QUALITY ASURANCE PLAN (QAP)

A)	This document outlines the requirements that should be fulfilled by the contracting agency for quality assurance of the work. Subsequent to the placement of work order, contracting agency shall submit a detailed program in line with this document for the approval of RRCAT.

B) Abbreviations:
IS: Indian Standard
ASME: American Society of Mechanical Engineers

Level 1:	Tests to be **performed at manufacturer's laboratory** during manufacturing / RRCAT approved laboratory before requesting RRCAT for accepting the material / works.
Level 2:	Tests to be conducted by the contracting agency **at the site laboratory** of contracting agency and to be witnessed by RRCAT representative before acceptance of material / works.
Level 3:	Tests to be conducted by the contracting agency **at laboratory** approved by RRCAT before acceptance of material / works
C)	For materials for which Quality Assurance Plan (QAP) is not specified, manufacture test certificate along with one test as per relevant codes at Check level 3 shall be conducted at the time of source approval or as directed by the Engineer In charge, RRCAT.

Notes:
1. All the expenses incurred on tests to be conducted as per Quality Assured Plan (QAP) shall be borne by the contractor only.

2. Existing Mix design for Concrete and GSB shall be provided by RRCAT. However, confirmatory tests shall be performed as per the QAP by contractor.

NAME OF WORK:- Construction of HTFIF building including Civil and Electrical works at ARPF campus near Devi Ahilyabai Holkar sabji mandi for RRCAT, Indore.

List of Material for which QAP is prepared:

1. Granular Sub-base
2. Cement
3. Fine Aggregate
4. Coarse Aggregate
5. Water
6. Chemical Admixture
7. Plain/Reinforced Cement concrete
8. Reinforcement Steel
9. Structural Steel

1. Granular Sub-base							
S. No.	**Name of the Test**	**Extent of check**	**Check level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	Gradation (Mix Grading)	One test at the time of source approval	3	IS:2386 - Part-4, MORTH 5th Revision (Table 400-1)	MORTH 5th Revision	As per IS/MORTH	
		One test for every 400 cum	2				
2	Density of compacted layer	Once for every 1000 sqm of the compacted layer	2	IS: 2720 – Part 28	MORTH 5th Revision	As per IS	

2. Cement						
S. No.	**Name of the Test**	**Extent of check/ Check level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	**Physical (PPC)**	i. Once for every source approval at check level 3. ii. Once in a year at check level 3. iii. Once in 3 months at check level 2	IS 1489 (Part-1)		As per IS	
a	Fineness (Blaine Air Permeability Method)		IS 4031 (Part-2)	Min 300 m^2/kg		
b	Soundness (Le chatelier)		IS 4031 (Part-3)	Max 10 mm		
	Soundness (Autoclave)			Max 0.8%		
c	Initial Setting Time		IS 4031 (Part-5)	Min 30 minutes		
	Final Setting Time			Max 600 minutes		
d	Compressive Strength		IS 4031 (Part-6)			
	a) 3 days			Min 16 MPa		
	b) 7 days			Min 22 Mpa		
	c) 28 days			Min 33 Mpa		
e	Consistency (%)		IS 4031 (Part-4)	-		
f	Drying shrinkage (%)		IS 4031 (Part-10)	0.15%		
g	Specific gravity		IS 4031 (Part-11)	-		
2	**Chemical (PPC)**	i. Once for every source approval at check level 3. ii. Once in a year at check level 3. iii. Once in 6 months at check level 2	IS 1489 (Part-1)			
a	Loss of ignition		IS 4032	Max 5%		
b	Magnesia			Max 6%		
c	Sulphuric anhydride (SO_3)			Max 3.5%		
d	Insoluble materials			Max: x+4.0(100-x)/100 Min: 0.6 x; x is % of fly ash		
e	Chloride Content			Max 0.1 % (for normal structures) Max 0.05 % (for prestressed structures)		
f	Alkali Content			Ref. Note 1 under Table 1 of IS 1489 (Part-1): 2015		

3. Fine aggregates

S. No.	Name of the Test	Extent of check	Check Level	Reference Document	Acceptance Norms				Format of Record	Remarks
1	Sieve Analysis	Once for every source approval	3	IS: 383 IS: 2386 (Part-I)	**IS Sieve Designation**	**Percent by weight passing for**			As per IS	For crushed stone sand the permissible limit of 150 micron IS Sieve is increased to 20 percent.
						Zone-I	**Zone-II**	**Zone-III**		
		Once in a year	3		10 mm	100	100	100		
					4.75 mm	90-100	90-100	90-100		
		Once in a month (for river sand)	2		2.36 mm	60-95	75-100	85-100		
					1.18 mm	30-70	55-90	75-100		
		One test for every 10 trucks (For crushed stone sand only)	2		600 µ	15-34	35-59	60-79		
					300 µ	5 – 20	8 – 30	12 – 40		
					150 µ	0-10	0-10	0-10		

4. Coarse aggregate

S. No.	Name of the Test	Extent of check	Check Level	Reference Document	Acceptance Norms			Format of Record	Remarks
1	Sieve analysis	Once for every source approval	3	IS: 383 IS:2386 (Part I)	Grading	IS Sieve Designation	% passing (by Weight)	As per IS	
					20 mm Nominal Size	40 mm	100		
		Once in a year	3			20 mm	85 – 100		
						10 mm	0 – 20		
						4.75 mm	0 – 5		
		Once in a month	2		10 mm Nominal Size	12.5 mm	100		
						10 mm	85 – 100		
						4.75 mm	0 – 20		
						2.36 mm	0 – 5		
2	Flakiness Index and Elongation Index	Once for every source approval	3	IS: 383 IS: 2386 (Part I)	40 % Maximum value of combined Elongation and Flakiness Index				
		Once in a year	3						
		Once in a month	2						

5. Water							
S No.	**Name of the Test**	**Extent of check**	**Check Level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	PH value	Once for every source approval	3	IS 456	Minimum 6	As per IS	Extra test shall be performed at check level 3 if any doubt on source of water, as per direction of EIC, RRCAT
		Once in a month	2				
2	Chloride (as Cl)	Once for every source approval	3	IS 456, IS:3025 (Part 32)	Maximum 2000mg/l for concrete not containing embedded steel & Maximum 500 mg/l for RCC		
		Once in a month	2				
3	Sulphates (as SO_3)	Once for every source approval	3	IS 456, IS:3025 (Part 24)	Maximum 400 mg/l		
		Once in a month	2				
4	Neutralisation with NaOH (with phenolphthalein as indicator)	Once for every source approval	3	IS 456, IS:3025 (Part 22)	Max. 5 ml of 0.02 normal NaOH to neutralize 100 ml sample of water		
		Once in a month	2				
5	Neutralisation with H_2SO_4 (with mixed indicator)	Once for every source approval	3	IS 456, IS:3025 (Part 23)	Max. 25 ml of 0.02 normal H_2SO_4 to neutralize 100ml sample of water		
		Once in a month	2				
6	Suspended matter	Once for every source approval	3	IS 456, IS:3025 (Part 17)	maximum 2000 mg/l		
		Once in a month	2				
7	Organic matter	Once for every source approval	3	IS 456, IS:3025 (Part 18)	maximum 200 mg/l		
		Once in a month	2				
8	Inorganic matter	Once for every source approval	3	IS 456, IS:3025 (Part 18)	maximum 3000 mg/l		
		Once in a month	2				

6. Chemical Admixture							
S No.	**Name of the Test**	**Extent of check**	**Check Level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	Relative density	Source Approval	3	IS 9103	Within 0.02 of the value stated by the manufacturer	As per IS	Manufacturer's Test certificate to be submitted for each batch
	Dry Material content				Within 5% of the value stated by the manufacturer.		
	Ash content				Within 5% of the value stated by the manufacturer.		
	chloride ion content				Within 10 percent of the value or within 0.2 percent whichever is greater as stated by the manufacturer		
	PH value				Minimum 6		
2	Relative density	Every Batch	1	IS 9103	Within 0.02 of the value stated by the manufacturer	As per IS	
	Dry Material content				Within 5% of the value stated by the manufacturer.		
	Ash content				Within 5% of the value stated by the manufacturer.		
	chloride ion content				Within 10 percent of the value or within 0.2 percent whichever is greater as stated by the manufacturer		
	PH value				Minimum 6		

7. Plain/Reinforced Cement Concrete/Temperature Controlled concrete									
S. No.	**Name of the Test**	**Extent of check**			**Check level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	Design Mix					IS 10262	As per IS	As per IS	Available RRCAT approved Mix Design can be adopted with the same material sources as indicated in design mix report till establishing of Mix Design as per QAP at check level 3. However, mix design as per QAP shall be established within 60 days from the date of commencement of work.
	a) Initial	Each grade of concrete			3				
	b) Yearly	Each grade of concrete			2				
2	Workability (Slump test)	Once for every batch of concrete			2	IS 1199	As per site requirement	As per IS	
3	(a) RCC - Compressive Strength at 28 days	Quantity (cum)	No. of samples	No. of samples	2	IS:516 & IS: 456	As per IS	As per IS	Please refer IS 456 for frequency of cube casting for RMC.
		1 to 5	One	1					
		6 to 15	Additional one	2					
		16 to 30	Additional one	3					
		31 to 50	Additional one	4					
		51 and above	one additional sample for every additional 50 cum or part thereof						
	(b) RCC - Compressive Strength at 7 days	1 to 100	One	1					
		100 and above	one additional sample for every additional 100 cum or part thereof						
	(c) PCC – Compressive Strength at 28 days	Every 100 cum			2	IS:516 & IS: 456	As per IS	As per IS	

8. Reinforcement steel							
S. No.	**Name of the Test**	**Extent of check**	**Check level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	**Chemical Tests**	Every consignment / lot	1	IS: 1786	As per IS: 1786	As per IS	If Heat No. tag is missed and not able to produce MTC, each dia. shall be tested as per IS 1786 with check level-3
	a) Carbon						
	b) Sulphur						
	c) Phosphorus						
	d) Sulphur +Phosphorus						
	e) Carbon Equivalent						
2	**Physical Test**						
	a) Ultimate Tensile strength						
	b) 0.2% proof stress						
	c) Percentage Elongation						
	d) Bend and Rebend Test						
	e) Mass per meter						
	f) Total Elongation						
1	**Chemical Tests**	Once for every 50 MT of steel for each dia. of bar.	3	IS: 1786	As per IS: 1786	As per IS	
	a) Carbon						
	b) Sulphur						
	c) Phosphorus						
	d) Sulphur +Phosphorus						
	e) Carbon Equivalent						
2	**Physical Test**						
	a) Ultimate Tensile strength						
	b) 0.2% proof stress						
	c) Percentage Elongation						
	d) Bend and Rebend Test						
	e) Mass per meter						
	f) Total Elongation						

9. Structural steel - Steel Beam, Column, Channel, Angle Sections, Plain Plates, Chequered Plates, Hollow sections (Box & Pipe)							
S. No.	**Name of the Test**	**Extent of check**	**Check level**	**Reference Document**	**Acceptance Norms**	**Format of Record**	**Remarks**
1	**Chemical Composition**	Every consignment / Lot	1	IS: 2062, IS: 1161, IS: 4923	As per IS 2062, IS: 1161, IS: 4923 for mentioned grade & Sub-qualities of steel in drawing	As per IS	MTC should be submitted for each section of the consignment coming to site. If not able to produce MTC, each section of the consignment/lot shall be tested with check level 3.
	a) Carbon						
	b) Manganese						
	c) Sulphur						
	d) Phosphorus						
	e) Silicon						
	f) Carbon equivalent, Max						
2	**Physical Properties**						
	a) Tensile Strength						
	b) Yield Stress						
	c) % Elongation						
1	**Chemical Composition**	Every 40 MT or part thereof	3	IS: 2062, IS: 1161, IS: 4923	As per IS 2062, IS: 1161, IS: 4923 for mentioned grade & Sub-qualities of steel in drawing	As per IS	The Type of section or member or element to be tested is at the discretion of the Engineer in Charge.
	a) Carbon						
	b) Manganese						
	c) Sulphur						
	d) Phosphorus						
	e) Silicon						
	f) Carbon equivalent, Max						
2	**Physical Properties**						
	a) Tensile Strength						
	b) Yield Stress						
	c) % Elongation						

Frequency For Determination of Properties of Fresh and Hardened Concrete

S No.	Description of Test	Frequency of testing
1.	Slump	First 3 transit mixers and then from every 5th transit mixer
2.	Temperature	From every transit mixer before pouring for temperature-controlled concrete
3.	Unit Weight	At the time of casting of cubes one sample per day for each grade
4.	Air content	One sample per week for each grade for temperature-controlled concrete
5.	Initial and final setting time	One sample per week for each grade for temperature-controlled concrete
6.	Bleeding	Whenever required
7.	Cube compressive strength 7, 28 days	As per QAP
8.	RCPT	One sample per week for each grade
9.	Chlorides and sulphate content test	One sample for each grade of concrete per six monthly