Quality Control & Management


MUTTONWALLAH

STANDARD OPERATING PRACTICES (SOP)

STANDARD OPERATING PRACTICES (SOP) FOR MATERIAL

All the material received at site will be tested at site laboratory as per the procedure laid down in the relevant BIS code or CPWD specification or the ASTM codes. Only the material which complies with the codal provisions will only be allowed to unload at the site. Following procedure must be followed once the material received at the gate of the site:

I. Security persons at Gate will inform Authorized representatives of client about the arrival of the material.
II. Authorized representatives of client (Store) will inform it to the quality engineers in lab.
III. The quality engineers along with the authorized representatives of client will go for the collection of sample.
IV. The sample will be tested at site lab in presence of authorized representatives of client (PMC) and test report will be made by the QC Engineers and it will be jointly signed by the QC Engineers and the authorized representatives of client (PMC) and they will make a slip of pass or fail. The slip will be in triplicate.
V. The one copy of slip will be given to store, one copy to Security at Gate.
VI. The security will allow the entry of vehicle which is having pass word (Stamp or colour code) on the slip and keep a record of it for future reference.

2. STANDARD OPERATING PRACTICES (SOP) FOR RMC PLANT

I. The QC will provide design mix for different grade of concrete if it is produced by the plant of Client or Contractor. If concrete is provided by the RMC plant from outside than it must be approved by QC before using it at site.

II. All the correction for the design mix because of moisture in sand and change in gradation of material will be done by QC. The corrected design mix slip will be made by QC and will be given to the plant operator.

III. The pic of PLC to be uploaded in group showing corrected design mix feed

IV. The Plant operator will run the plant as per the provided corrected design mix slip.

V. The QC will check the batch report, check the slump, flow etc and make cubes and maintain proper record of it as per the frequency.

Time Limits for Testing

S.NO	Test	Time limit in minutes
A	Material	
1	Coarse Sand	90
2	20 mm	60
3	10 mm	60
4	Cement, Flyash, GGBS, Silica, Admixture	180
B	RMC	
5	Quality of RMC at Plant	20
6	Quality of RMC at site	15
7	RMC UTILIZATION TIME AFTER BATCHING START TIME FROM PLANT	90 to 120

Material Testing Sequence

Arrival of Vehicle

- First Vehicle Report at Security Gate.
- Vehicle Report Time at Store within 5 Min of arrival.
- Vehicle Report Time at Quality Lab within 10 Min of arrival.

Testing

- Vehicle's Royalty Paper checked by QC Lab within 15 Min of arrival.
- Vehicle's Sample Collect by QC Lab within 20 Min of arrival.
- Testing of Sample Start within 5 min on sample taken.

Result

- Testing completed of Sample within
- 60 Min (10mm, 20mm)
- 90 Min (Sand)
- 180 Min (Cement, Flyash, GGBS, Silica, Admixture)
- Testing Result Report will send to store within 5 Min of Testing complete.

RMC Testing and Pouring Sequence

Moisture

- Gradation and Moisture report of Material available in Bin Like like- 10 & 20 mm and C/Sand by QC Engineer.
- Cement & Admixture Make & raw matirial Gradation Report to be provide by Quality Engineer for Corrected Design Mix.
- Above information must be updated in whatsapp group 30 min before concrete start time by QC Engineer
- Corrected Design mix to be provided by Expert within 30min of receiving of information on Whatsapp group

Design Mix

- Corrected Design Mix to plant & start Loading by QC Engineer
- After getting feeded the design mix in plant send pic of Display of plant showing design mix feeding
- Give a signed copy of corrected design mix to plant
- After loading of check the Batch report with in 20 min QC Engineer
- If all ok Allowed for further Loading work QC Engineer

Checking

- Check the Slump, Flow, Vflow etc by QC Engineer.
- check concrete after 10 min also.
- If all ok Allowed for further Casting work
- Casting, curing and Testingof cube for 7, 28 & 90 days QC Engineer
- Display the equipment name, calibration report in Lab
- Daily Cube testing time must be fixed at 4pm and it must be displayed at site.

Site Testing Sequence

Pouring

- Check the Slump, Flow at Site by Site QC Engineer.
- If ok Concrete must be poured with in 120 to 150 minutes from loading time.
- If flow or slump is less then the desired discuss the quality engineer at plant and quality engineer at plant will take desision after consulting the expert.
- If concrete is bleeding hold the TM till bleeding goes, for duartion consult the expert

Post

- Next day Post concreting checked by Site QC Engineer (fill the post concreting format).
- Consult if any defiviencies is observed to Quality/Structural Consultant - site incharge
- go for curing for 7 days - site engineer (Enter it in curing register)

Precautions

1. CTM and other Equipment is calibrated
2. CTM is not having any vibration, oil leaking, loss of pressure, fluctuation in pressure etc
3. Take concrete for testing always in wheel barrow
4. Cube is in shed, no vibration and wrapped in moist Haisen clothes, slump about 120mm or mix properly before cube filling, light tapping is done to remove entrapped air.
5. Cube mould is of proper shape and size and oiled properly, check size, gunia and any leakage of mpouild
6. Cement, flyash, silica, superplasticizer is tested before taking
7. water of curing, plant and site curing is tested

7	**CUBE TESTING MACHINE**				
		CALIBRATION	EVERY THREE MONTHS	EXTERNAL AGENCIES	STORE OF CLIENT
9	**ALL TESTING MACHIN E IN LAB**	CALIBRATION	EVERY THREE MONTHS	EXTERNAL AGENCIES	STORE OF CLIENT
10	READY MIX CONCRETE				
	FRESH CONCRETE	SLUMP/FLOW TSET/VFLOW/L BOX	50 CUM OR PART THERE OF	INTERNAL LAB	QC ENGINEER SITE LAB
		TRAIL DESIGN MIX	FOR EVERY LOT OF CEMENT, FLYASH, SILICA AND ADMIXTURE	INTERNAL LAB	QC ENGINEER SITE LAB
	HARDENED CONCRETE	CUBE TEST, 7 DAYS, 28 DAYS AND 90 DAYS INCLUDING DEFORMATION MEASURMENTS	ONE SET 50 CUM OR PART THERE OF OR ATLEAST ONE SET FOR EACH GRADE OF CONCRETE PER DAY	INTERNAL LAB	QC ENGINEER SITE LAB
		RAPID CHLORINE PENETERAION TEST AFTER EVERY 28 DAYS RAND	ONE SET PER 1000 CUM OR ATLEAST ONE SET FOR EACH GRADE (ABOVE M30) OF CONCRETE USED IN THE PROJECT	EXTERNAL LAB	STORE OF CLIENT
		CORE TEST	ONE FROM EVERY GRADE AFTER 90 DAYS OF CASTING	EXTERNAL LAB	STORE OF CLIENT
		CUBE TEST ON 28 DAYS	RANDOMLY ONE SET AT EVERY MONTHS SO THAT EACH GRADE IS TESTED IN PROJECT CONSTRUCTION PERIOD	EXTERNAL LAB	STORE OF CLIENT

CHECK LIST FOR REGISTERS & FILES TO BE MAINTAINED AT QC LAB

NAME OF SITE : **DATE:**

S.N.	TYPE OF WORK	FREEQUENCY	REMARKS OF SENIORS INSPECTING
1	CUBE REGISTER	EVERY DAY	
2	CUBE TRAIL REGISTER	EVERY DAY	
3	CUBE TANK CLEANING	EVERY WEAK	
4	CURING TANK TEMPERATURE	EVERY DAY IN WINTER	
5	BUFFING OF AGGREGATES	EVERY DAY IN SUMMER	
6	BIN MATERIAL MOISTURE AND CORRECTED MIX DESIGN	EVERY DAY/WEATHER CHANGE	
7	FLYASH TEST	EVERY LOT TRAIL	
8	CEMENT TEST	EVERY LOT TRAIL	
9	ADMIXTURE TEST	EVERY LOT TRAIL	
10	WATER TEST	EVERY DAY	
11	10MM TEST	EVERY DAY/EVERY TRUCK	
12	20MM TEST	EVERY DAY/EVERY TRUCK	
13	COARSE SAND TEST	EVERY DAY/EVERY TRUCK	
14	STONE DUST TEST	EVERY DAY/EVERY TRUCK	
15	BEND AND ROLLING MARGIN TEST OF STEEL	EVERY DAY/EVERY TRUCK	

16	DAILY PRODUCTION RECORD	EVERY DAY	
17	MONTHLY PRODUCTION RECORD	EVERY DAY	
18	THIRD PARTY TEST: CEMENT	EVERY 3 MONTH	
19	THIRD PARTY TEST:ADMIXTURE	EVERY 3 MONTH	
20	THIRD PARTY TEST: FLYASH	EVERY 3 MONTH	
21	THIRD PARTY TEST: SILICA/ ALCOFINE	EVERY 3 MONTH	
22	THIRD PARTY TEST: 10MM/20MM/COARSE SAND & STONE DUST	EVERY 3 MONTH	
23	THIRD PARTY TEST: CORE TEST	EVERY 3 MONTH	
24	THIRD PARTY TEST: WATER TEST	EVERY 3 MONTH	
25	THIRD PARTY TEST:STEEL TEST	EVERY 3 MONTH	
26	PLANT CALIBRATION	EVERY 3 MONTH- EXTERNAL	
27		EVERY 15 DAYS: INTERNAL	
31	BRICK TEST	EVERY TRUCK	
32	STEEL/FLYASH/ADMIXTURE & SILICA MTC'S	EVERY TRUCK / EVERY LOT	
33	VISIT REPORT	EVERY VISIT	

SIGNATURE OF LAB VISITOR **SIGNATURE OF LAB INCHARGE**

CONCRETE QUALITY

The desired concrete quality--can only be fully achieved if following is ensured:

I. Quality of ingredients.
II. Proper mix design.
III. Correction to design mix.
IV. Calibration to plant.
V. Cleaning of mixing tank and pipe line etc.

➢ Through proper placement and finishing,

Followed by prompt and effective curing.

Aggregate

- Coarse Aggregate: 20mm and 10mm
- Fine Aggregate: Coarse Sand
- Aggregate occupy 70 to 75% volume of concrete.
- Quality of Aggregate:
- Aggregate shall be hard, strong, dense, durable, clear and free from alkali vegetable matter and other deleterious substances.

Properties	Limiting Value in %		Remarks
	For wearing surfaces	For surface other than wearing surfaces	
Crushing Value	30	30	Strength
Impact Value	30 (25%) (M 65 and above, not exceed 15 %)	45	Toughness
Abrasion Value	30	50	Hardness
Soundness			Resistance against physical and chemical actions
Fine aggregate	10 when tested with sodium sulphate, 15 when tested with magnesium sulphate (MgS04)		
Coarse aggregate	12 when tested with sodium sulphate, 18 when tested with magnesium sulphate (MgS04)		

Deleterious Material

- Aggregate shall not contain any harmful material, such as pyrites, coal, mica, shale or similar laminated material, clay, alkali, soft fragments and organic impuriries.
- The effect of these material is to reduce strength , durability of the concrete and the presence of alkali may cause cracking of Concrete.

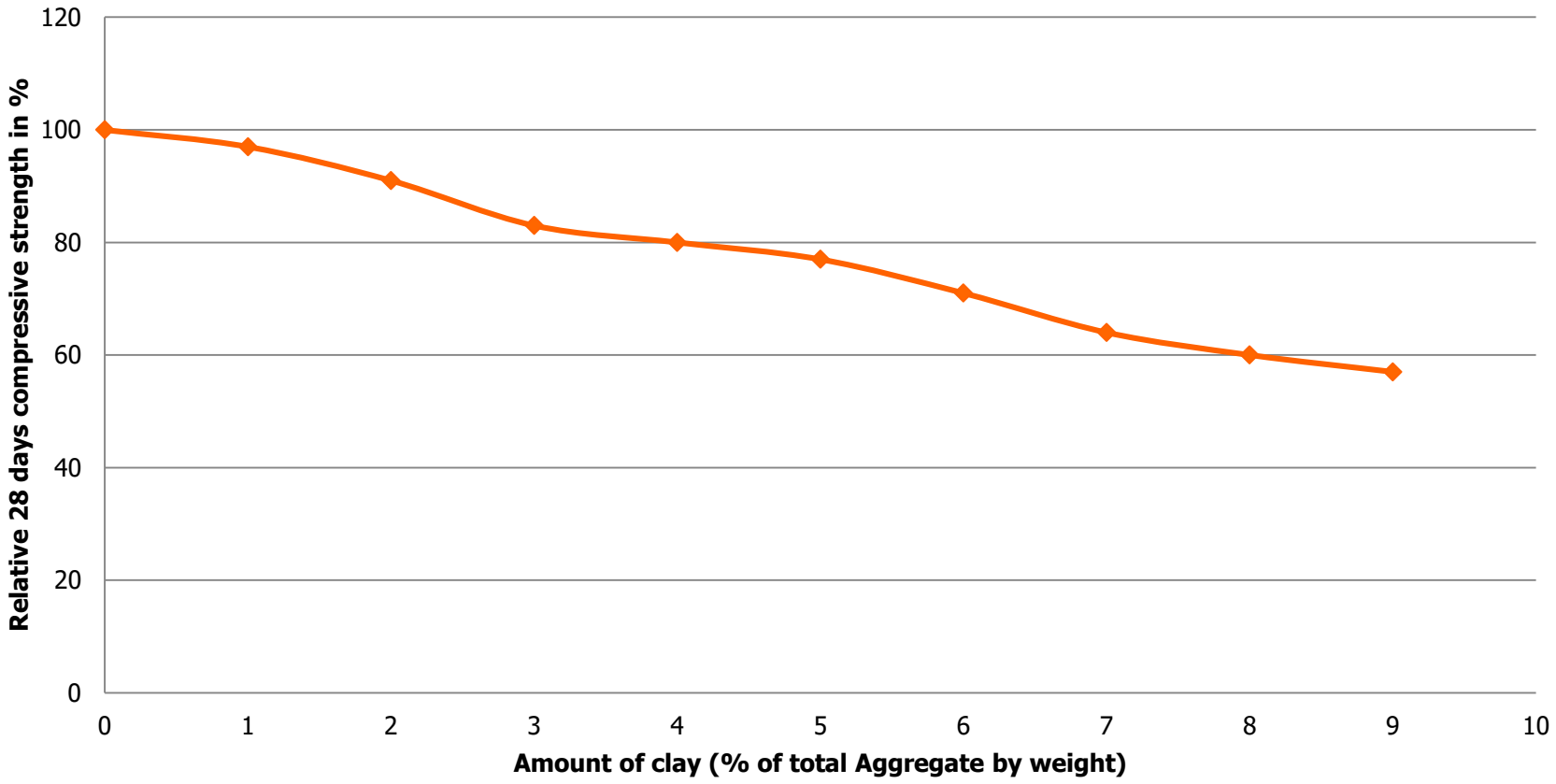
Permissible limit (% in terms weight) of Deleterious material in aggregate (I.S.383:2016

Table 2 Limits of Deleterious Materials

(*Clause* 5.2.1)

Sl No.	Deleterious Substance	Method of Test, Ref to	Fine Aggregate Percentage by Mass, *Max*			Coarse Aggregate Percentage by Mass, *Max*		
			Uncrushed	Crushed/ Mixed	Manufactured	Uncrushed	Crushed	Manufactured
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Coal and lignite	IS 2386 (Part 2)	1.00	1.00	1.00	1.00	1.00	1.00
ii)	Clay lumps	IS 2386 (Part 2)	1.00	1.00	1.00	1.00	1.00	1.00
iii)	Materials finer than 75 µm IS Sieve	IS 2386 (Part 1)	3.00	15.00 (for crushed sand) 12.00 (for mixed sand) *see* Note 1)	10.00	1.00	1.00	1.00
iv)	Soft fragments	IS 2386 (Part 2)	—	—	—	3.00	—	3.00
v)	Shale	(*see* Note 2)	1.00	—	1.00	—	—	—
vi)	Total of percentages of all deleterious materials (except mica) including Sl No. (i) to (v) for col 4, 7 and 8 and Sl No. (i) and (ii) for col 5, 6 and 9	—	5.00	2.00	2.00	5.00	2.00	2.00

Influence of % clay fraction on 28 days strength



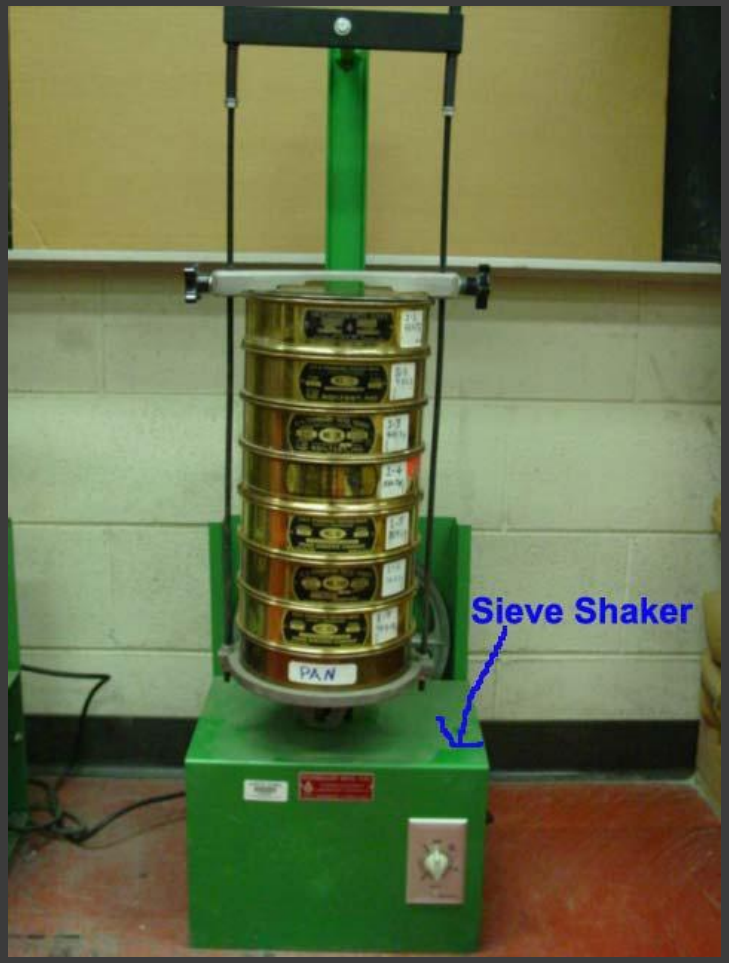
Silt by Volume

Silt by Weight

Apparatus

Grain Size Analysis

Apparatus



Tabulation and Calculation

Sieve size in mm	Wt Retained	% wt retained	% Cummmulative retained	% finer
4.75	22.5	2.25	2.25	97.75
2.36	54.7	5.47	7.72	92.28
1.18	58.4	5.84	13.56	86.44
0.6	50.2	5.02	18.58	81.42
0.3	566.9	56.69	75.27	24.73
0.15	204.8	20.48	95.75	4.25
Pan	3.9	0.39	100	0
	1000			

Gradation Requirement for Coarse Aggregate (I.S.383)

I.S. Sieve in mm	% passing for single size aggregate	
	20mm	10mm
40	100	
20	85-100	
12.5		100
10	0-20	85-100
4.75	0-5	0-20
2.36		0-5

Gradation Requirement for Fine Aggregate (I.S.383)

I.S. Sieve in mm	% passing			
	Zone -I	Zone-II	Zone-III	Zone-IV
10	100	**100**	100	100
4.75	90-100	90-100	90-100	95-100
2.36	60-95	75-100	85-100	95-100
1.18	30-70	55-90	75-100	90-100
0.600	15-34	35-59	60-79	80-100
0.300	5-20	8-30	12-40	15-50
0.150	0-10	0-10	0-10	0-15

Gradation Requirement for Fine Aggregate (I.S.383)

- The grading falls outside the limits of any particular grading zone of sieves other than 600 micron IS sieve by total amount not exceeding 5% for a particular sieve size, (subject to a cumulative amount of 10 %), it shall be regarded as falling within that grading zone.
- This tolerance is not applied to % passing the 600 micron sieve or % passing any other sieve size on the coarse limit of grading Zone-I or the finer limit of Grading Zone-IV.
- For Crushed stone sand permissible limit on 150 Micron sieve increase by 20% in addition to 5% allowance as mentioned above.

Gradation Requirement for Fine Aggregate (I.S.383)

- Fine aggregate confirming to zone-IV should not be used for R.C.C.
- The grading of fine aggregate has much greater effect on workability of concrete than that of coarse aggregate.
- From the experience it has been seen that usually very Coarser sand (Cause Harshness, bleeding and segregation) and very finer sand (for same workability require more water) is unsatisfactory for concrete making.

Cement

- I.S 456 permits the use of following type of cement:

✓O.P.C (I.S. 269: 2015)

✓P.P.C (I.S.1489- part-I)

Table 3 Physical Requirements for Ordinary Portland Cement

(*Clause* 7)

Sl No.	Characteristic	Requirement					Method of Test, Ref to
		OPC 33	OPC 43	OPC 43S	OPC 53	OPC 53S	
(1)	(2)	(3)	(3)	(3)	(3)	(3)	(4)
i)	Fineness, m^2/kg, *Min*	225	225	370	225	370	IS 4031 (Part 2)
ii)	Soundness:						
	a) By Le-Chatelier method, mm, *Max*	10	10	5	10	5	IS 4031 (Part 3)
	b) By autoclave test method, percent, *Max*	0.8 *see* Note 1	0.8 *see* Note 1	0.8 *see* Note 1	0.8 *see* Note 1	0.8 *see* Note 1	
iii)	Setting time:						IS 4031 (Part 5)
	a) Initial, min, *Min*	30 *see* Note 2	30 *see* Note 2	60 *see* Note 2	30 *see* Note 2	60 *see* Note 2	
	b) Final, min, *Max*	600	600	600	600	600	
iv)	Compressive strength, MPa (*see* Note 4):						IS 4031 (Part 6)
	a) 72 ± 1 h, *Min*	16	23	23	27	27	
	b) 168 ± 2 h, *Min*	22	33	37.5	37	37.5	
	c) 672 ± 4 h, *Min*	33	43	43	53	53	
	Max	48	58	–	–	–	
v)	Transverse strength (optional)	*See* Notes 3 and 4	*See* Notes 3 and 4	*See* Notes 3 and 4	*See* Notes 3 and 4	*See* Notes 3 and 4	IS 4031 (Part 8)

By Sieving 90 micron < 10%

IS 3812 (Part 1) : 2013 flyash as Pozolona material in Cement, cement mortar and Concrete

Table 2 Physical Requirements
(***Clauses*** 5.1 ***and*** 7.1)

Sl No. (1)	Characteristic (2)	Requirements (3)
i)	Fineness — Specific surface in m^2/kg by Blaine's permeability method, ***Min***	320
ii)	Particles retained on 45 micron IS sieve (wet sieving) in percent[1)], ***Max***	34
iii)	Lime reactivity — Average compressive strength in N/mm^2, ***Min***	4.5
iv)	Compressive strength at 28 days in N/mm^2, ***Min***	Not less than 80 percent of the strength of corresponding plain cement mortar cubes
v)	Soundness by autoclave test — Expansion of specimen in percent, ***Max***	0.8

NOTE — Fly ash of fineness 250 m^2/kg, ***Min*** is also permitted to be used in manufacture of Portland pozzolana cement by intergrinding it with Portland cement clinker if the fly ash when ground to fineness of 320 m^2/kg or to the fineness of the resultant Portland pozzolana cement, whichever is lower, conforms to all the requirements specified in **6** and **7**.

[1)] Optional test.

SILICA FUME

Table 2 Physical Requirements
(*Clause* 5)

Sl No.	Characteristic	Requirement	Method of Test, Ref to	
			Annex	IS No.
(1)	(2)	(3)	(4)	(5)
i)	Specific surface m^2/g, *Min* (*see* Note 1)	15	A	—
ii)	Oversize percent retained on 45 micron IS Sieve, *Max* (*see* Note 1)	10	—	1727
iii)	Oversize percent retained on 45 micron IS Sieve, variation from average percent, *Max* (*see* Notes 1 and 2)	5	—	1727
iv)	Compressive strength at 7 days as percent of control sample, *Min* (*see* Note 3)	85.0	—	1727

NOTES

1 Any one of the tests specified in (i) or (ii) and (iii) indicated may be adopted.

2 For (iii) the average shall consist of the ten preceding tests or all of the preceding tests if the number is less than ten.

3 In the test method for determination of compressive strength of silica fume cement mortar in accordance with IS 1727, the value of factor N may be taken as one.

Water Test

SELF COMPACTING CONCRETE (SCC)

- IS 456: 2000, with Amendment No:3 in August 2007 Through ANNEX J included provision of SCC for guidance

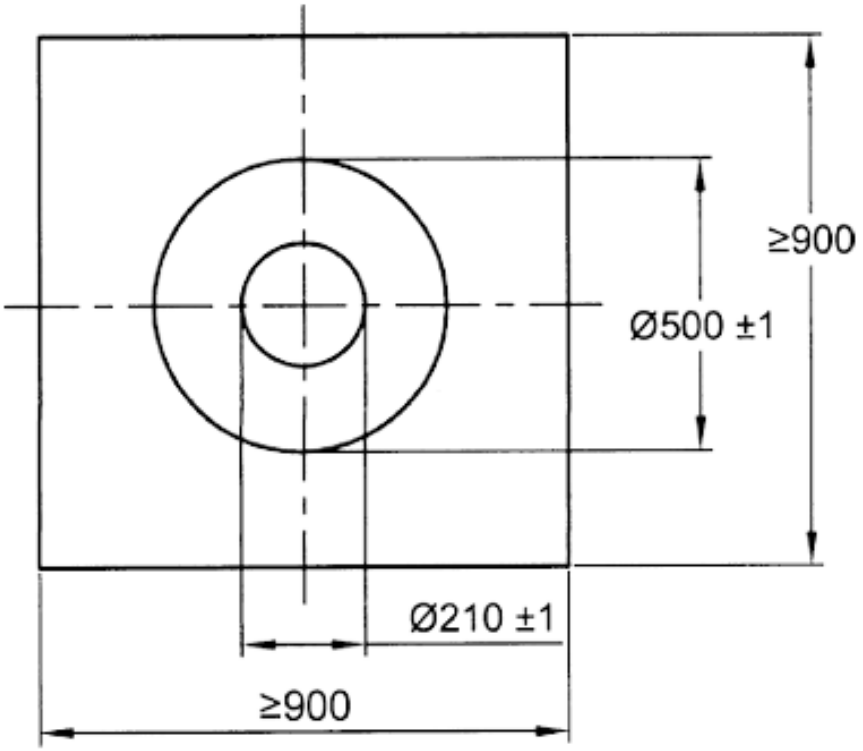
- SCC is a concrete that fills uniformly and completely every corner of formwork by its own weight without application of vibration, without segregation, whilst maintaining homogeneity.

- Features of fresh SCC

I. Slump flow 600 mm Min
II. Sufficient Fines (<0.125mm) 400 kg/cum to 600 kg/cum, using mineral admixture in order of 25 % to 50% by mass of cementitious materials.
III. Use of HRWA and VMA in appropriate dosages

Fresh Concrete , SCC

Slump Flow Test and T500 Test



All dimensions in millimetres.

8 TEST RESULT

The slump-flow (SF) is the mean of d_1 and d_2, expressed to the nearest 10 mm, given by the following equation:

$$SF = (d_1+d_2)/2$$

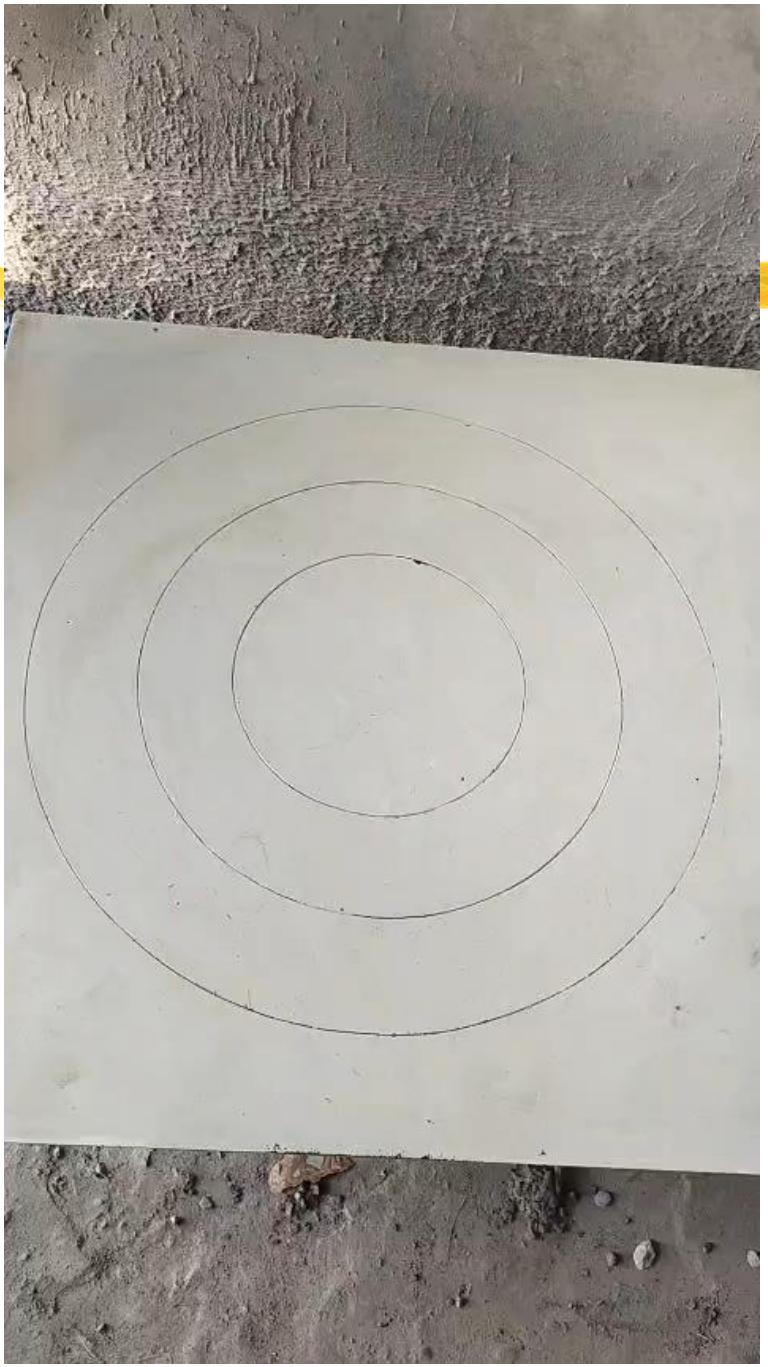
where

SF = slump-flow, in millimetres;

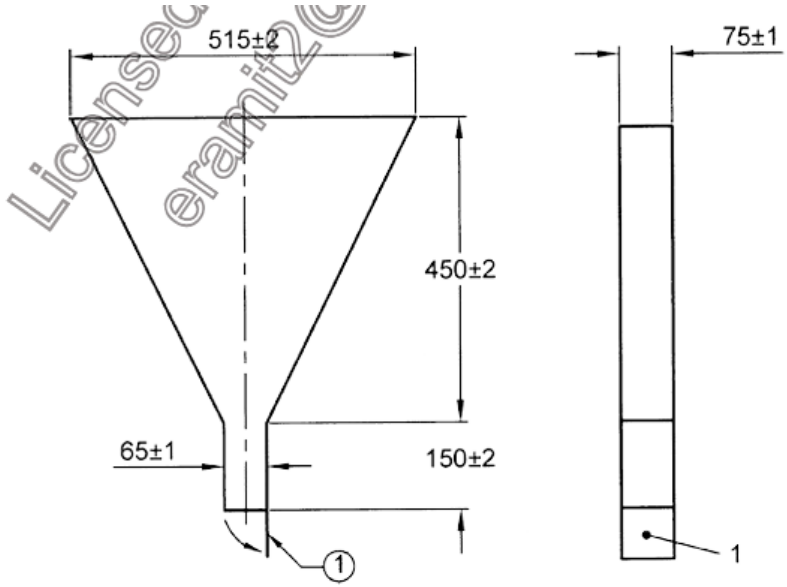
d_1 = largest diameter of flow spread, in millimetres; and

d_2 = flow spread at 90° to d_1, in millimetres.

The t_{500} time is reported to the nearest 0.1 s.



V-Funnel Test

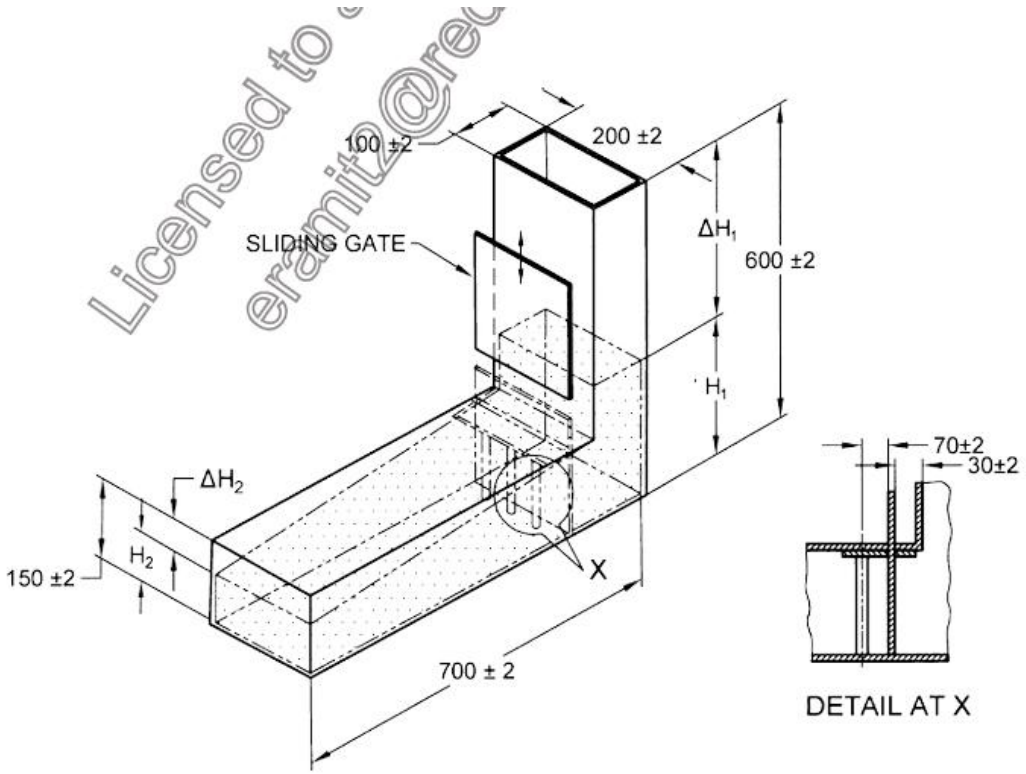


KEY

1 Hinged or Sliding Gate

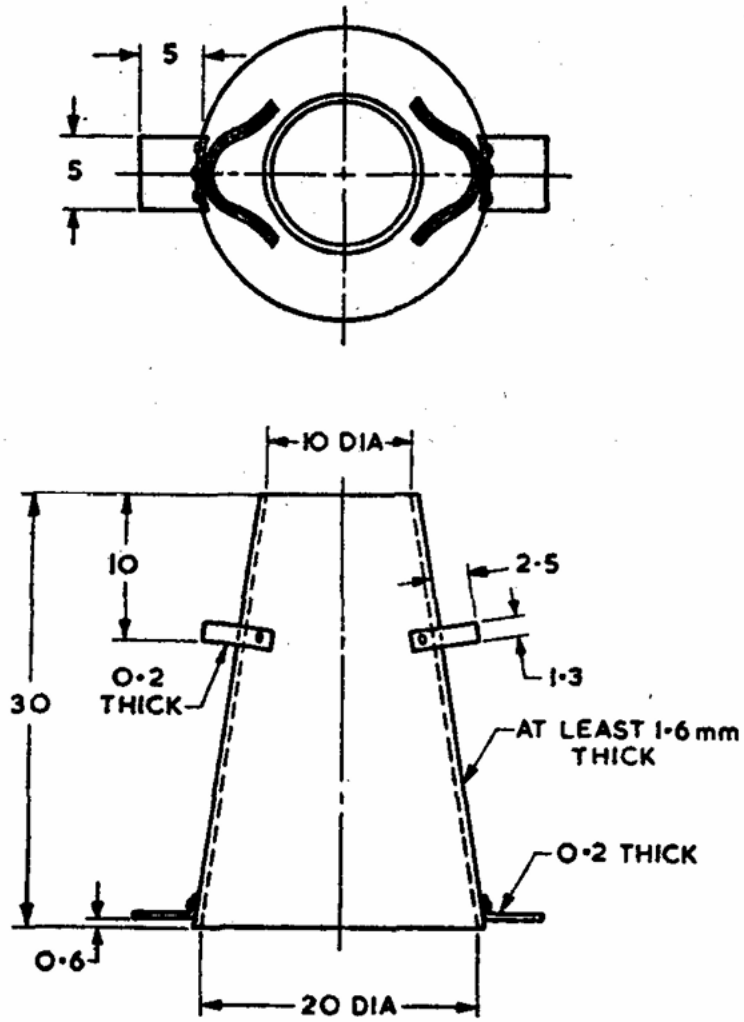
All dimensions in millimetres.

FIG. 2 V-FUNNEL



All dimensions in millimetres.

FIG. 3 TYPICAL GENERAL ASSEMBLY OF L-BOX SHOWING REQUIRED DIMENSIONS



The niould shall be filled in four layers, each approximately one-q6arter of the height of the mould. Each layer shall be tamped with twenty-five strokes of the rounded end of the tamping rod. The strokes shall be distributed in a uniform manner over the cross-section of the mould and for the second and subsequent layers shall penetrate in@ the underlying layer. The bottom layer shall be tamped throughout its depth. After the top layer has been rodded, the concrete shall be struck off level with a trowel or the tamping rod, so that the mould is exact19 filled. Any mortar which may have leaked out between the mould and the base plate shall be cleaned away. The mould shall be removed from the concrete immediately by raising it slowly and carefully in a vertical direction. This allows the concrete to subside and the slump shall be measured immediately by ddtermining the difference between the height of the mould and that of the highest point of the specimen being tested.

Cube Test IS 516

Rate of Loading 14 N/mm2/min

Thanks