no difference in strength [12].

In the present study, the influence of mineral admixture and influence of ambience temperature on slump retention capacity, a M30 grade of concrete made and slump cone test was conducted with different mineral admixtures like fly ash, GGBS, limestone powder.

MATERIALS Used

1. Cement:

Normal consistency of cement is 34%, finess of cement is 3grms, Specific gravity of cement is 2.94 & soundness of cement is 7 mm.

2. Coarse aggregate:

Fineness modulus of coarse aggregate is 7.145; Maximum size of aggregate 20 and specific gravity of aggregates is 2.8.

3. Fine aggregate

Fineness modulus of Coarse aggregate is 2.4; Zone II sand and specific gravity of aggregates is 2.64.

4. Fly ash

Fly ash, specific gravity is 2.9

5. GGBS

Specific gravity is 2.8

6. Lime stone Powder

Lime stone powder Specific gravity is 2.8

7. CAC Admixture

Mix details

S.No	Material	Trial mix-1	Trial mix-2	Trial mix-3
1	Cement (kg/m ³)	311.64	311.64	311.64
2	Coarse aggregate (kg/m ³)	1125.43	1150.12	1167.07
3	Fine aggregate (kg/m ³)	625.55	639.28	637.32
4	Fly ash (kg/m ³)	133.6	-	-
5	GGBS (kg/m ³)	-	133.6	-
6	Lime stone (kg/m ³)	-	-	133.6
7	CAC Super flow	2.67	2.67	2.67
8	Water (kg/m ³)	200.37	200.37	200.37

III. RESULT AND DISCUSSION

S. NO	SLUMP VALUE	TIME	CONCRETE TEMP	ROOM TEMP
1	Collapse	11:55am	19	23
2	190mm	12:25pm	20	24
3	170mm	12:55pm	20	24
4	160mm	1:25 pm	20	24
5	130mm	1:55pm	19	24
6	120mm	2:25 pm	19	24
7	90mm	2:55 pm	20	24

Table: Mix details

Graph: Slump retention capacity with Fly ash

With the fly ash, the slump was retained up to 180min. the rate of loss of slump is about 10% . the concrete was maintained the temperature between the range of 19°-20°C

Table: Slump retention test with GGBS

S.No	SLUMP VALUE	TIME	CONCRETE TEMP	ROOM TEMP
1	210mm	9:45am	19	21
2	150mm	10:15 am	19.5	21
3	95mm	10:45 am	19	23

Graph: Slump retention test with GGBS

With GGBS, the slump was retained upto 1 hour. The rate of slump is about 25%. The concrete temperature maintained about 19°C.

Table: Slump retention test with Lime stone Powder

S. NO	SLUMP VALUE	TIME	CONCRETE TEMP	ROOM TEMP
1	170mm	12:50 pm	21	26
2	85mm	1:20 pm	20	27

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Graph: Slump retention test with lime stone powder

With lime stone Powder, the slump was retained upto 30min hour. The rate of loss of slump is about 40%. The concrete temperature maintained about 19°C.

Graph: Slump test

Compressive Test

The compressive test was done in Compression testing Machine (capacity of 2000kN) . with fly ash , 19 Mpa strength was achieved. With GGBS and lime stone powder the strength was reached up to 35 Mpa and reached the target mean strength.

Replaced material	Trail	3-days	7-days	28-days
With Fly ash	T1	11.33	14.39	18.09
	T2	11.56	15.01	18.59
	T3	11.45	14.89	20.51
	Average	11.45	14.76	19.06
With GGBS	T1	20.70	24.36	34
	T2	20.80	25.79	36.68
	T3	20.51	25.87	37.15
	Average	20.67	24.35	35.94
With limestone powder	T1	15.79	26.58	30.79
	T2	16.78	22.89	31.87
	T3	16.45	24.50	32.48
	Average	16.43	24.65	31.73

IV. CONCLUSION

1. The cities like vizag, nagpur, ranchi, tricity were shown that a tremendous growth of RMC plants. The growth rate was reached upto 9%. The overall growth rate was 58% and cumulative growth rate is 65%. Hence, a huge growth was taken place in through out india in recent times.
2. From the experimental study, the trial mix with fly ash, GGBS, lime stone Powder slump retained about 3 hours, 1.5 hours, 1 hour with 0.6% of super plasticizer dosage.
3. A part from the admixtures effect, temperature was also shown a remarkable influence on slump retention capacity. For trial mix 2,3 the concrete temperature was higher than trial mix 1, Hence with in short time slump value was reduced.
4. The concrete temperature with the all the replaced material is about 19°C.
5. the 28-days strength value, with GGBS and Limestone powder is higher than the with flyash.
6. Only the with GGBS, the concrete achieved the target mean strength.
7. From the above the tests, the concrete performance with GGBS given satisfactory results.

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