**Developing and Analysis Of Concrete-Mix Design For Different Weather Condition**

Jugal Kishor Baruah, Juganta Dulakakharia, Jushmita Choudhury, Prithwib Patgiri and Zipshit Saikia

Department of Civil Engineering, Bineswar Brahma Engineering College, Kokrajhar, Assam, India.

Email:jugalbbec@gmail.com.jugantadulakakharia10@gmail.comjushmitachoudhury22@gmail.com,

prithwiv123@gmail.com,zipshit.saikia54@gmail.com

**Abstract**

Approximately 70 to 80% of the total volume of concrete is consumed by aggregates (Alexander and Mindess, 2005) Cement and concrete production industries are also widely regarded as one of the major contributors to global warming, due to their energy intensive and high carbon dioxide (CO2) footprint resulting their production. Concrete ingredients have to be properly classified and proportioned to build a mix that will be economical as well as meet the minimum requirements of functionality, safety and economics. For this, study has been undertaken to select the appropriate concrete mix proportion to achieve desired strength with locally available materials. The study was also undertaken to understand the effect of weather conditions on concreting. Two different temperature 28OC (normal weather condition) and 5OC (adverse weather condition) controlled environment has been setup to evaluate the performance of concrete quality.

Three different proportions were developed in the present study, one with 0.50 water-cement ratio, and the other two with 0.45 and 0.42 water-cement ratio respectively. The characteristics focused in the study include density, flexural behavior and compressive strength of the concrete at 28 days.

**Experimental Setup**

To simulate the adverse weather condition, an experiment was conducted on cold temperature condition. The temperature for the experiment was considered at 5o C for conducting the test. The change made during concreting was the water temperature, which was kept at 5o C.To get the desired conditions, the aggregates, cements and water was kept at 5o C in the freezer for 24 hours. After 24 hours, all the materials were taken out and mixed thoroughly. After the mixing, the concrete is poured into desired cube size and kept in freezer for 24 hours to maintain the working condition. The cube sample is again kept in immerse in water inside the freezer for desired curing periods. Test performed for the aggregates are particle size distribution, specific gravity, bulk density, flakiness index, crushing value, water absorption.

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| --- | --- | --- | --- | --- | --- | --- |
| **Sample No** | **Water-cement ratio** | **Age of curing (days)** | **Weight of cube (kg)** | **Failure Load(KN)** | **Compressive Strength(N/mm2)** | **Average Compressive Strength(N/mm2)** |
| For normal weather condition | | | | | | |
| A-1 | 0.5 | 7 | 8.121 | 261.5 | 11.62 | 11.62 |
| A-2 | 14 | 8.059 | 421.6 | 18.73 | 18.73 |
| A-3 | 28 | 8.067 | 504 | 22.4 | 22.15 |
| A-4 | 8.211 | 419.9 | 18.66 |
| A-5 | 8.197 | 571.6 | 25.4 |
| B-1 | 0.45 | 7 | 8.006 | 410.6 | 18.24 | 18.24 |
| B-2 | 14 | 8.001 | 448.7 | 19.94 | 19.94 |
| B-3 | 28 | 8.271 | 595.6 | 26.47 | 27.45 |
| B-4 | 8.202 | 621.9 | 27.64 |
| B-5 | 8.167 | 635.4 | 28.24 |
| C-1 | 0.42 | 7 | 8.343 | 495.6 | 22.02 | 22.02 |
| C-2 | 14 | 8.374 | 487.2 | 21.65 | 21.65 |
| C-3 | 28 | 8.049 | 691.5 | 30.73 | 29.22 |
| C-4 | 8.672 | 682.9 | 30.35 |
| C-5 | 8.970 | 598.1 | 26.58 |
| For adverse climatic condition | | | | | | |
| D-1 | 0.42 | 7 | 0.738 | 100.3 | 20.12 | 22.38 |
| D-2 | 0.746 | 119.5 | 23.97 |
| D-3 | 0.734 | 114.9 | 23.05 |
| D-4 | 14 | 0.756 | 128.4 | 25.76 | 26.60 |
| D-5 | 0.749 | 133.5 | 26.78 |
| D-6 | 0.752 | 135.9 | 27.26 |

Table 1: Compressive Test Result of Concrete Mix Design

For normal weather condition, after 28 days of curing at 0.42 water-cement ratio the values obtained 29.22 N/mm2, the compressive strength at 14 days was found to be 21.65N/mm2.For adverse weather conditions, the results obtained after 14days of curing is 26.60N/mm2.

From these set of experiment, it is evident that the concrete is performed better in a adverse weather condition. The temperature of water plays an important role while concreting, it appear that the temperature at 5OC ±1OC is best suitable for achieving the target strength in 14 days. To achieve the target strength of M-25 grade it is suggested to adopt the proportion of 1:1.2:2.02 in place of 1:1:2 as per I.S code for the locally available material.

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