Quality Control Management in Building Construction

[1]Ali Hamid Abdullah, [2]Rishav Kumar, [3]Chaman Singh Rawat, [4]Abdullah Abdulghany,
[5]Prof. Dr. C.P Sharma
[1,2,3,4]Student Of Civil Engineering, [5]Project Guide & Hod & Research Scholar, Civil Engineering Department, NIMS Institute Of Engineering And Technology, Jaipur, Rajasthan, India.

***Abstract*—Quality is the symbol of human civilization, and with the progress of human civilization, quality control will play an incomparable role in the construction industry. It can be said that if there is no quality control, there is no economic benefit.**

Projects comprise of enormous interconnected processes. Lot of determinants which determine the quality of construction are design, grade of technology .technicality, handling and managing etc. Need for insistence on the quality should be priority, with the core of artificial control and prevention, to provide more high quality, safe, suitable, and economic composite products.

Implementing quality management in the course of building construction can effectively prevent the safety accidents to occur during the latter process of the use of building products. Meanwhile thetotal cost of construction supply chain can be decreased. Also it's beneficial to enhance the brand popularity and reputation of construction enterprises.

***Keywords:-* Quality Control, Complex, Topography, Geology, Hydrology, Construction technology.**

I. INTRODUCTION A QUALITY OF CONCRETE

Concrete is one of the major construction materials in building construction industry and it is produced from three basic materials; namely, cement, aggregate and water. In addition admixture is sometimes used to improve some properties of concretes like workability and setting times. The ingredients of concrete should be of good quality that satisfies the requirements set in standards. It is not enough to have only good quality concrete ingredients; the production processes also have the most important influences on concrete quality. These production processes are batching, mixing, transporting, placing compacting and curing which requires proper and scientific approaches The quality control will assure the production of high or low quality.

To get quality concrete products, proper care and control has to be done during ingredient selection and production processes. It should also be reminded that all professionals and firms involved in the construction industry have to give special emphasis to quality control. It is observed that building constructions in India is currently flourishing here and there in various parts of the country, especially in major cities and towns. Most of these buildings are reinforced concrete structures in which concrete takes the major proportion.

In addition, concrete is a non-factory product which is mostly produced onsite; therefore a number of determinants produce variations in concrete grade. This include the grade of ingredients, variation in concrete method of preparation and quality of work man ship. As a result, proper quality control is extremely necessitated, particularly to concrete which forms the critical part of abuilding.

B *Objective of Quality Control in Building Construction*

The main objective is comprehensive assessment standard of concrete in the building construction industry of India

- Invigilating the present methods of concrete production in places of work and accesses the gap of methods practiced there.
- Checking the methods of standards by randomly selecting any sample for analysis as per Indian Standards.

II. COMPOSITION OF CONCRETES

Concrete is a composite material which consists essentially of a binding medium within which are embedded particles or fragments of relatively inert mineral fillers. In concrete the binder or matrix is a combination of cement and water; it is commonly called the "cement paste. The filler material, called "aggregate," is generally graded in size from fine sand to pebbles or fragments of stone. In addition to aggregates and binders, there is another material called additive which may be used in concretes to improve certain of itsproperties.

In concretes, the proportions of these principal components, the binder and the aggregate are controlled by the requirement that;

- When freshly mixed, the mass be workable or place able.

 DOI : 10.35291/2454-9150.2020.0626

- When the mass has hardened, it possesses strength and durability adequate to the purpose for which it is intended.
- The cost of the final product is a minimum consistent with acceptable quality.

A Diagrammatic representation of the composition of concrete of the proportions used is shown in fig. 1.

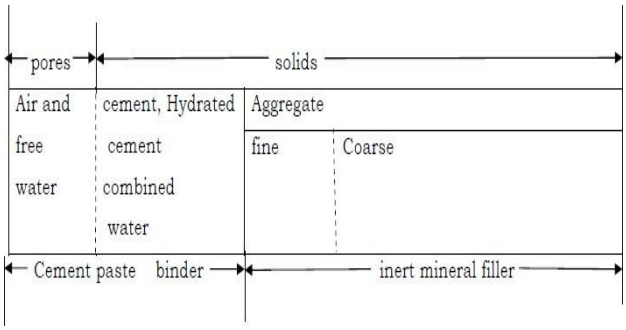

Figure 1: Compositions of Concretes

The aggregates occupy about 3/4 total volume. The space which is not occupied by aggregate, roughly one-quarter of the entire volume of an average, is filled with cement paste and air voids. After concrete has been placed, even though it has been compacted with considerable thoroughness, some entrapped air remains with in the mass. In a well compacted concrete of suitable proportions, the volume of unavoidable entrapped air is comparatively small, usually not over 1 or 2percent.

The purposes of entertaining air in concrete are to increase the workability and to improve the resistance of concrete to weathering. The voids left in concrete due to air entertaining agents are discontinuous and very small size with an average diameter of less than 0.05mm. Hence entertained air is not significant problem as compared to the entrapped air, which forms continuous channels and increases the concrete's permeability.

The solid portion of hardened concrete is composed of the mineral aggregate and the hardened cement paste, which may include some of the original cement, and a new product formed, by combination of the remainder of the cement with some of the water. After any period, the amount of free water left depends upon the extent of combination of cement and water, and upon possible loss of water from the mass due to evaporation under drying conditions.

III. METHODOLOGY

A. Cement

Cement is a material with adhesive & cohesive properties. Cement, when mixed with mineral fragments & water, binds the particles into a compact whole. This description includes a large number of cementing materials. For the purpose of construction works, the cement is used to bind stones, sand, bricks, etc.

Cement is the most important and costly as ingredient of all great. Joseph Aspadin of U.K. invented it in 1924. He named it Portland cement because the hardened concrete made out of cement, fine aggregates, coarse aggregates and water in definite proportions resembled the natural stone occurring at Portland in England. As cement gets strength by reaction between cement and water (known as hydration) and its ability to harden underwater, it is also known as hydrauliccement.

Portland cement is manufactured by grinding together calcareous (limestone or chalk) and argillaceous (shale or clay) in dry or wet condition. The mixture is burnt in a kiln to 1300 – 1500 C where it sinters and produces small clinkers. Clinkers (of nodular shape) are called and mixed with above 2% gypsum to avoid flash setting (to delay the chemical action when water is added). The mixture is ground to required fineness in ball mills to get the finer product as cement. One bag of cement masses to 50 kg is equivalent to 34.5 liters (1440kg/m3).

For using the Portland cement to produce high strength concrete (M35 and above) for specialized works, high strength cement is required. Bureau of Indian Standards has therefore introduced three different grades of ordinary Portland cement. It is available in three different grades.

1.Grade 33 (I.S.:269-1989)

2.Grade 43 (I.S.: 8112-1987)

3. Grade 53 (I.S.: 12269-1987)

The grade indicates the compressive strength of cement at 28 days curing. By altering Proportions of ingredients of cement various types of cements can be prepared. Physical properties of a few types of cement are given in table –

TABLE –3.1: SPECIFICATION FOR PHYSICAL PROPERTIES OF PORTLAND CEMENT

Note:- Tests should be carried out in accordance with IS 4031 – parts to XV

SrNo	Properties	IS269 Ordinary Grade	IS8112 Ordinary Grade	IS12269 Ordinary Grade 53Grade	IS12600 Low Heat	IS8041 Rapid Hardening
1	**Fineness:-**					
	Residue by mass on IS Sieve 90u not to exceed percent.	10	10	10	5	5
	Specific	225	225	225	320	325
	surface (m2/kg) by air permeability method not less than					

 DOI : 10.35291/2454-9150.2020.0626

2	**Setting Time (In min):-**					
	Initial setting time not less than	30	30	30	60	30
	Final setting time not morethan	600	600	600	600	600
3	**Compressive Strength (N/mm2) of 1:3 cement mortar cube:-**					
	At 1 day (24hr. + 30min) not less than	-	-	-	-	-
	At 3days (72hr.+ hr) not lessthan	16	22	27	10	27
	At 7days (168hr.+hr)not less than	22	33	37	16	-
	At 28 days (672hr. + 4 hr) not less than	33	43	53	35	-
4	**Soundness:-**					
	By Le Chatelier method specimen shall not have an expansion of more than(mm)	**10**	**10**	**10**	**10**	5
	By Auto Clave method specimen shall not have an expansion of more than (percent)	**0.8**	**0.8**	**0.8**	**0.8**	**0.6**
5	**Heat of Hydration (KI/kg):-**					
	At 7days not more than	-	-	-	**272**	-
	At 28 days not morethan	-	-	-	**314**	-

(Methods of physical tests for hydraulic cement)

B. Initial and Final Setting time of Ordinary Portland Cement

For this take Quantity of cement C = **300gms.** Water for standard consistency P = **32%** Water to be added 0.85 P x C = **81.6 ml** Cement grade **= 53 O.P.C.**

TABLE – 3.2

GRADATION OF AGGREGATES FOR 20 MM AGGREGATE						
IS Sieve gm	**Mass of Material Retained (gm.)**	**Cummulative Mass Retained (gm.)**	**Cummulative Percentage Mass Retained**	**Cummulative Percentage Passing**	**Limits of Specification**	
			%	**%**	**Lower Limit**	**Upper Limit**
20 mm	122.92	122.92	1.4	98.6	95	100
12.5 mm	1676.9	1799.90	20.5	79.5	70	100
10 mm	4521.7	6321.60	72	28	20	40
4.75 mm	2291.5	8613.18	98.1	1.9	0	5
PAN	166.82	8780.00	100	0	0	0
Total	8780.0	-	-	-	-	-

As per experiment the initial setting time as 25.

D. DETERMINATION OFAGGREGATE

IMPACT VALUE (TABLE –3.4)

Sr. No.	**Initial Setting Time**		**Final Setting Time**	
	Time (Min)	**Penetration from bottom of mould (mm)**	**Time (Min)**	**Penetration from bottom of mould (mm)**
1	18	0	585	18
2	20	0	-	-
3	22	2	-	-
4	23	3.5	-	-
5	25	5	-	-

minute which is permissible. (Permissible limit 30 minute) As per experiment the final setting time is 585 minute which is also permissible limit. (Permissible limit)

C. GRADATION OF AGGREGATES FOR 20 MM AGGREGATE

Mass of Coarse Aggregate= 8780 gm.

TABLE – 3.3

ATION OF AGGREGATEIMPACT VALUE **IS:2386 (Part 4) 1963**				
Observations	**est 1**	**est2**	**est3**	**Average**
Weight of oven dry sample filling in Cylinder (A)	627	628	624	**8.62**
Weight of fractionretained on 2.36 mmIS sieve after Impact test(B)	573	575	569	

 DOI : 10.35291/2454-9150.2020.0626

Weight of fractionpassing 2.36 mm IS sieve after Impact test(C)	54	53	55	
Total weight of sample after Impact test(B+C)	626	626	626	
ImpactValue = (C/A)x100	8.61	8.44	8.81	
Remarks: Good quality of Aggregates.				

E. Grades of Concrete

The Concrete shall be in grades designated as per table-1. The characteristics strength is defined as the strength of material below which not more than 5% of the testresults.

Table-3.5 Grades of Concrete

Grade Designation	Specified Characteristics Comp. Strength at 28 Days, fck (N/mm2)	As per Test Resultfor M 20 Grade
M 10	10	-
M 15	15	-
M 20	20	20.16
M 25	25	-
M 30	30	-
M 35	35	-
M 40	40	-

Note 1:- The designation of concrete mix, letter M refer to the mix and the number the specified characteristics compressive strength of 150 mm cube at 28 days expressed in N/mm2.

Note 2 :- Grades of concrete lower than

M 15 shall not be used in reinforced concrete.

IV. CONCLUSION

- Aggregate sources have to be identified and studied. The mineralogical contents ofquarry

  sites should be known and made available to any concrete producer, contractors or consultants by the responsible government bodies or institutes.

- Adapting the standard methods there will be reduction cement consumption and save the capital.Therfore standard method of plays a crucial role in getting standard and saving capital. The cement manufacturers should mention the date of expiry. When slump fails there is a tendency to correct the slump by adding or reducing water. However, it is required to investigate and identify the cause than trying to adjust the slump by varying the water content only. The specification prepared has to include important tests for concrete materials and mentioned tests as per Indian should be carried out.. It is better if concrete is produced by specialist subcontractors to improve the quality in large towns andcities.

- Both contractors and consultants have to conduct their work in accordance with their professional ethics.

- Well skilled engineers and supervisors will ensure improve quality.

- Training should be given to the semi-skilled laborers on concreting work.

- As concrete is a major construction material forming the structural part of buildings manual on concrete production has to be separately prepared and used as a guide on construction sites.

- Quality management plan has to be prepared and properly implemented during concrete production processes that identifies the critical activities and helps in taking the appropriate measures at any stages during concrete production.

- Systematic and Well-organized quality control by an independent body is useful in improving concrete quality on constructionprojects.

REFERENCE

[1] George Earl Troxell, Harmer Davis & Joe W.Kelly, (1965); Composition and Properties of Concretes, MC Graw Hill Book Company.

[2] http://www.nic.edu

[3] IndianStandards

[4] M.L. Gambhir (2nd edition, 2002); Concrete Technology, MC Grawhill Book Company, NewDelhi.

[5] Nevielle, A.M and Brook, J.J, (2003); Concrete Technology, Replica Press,India.

[6] The Indian Concrete Journal October 2007

[7] Construction Project Management by Prof. Harbhajan Singh – Chartered Engineer, Chitkara School of Planning and Architecture.

[8] Concrete Technology – Theory and Practice by M.S. Shetty – BE, ME, FICI, FIE, MACCE. – Consultant to IMCC Delhi Metro Corporation.

[9] Quality Control by D. Paranthaman, TechnicalTeacher's Training Institute –Madras.

[10] New Administration Building of Sardar Vallabhbhai Patel Institute of Technology – Vasad. (UnderConstruction)

 DOI : 10.35291/2454-9150.2020.0626