



# BIHAR STATE POWER TRANSMISSION COMPANY LIMITED

## FIELD QUALITY PLAN

<b>Item</b>	Switchyard Civil works
<b>Applicability</b>	BSPTCL Projects
<b>Date of Issue</b>	15.01.2016
<b>Validity</b>	Till next revision

<b>FQP No.</b>	001
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S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by BSPTCL	Accepting authority in BSPTCL
					Agency	Extent		
1.	Detailed Soil Investigation	a) Bore log	1. Depth of bore log 2. SPT Test 3. Collection of samples	As per BSPTCL Specification	Contractor	100% at Field	To witness 20% at Field	Site Engineer
		b) Tests on samples	As per tech. Specs.	As per BSPTCL Specification	<b>Contractor (Testing in BSPTCL accepted Lab)</b>	100% by testing lab (Reports to be signed by Testing person & Checking person)	Review of lab test results (All soil reports to have signature of BSPTCL executive reviewing the report )	Site In-charge based on the guide line issued by BSPTCL
2.	<b>Earth Work (site leveling)</b>							
		<b>1. Mandatory testing for filling</b>						
			1. Proctor compaction test for maximum dry density	IS:2720(part-7) & Specification	Contractor from BSPTCL approved Lab.	One sample per 25000 Cu. m. for each type & source of filling material.	100% review of lab test results	Site In charge
			2. Optimum Moisture Content	do	Contractor/ From BSPTCL approved Lab.	do	Do	do
		<b>2. Field Compaction Test</b>	1. Field dry density & Moisture content test for each layer of compaction.	IS:2720 (part-29) & BSPTCL Specification	Contractor Field lab./ BSPTCL approved Lab.	One sample for every 2500 sqm. or part there of for compacted soil for each compacted layer.	Do	do



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					Agency	Agency		
3.	<b>Checking of foundation Material</b>							
	A. Materials	1. Cement	1. Brand approval	Cement of approved brands by BSPTCL may be procured.	Contractor	As proposed by Contractor	Any new brand cement proposed by Contractor shall be assessed and approved by BSPTCL.	BSPTCL -HQ
			2. Physical tests	As per document at Annexure-I of this FQP	<b>Contractor</b> Samples to be taken jointly with BSPTCL and tested at BSPTCL accepted lab	<b>Review of 100% MTC's and one sample for every Batch No. of Manufacturer.</b>	100% review of lab test results and MTC.  <b>Test results shall be sent by the Lab, by E mail directly to BSPTCL; further, hard Copy of Test Certificate shall also be sent by the Lab directly to BSPTCL by Postal Address.</b>	Site in charge
			3. Chemical Tests Chemical composition of Cement	-do-	Contractor to submit MTC	<b>Review of all MTC's</b>	<b>100% review of MTC results</b>	Site In charge
		2. a) Reinforcement Steel	1. Source approval	<b>May be procured either from main producers directly or through the authorized dealers who can produce MTC from main producers with traceability.</b>  Refer BSPTCL for List of Main Producers of Re-enforcement Steel.	Contractor	<b>As proposed by contractor.</b>	Material shall be supplied from Main producers / authorized dealers.	Site in charge.



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					Agency	Extent		
			2. Physical and Chemical analysis test	<b>As per annexure-2 of this FQP</b>	Contractor to submit MTC	100% MTC's  One sample* / 500 MT / Manufacturer shall be jointly sealed by BSPTCL and tested at BSPTCL approved Lab.  *Note: All sizes of 10mm and above shall be taken for testing in every 500MT.	100% review of MTC, and embossing.  Review of lab test results. <b>Test results shall be sent by the Lab, by E mail directly to BSPTCL; further, hard Copy of Test Certificate shall also be sent by the Lab directly to BSPTCL by Postal Address.</b>	site In charge
		2. b) Miscellaneous structural steel excluding cable trench, transformer & reactor fdn.	<b>Source to be proposed by contractor.</b>	<b>Source with material meeting BSPTCL Specification</b>	<b>contractor</b>	<b>As proposed by contractor</b>	<b>To verify documents.</b>	site In charge
			1. <b>Dimensional check</b> 2. <b>Visual check for damages rusting pitting etc</b>	BSPTCL specification and approved drawing	Contractor	100%	Random	Site Engr
		2.c) Structural steel used in cable trenches, transformer & reactor fdn.	<b>Source to be proposed by contractor.</b>	<b>BSPTCL Specification</b>	<b>contractor</b>	<b>As proposed by contractor</b>	<b>To verify documents.</b>	



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					Agency	Extent		
			<b>1. Dimensional check</b>	BSPTCL specification and approved drawing	Contractor	100%	Random	Site Engr
			<b>2. Visual check for damages rusting pitting etc.</b>	BSPTCL specification and approved drawing	Contractor	100%	Random	Site Engr
			3. Visual check for welding defects primer coating and painting/ galvanizing as applicable	BSPTCL specification and approved drawing	Contractor	100%	Random	Site Engr
			4. Physical properties of Structural steel	IS:2062 BSPTCL specification and approved drawing	Contractor	1 sample per lot of 40MT or part thereof for tensile tests and 1 sample per lot of 20 MT or part thereof for bend test of each size.	Review of lab test results by BSPTCL.	Site Engr
		3. Coarse Aggregates	1. Source approval	<b>Source meeting BSPTCL Specification</b>	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested in BSPTCL accepted lab	To review the proposal based on the documents	Project In-charge. Once approved, the particular source shall be used for all the running contracts under various Packages.



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					Agency	Extent		
			2. Physical tests	<b>As per document at Annexure-3 of this FQP</b>	Samples to be taken jointly and tested in BSPTCL accepted lab	<b>One sample per 500 cum or part thereof per source, Samples to be tested by Contractor in BSPTCL accepted lab.</b>	100% review of lab test results. <b>Out of these 100% samples, BSPTCL shall witness 5 samples selected at random, spread during the overall execution period of contract .</b>	Site In charge
		4. Fine aggregate	1. Source approval	<b>Source meeting BSPTCL Specification</b>	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the results of Joint samples tested in BSPTCL accepted lab.	To review the proposal based on the documents.	Project In-charge.  Once approved, the particular source shall be used for all the running contracts under various Packages.
			2. Physical test	<b>As per Annexure-4 of this FQP</b>	Samples to be taken jointly and tested in BSPTCL accepted lab	<b>One sample per 500cum or part thereof per source, Samples to be tested by Contractor in BSPTCL accepted lab.</b>	100% review of lab test results. <b>Out of these 100% samples, BSPTCL shall witness 5 samples selected at random, spread during the overall execution period of contract.</b>	Site In charge
		5. Water	1. Cleanliness	BSPTCL Specification (Water shall be fresh and clean)	Contractor	100% visual check at Field	Verification at random	Site Engineer



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					Agency	Extent		
			2. PH Value	- do -	Contractor	One sample per source	100% review of the test results Ph value not less than 6	Site Engineer
		6.Finishing materials of building	Physical verification of Different items as per specification	As per Spec.	Contractor	100%	MTC/Manufacturer catalogue To be reviewed by BSPTCL.	Site In charge.
	<b>B. Concrete Works</b> a)Before concreting							
		1. Dimensions of excavation	Dimension & Depth of foundation	Appd. Drgs.	Contractor	100% at Field	100% check by BSPTCL	Site. Engr.
		2. Stub setting/Setting of Foundation Bolts, Embedments etc.	1) Centre Line	-do-	-do-	-do-	-do-	*-*-do-
			2) Diagonals	-do-	-do-	-do-	-do-	*-*-do-
			3) Level of stubs./ Foundation bolts	-do-	-do-	-do-	-do-	*-*-do-



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					Agency	Extent		
		3. Reinforcement steel	Placement	Bar bending schedule	-do-	-do-	-do-	-do-  *-*At least 5% locations shall be cross verified by immediate Reporting officer/ Site In charge, at Random with respect to stub setting and reinforcement steel placement
	b) During concreting	1. Workability	Slump test	Range 25 mm to 75 mm refer document at Annexure-5 of this FQP	Contractor	Minimum 01 sample per day	20% check at random	Site Engr.



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					Agency	Agency		
		2. Concrete Strength	Cubes Comp Strength	CPWD SPEC as referred in document at annexure-5 of this FQP	Contractor Casting of cubes at site. Cubes to be tested for 28 days strength at BSPTCL appd. Lab /BSPTCL Lab/At site ( if testing machine installed by contractor is duly calibrated by NABL Lab.) Cubes at <b>100%</b> location are to be taken in presence of BSPTCL officials.	One sample of 3 cubes for every 20 Cum or part thereof.  (Mini. Qty. required for testing is 5 cu. m. for each day of concrete).	100% review of Lab test results. Cubes at 100% location are to be taken in presence of BSPTCL officials. Normally testing shall be carried out at the Cube Testing Facility installed at BSPTCL premises, in the witness of BSPTCL. Alternatively, samples shall be tested at BSPTCL approved Labs.  <b>In this case, test results shall be sent by the Lab, by E mail directly to BSPTCL; Further, hard Copy of Test Certificate shall also be sent by the Lab directly to BSPTCL by Postal Address.</b> <b>Further, BSPTCL to witness testing on 20% samples and also to review 100% test results.</b>	Site Engineer.  10% samples to be witnessed by BSPTCL Site Engineer and at least 5% samples at random, shall be witnessed by Site In-charge.  In-case of Site / BSPTCL Lab, 100% witnessed by BSPTCL representative
	c) Backfilling	Watering & Ramming for compaction	a) Visual	BSPTCL Spec	Contractor	100%	Random	Site Engr.





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			b) Compaction Test	BSPTCL Spec	Contractor At Site/ BSPTCL Accepted Lab	a) One Sample of three specimen for 50% of tower location b) One Sample of three specimen for 20% of Equipment Foundation location c) 3 Samples ( three specimen for one sample) for every Building (The depth of sampling and the locations shall be decided by Site Engineer)	Physically at Random & 100% review of Test results	Site In charge
4.	Pile foundations	<b>REFER FQP OF SWITCHYARD PILE WORK</b>						
5.	Brick Masonry							
		a) BRICKS	1.Dimensional tolerance	BSPTCL Specification/enclosed annexure 6	Contractor (samples to be taken jointly and tested in BSPTCL accepted lab)	Enclosed Annexure 6	Review 100% of test results	Site Engineer



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			2.Compressive strength	BSPTCL Specification/enclosed annexure 6	-Do-	-Do-	-do-	Site Engineer
			3.Water Absorption	BSPTCL Specification/enclosed annexure 6	-Do-	-Do-	-do-	Site Engineer
			4.Efflorescence	BSPTCL Specification/enclosed annexure 6	-Do-	-Do-	-do-	Site Engineer
		b) Mortar Mix	<b>Cement sand Proportion</b>	As per BSPTCL Spec .	Contractor	100%	random	Site Engr
6.	<b>P.C.C</b>	Grade , thickness, plan dimension	completeness	IS:456 and BSPTCL approved foundation drawings & specification	Joint Inspection by BSPTCL and CONTRACTOR	For all locations	Joint Inspection by BSPTCL and CONTRACTOR	Site Engr.
7.	<b>PLASTERING</b>							
		1.Plastering	thickness and evenness	As per BSPTCL Spec.	Contractor	100%	Random	Site Engr
		2. ingredients	Mortar Mix/Proportion	As per BSPTCL Spec.	Contractor	100%	Random	Site Engr
8.	<b>Switchyard earthing</b>							
		1. Check for dimension of earth mat	Physical check	BSPTCL spec & approved drawings	contractor	100%	Random	Site Engr



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					Agency	Extent		
		2. Depth of excavation	Physical check	BSPTCL spec & approved drawings	Contractor	100%	Random	Site Engr
		3. Check for weld joints and anti corrosion treatment	Physical check	BSPTCL spec & approved drawings	Contractor	100%	Random	Site Engr
<b>9.</b>	<b>Site surfacing</b>							
		1.Leveling,Level & Height & evenness	Physical Check	BSPTCL spec & approved drawings	Contractor	100%	Random	Site Engr
		2. Soil sterilization : spraying of chemicals	Physical Check	BSPTCL spec & manufacturers recommendations	Contractor	100%	random	Site engineer
		'3.P.C.C (Grade, thickness & Size) 'a) PCC 1:5:10 (1 cement:5 coarse/fine sand:10 burnt brick aggregates) -Burnt brick aggregate of nominal size 40 mm	Completeness	BSPTCL specifications	Joint Inspection by BSPTCL and Contractor	100%	Random	Site Engr
			Grading	As per Annexure-8	Samples to be taken jointly & tested in BSPTCL accepted lab	1 sample per 500 cu.mtr	100% review of lab test results	Site In-charge
		4. 20/40mm stone aggregate	Grading	IS 383, IS 2386 and BSPTCL Speci. The grading shall be as per single sized nominal size	Contractor (BSPTCL accepted lab)	1 sample per lot of 500 Cubic Meter or part thereof from each source for each size.	100% review of test report	Site Engineer



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					Agency	Extent		
		5. Resistivity of 20/40mm stone aggregate.	Electrical Check	BSPTCL Technical Specification. (resistivity of the stone for spreading over the ground shall be minimum 3000 ohm-m under wet condition)	Contractor	1 sample of stone from each source (in case stones are supplied from more than one source)	100% review of test report.	Site Engineer
		6. Compacted thickness of 20/40mm stone layers as applicable	Physical	BSPTCL spec & approved drawings	Contractor	100%	Random	Site Engineer
<b>10</b>	<b>Road (WBM layers)</b>							
		1. Alignment & Level	Physical check	BSPTCL spec & approved drawings	Contractor	100%	100%	Site In charge
	Material	A. Coarse Aggregates	1. Source approval	Source with materials meeting BSPTCL Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested in BSPTCL accepted lab	To review the proposal based on the documents	Site In charge
			2. Physical tests	As per document at Annexure-7 of this FQP	Samples to be taken jointly and tested in BSPTCL approved lab	One sample per lot of <b>200</b> cum or part thereof per source	100% review of lab test results	Site In charge



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					Agency	Extent		
		B) Stone Screening						
			1. Source approval	Source with materials meeting BSPTCL Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested in BSPTCL accepted lab	To review the proposal based on the documents	Site In charge
			2. Grading	As per document at Annexure-7 of this FQP	Samples to be taken jointly and tested in BSPTCL accepted lab	One sample per lot of <b>200</b> cum or part thereof	100% review of lab test results	Site In charge
		C) Binding Material	Plasticity index	As per document at Annexure-7 of this FQP	Contractor	One sample per lot of <b>25</b> cum or part thereof	100% review of lab test results	Site In charge
		D) Laying of sub base Course	Physical check	As per CPWD spec clause 17.7.2	Contractor	100%	Random	Site Engr
		E) Laying of base Course	Physical check	As per CPWD spec clause 17.8.1	Contractor	100%	Random	Site Engr
<b>11</b>	<b>Drain</b>	Alignment and invert level	Physical	BSPTCL spec and approved drawing	Contractor	100%	Random	Site Engr



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**Annex-1**  
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## ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

ORDINARY PORTLAND CEMENT					
S. No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269	Ordinary Portland Cement 43 grade as per IS 8112	Ordinary Portland Cement 53 grade as per IS 12269	Remarks
a)	<b>Physical tests</b>				To be conducted in Appd. Lab
(i)	Fineness	Specific surface area shall not be less than 225 sq.m. per Kg. or 2250 Cm <sup>2</sup> /gm.	Specific surface area shall not be less than 225 sq.m. per Kg or 2250 Cm <sup>2</sup> /gm.	Specific surface area shall not be less than 225 sq.m. per Kg or 2250 Cm <sup>2</sup> /gm.	Blaine's air permeability method as per IS 4031 (Part-2) / Sieve analysis as per IS 4031 (part-3)
(ii)	Compressive strength	72 ± 1 hour : Not less than 16 Mpa (16 N/mm <sup>2</sup> )  168 ± 2 hour : Not less than 22 Mpa (22 N/mm <sup>2</sup> )  672 ± 4 hour : Not less than 33 Mpa (33 N/mm <sup>2</sup> )	72 ± 1 hour : Not less than 23 Mpa ( 23 N/mm <sup>2</sup> )  168 ± 2 hour : Not less than 33Mpa ( 33 N/mm <sup>2</sup> )  672 ± 4 hour : Not less than 43 Mpa ( 43 N/mm <sup>2</sup> )	72 ± 1 hour : Not less than 27Mpa (27 N/mm <sup>2</sup> )  168 ± 1 hour : Not less than 37Mpa ( 37 N/mm <sup>2</sup> )  672 ± 1 hour : Not less than 53 Mpa ( 53 N/mm <sup>2</sup> )	As per IS 4031 (Part-6)
(iii)	Initial & Final setting time	Initial setting time : Not less than 30 minutes  Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes  Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes  Final setting time : Not more than 600 minutes	As per IS 4031 (Part-5)  -do-
(iv)	Soundness	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Le Chatlier and Autoclave test as per IS 4031 (Part-3)



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S. No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269	Ordinary Portland Cement 43 grade as per IS 8112	Ordinary Portland Cement 53 grade as per IS 12269	Remarks
b)	<b>Chemical composition tests</b>				Review of MTC only
		a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.80 to 1.02%	
		b) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	
		c) Insoluble residue, percentage by mass Max. 4.00%	c) Insoluble residue, percentage by mass Max. 2.00%	c) Insoluble residue, percentage by mass Max. 2.00%	
		d) Magnesia percentage by mass Max. 6%	d) Magnesia percentage by mass Max. 6%	d) Magnesia percentage by mass Max. 6%	
		e) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5 or less and greater than 5 respectively.	e) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5 or less and greater than 5 respectively.	e) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5 or less and greater than 5 respectively.	
		f) Total loss on ignition shall not be more than 5 percent	f) Total loss on ignition shall not be more than 5 percent	f) Total loss on ignition shall not be more than 5 percent	



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**Annex-1  
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S. No.	Name of the test			Remarks
2.	<b>POZZOLANA PORTLAND CEMENT AS PER IS 1489</b>			
a)	<b>Physical tests</b>	i) Fineness	Specific surface area shall not be less than 300 sq.m. per Kg. or 3000 Cm <sup>2</sup> /gm	
		ii) Compressive strength	a) 72 ± 1 hour : Not less than 16 Mpa (16 N/mm <sup>2</sup> ) b) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm <sup>2</sup> ) c) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm <sup>2</sup> )	
		iii) Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	
		iv) Soundness	Un-aerated cement shall not have an expansion of more than 10mm Le Chatlier test and 0.8% by Autoclave test as per IS 4031 (Part-3)	
b)	<b>Chemical composition tests</b>			
		a) Magnesia percentage by mass Max. 6%		Review of MTC only
		b) Insoluble material, percentage by mass $x + 4(100-x)/100$ where x is the declared % of pozzolana in the PPC		-do-
		c) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 3.0		-do-
		Total loss on ignition shall not be more than 5 percent		





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**Annex-2**

### ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR REINFORCEMENT STEEL AS PER IS 1786-1985 Edition-4.3 (2004-12)

S. No.	Name of the test	Fe 415	Fe 500
i)	<b>Chemical analysis test</b>		
	Carbon	<b>0.30 Percent Maximum</b>	<b>0.30 Percent Maximum</b>
	Sulphur	<b>0.060 Percent Maximum</b>	<b>0.055 Percent Maximum</b>
	Phosphorus	<b>0.060 Percent Maximum</b>	<b>0.055 Percent Maximum</b>
	Sulphur & Phosphorus	<b>0.11 Percent Maximum</b>	<b>0.105 Percent Maximum</b>
ii)	<b>Physical tests</b>		
	a) Tensile Strength Minimum	10% more than actual 0.2% proof stress but not less than 485 N/Sq.mm.	8 % more than actual 0.2% proof stress but not less than 545 N/Sq.mm
	b) 0.2% of proof stress/Yield stress Minimum, N/mm <sup>2</sup>	415	500
	c) Elongation percent , Minimum	14.5	12
iii)	<b>Bend &amp; Rebend tests</b>	Pass	Pass



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**Annex-3**

### ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR COARSE AGGREGATES AS PER IS 383

<b>3.</b>	<b>Coarse Aggregates</b>										
i)	Physical Tests										
	a) Determination of particles size	a. IS Sieve Designation	%age passing for Single-Sized Aggregate of nominal size					Percentage Passing for grades Aggregate of nominal size			
			<b>40 mm</b>	<b>20 mm</b>	<b>16 mm</b>	<b>12.5 mm</b>	<b>10 mm</b>	<b>40 mm</b>	<b>20 mm</b>	<b>16 mm</b>	<b>12.5 mm</b>
		63 mm	100	-	-	-	-	-	-	-	-
		40 mm	85 to 100	100	-	-	-	95 to 100	100	-	-
		20 mm	0 to 20	85 to 100	100	-	-	30 to 70	95 to 100	100	100
		16 mm	-	-	85 to 100	100	-	-	-	90-100	-
		12.5 mm	-	-	-	85 to 100	100	-	-	-	90 to 100
		10 mm	0 to 5	0 to 20	0 to 30	0 to 45	85 to 100	10 to 35	25 to 55	30 to 70	40 to 85
		4.75 mm	-	0 to 5	0 to 5	0 to 10	0 to 20	0 to 5	0 to 10	0 to 10	0 to 10
		2.36 mm	-	-	-	-	0 to 5	-	-	-	-
	b. Flakiness index	Not to exceed 25%									
	c. Crushing Value	Not to exceed 45%									
	d. Presence of deletrious material	Total presence of deleterious materials not to exceed 5%									
	e. Hardness	Abrasion value not more than 40%, Impact value not more than 30%									
	f. Soundness test (for concrete work subject to frost action)	12% when tested with sodium sulphate and 18% when tested with magnesium sulphate									



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**Annex-4**

### ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR FINE AGGREGATES AS PER IS 383

4. Fine aggregates					
i)	Physical Tests	IS Sieve Designation	Percentage passing for graded aggregate of nominal size		
			F.A. Zone I	F.A. Zone II	F.A. Zone III
	a) Determination of particle size				
		10 mm	100	100	100
		4.75 mm	90-100	90-100	90-100
		2.36 mm	60-95	75-100	85-100
		1.18 mm	30-70	55-90	75-100
		600 microns	15-34	35-59	60-79
		300 microns	5 to 20	8 to 30	12 to 40
		150 microns	0-10	0-10	<b>0-10</b>
	b) Silt content		Not to exceed 8%	Not to exceed 8%	Not to exceed 8%
	c) Presence of deleterious material	Total presence of deleterious materials shall not exceed 5%			
	d) Soundness Applicable to concrete work subject to frost action	12% when tested with sodium sulphate and 15% when tested with magnesium sulphate			



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**Annex-5**

### ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CONCRETE WORK

<b>1)</b>	<b>Concrete</b>	a) Workability	Slump shall be recorded by slump cone method and it shall be between 25-75 mm. depending upon workability requirement as per IS 456.
		b) Compressive strength	For Design mix as per IS:456 for Grade M20 or above For nominal (volumetric) concrete mixes compressive strength for 1:1.5:3 (Cement : Fine aggregates : Coarse aggregates) concrete 28 days strength shall be min 265Kg/cm <sup>2</sup> and for 1:2:4(Cement: Fine Aggregate: Coarse aggregate) nominal mix concrete 28 days strength shall be min 210Kg/cm <sup>2</sup> .

**Notes :**

- 1) All Design Mix concrete shall be as per IS: 456.
- 2) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR DESIGN MIX CONCRETE: AS PER Table-11 of IS:456 as given below:

Specified Grade	Mean of the Group of 4 Non-Overlapping consecutive test results in N/sq mm	Individual Test Results in N/sq mm
M 20 or above	Shall be greater than or equal to $f_{ck} + 0.825 \times \text{established standard deviation (rounded off to nearest 0.5 N/sq mm)}$ * Or $F_{ck} + 3 \text{ N/sq mm}$ , whichever is greater	$\geq f_{ck} - 3 \text{ N/sq mm}$

\* Established value of standard deviation shall be determined based on Note of Table-11 of IS:456

- 3) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR NOMINAL MIX CONCRETE:
  - a) On the basis of mandatory lab test result, in case of actual average compressive strength being less than specified strength but up to 70% of specified strength, concrete may be accepted and the rate payable shall be in the same proportion as the actual average compressive strength bears to specified compressive strength.
  - b) If the actual average strength of accepted sample is less than 70% of specified strength, the Site-in-charge shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contractor. If, however, the Engineer-in-charge / Project In-charge so desires, he may order additional tests to be carried out to ascertain if the structure can be retained/rectified. All the charges in connection with these additional tests shall be borne by the Contractor.
  - c) 53 Grade cement shall be used after obtaining specific approval of the Engineer in charge.
  - d) Portland slag cement conforming to IS: 455 may be used as per Technical Specification.



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**Annex- 6**

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## SAMPLING PLAN FOR BRICK-WORK

Scale of sampling and permissible number of defectives for visual and dimensional characteristics.

No of Bricks in the lot	For characteristics specified for individual bricks		For Dimensional characteristics for group of 20 bricks- No of bricks to be selected
	No of bricks to be selected	Permissible no of defective in the sample.	
(1)	(2)	(3)	(4)
2001-10000	20	1	40
10001-35000	32	2	60
35001-50000	50	3	80

Note : In case the lot contains 2000 or less bricks the sampling shall be as per decision of the Engineer – in- charge.

Scale of sampling for physical characteristics

Lot size	Sampling size for compressive strength water absorption and efflorescence	Permissible No of defectives for efflorescence
(1)	(2)	(3)
2001-10000	5	0
10001-35000	10	0
35001-50000	15	1



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**Annex- 6**

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### ACCEPTABLE CRITERIA FOR BRICK WORK

1) Dimensional Tolerances: The dimensions of modular/ Non modular bricks when tested shall be within the following limits per 20 bricks.

S.No	DESCRIPTION	MODULAR BRICKS	NON-MODULAR BRICKS
1	LENGTH	372 to 388 cm (380± 8 cm)	432 to 468 cm (450 ± 18)
2	WIDTH	176 to 184 cm (180± cm)	213 to 231cm (222± 9)
3	HEIGHT	176 to 184 cm (180± 4 cm)	134 to 146 cm (140 ± 6)

2) Compressive strength: the bricks shall have a minimum average compressive strength as specified in BSPTCL specification. The compressive strength of any individual brick tested shall not fall below the min. average compressive strength specified for the corresponding class of brick by more than 20% . in case compressive strength of any individual brick tested exceeds the upper limit specified for the corresponding class of bricks, the same shall be limited to upper limit of the class as specified for the purpose of calculating the average compressive strength.

3) Water absorption : The average water absorption of bricks shall not be more than 20% by weight.

4) Efflorescence : The rating of efflorescence of bricks shall not be more than moderate.



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**Annexure-7**

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### PHYSICAL, REQUIREMENT OF COARSE AGGREGATE

S.No.	Type of Constn.	Type of Test	Test Method	Requirements
1.	Sub-base	Los Angeles Abrasion Value or Aggregate Impact value	IS:2386(Pt.IV) IS:2386 (Pt.IV) IS:5640***	60% max. * 50% max
2.	Base	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness & Elongation Index	IS:2386(Pt.IV) IS:2386 (Pt.IV) IS:5640*** IS:2386 (Pt.I)	50% max. * 40% max ** 35% max
3.	Surface Course	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness & Elongation Index	IS:2386(Pt.IV) IS:2386 (Pt.IV) IS:2386 (Pt.I)	40% max. 30% max 35% max

\* Aggregates may satisfy requirements of either of the two tests

\*\* The requirements of flakiness index shall be enforced only in case of crushed/broken stone and crushed slag.

\*\*\* Aggregates like brick metal, kankar and laterite which get softened in presence of water, shall be tested for impact value under wet conditions in accordance with IS:5640.



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### GRADING REQUIREMENTS OF COARSE AGGREGATE FOR GSB

GRADING FOR CLOSE-GRADED GRANULAR				
SUB-BASE MATERIALS				
IS Sieve	Per cent by weight passing the IS sieve			
Designation	Grading I	Grading II	Grading III	
75.0 mm	100	---	---	
53.0 mm	80-100	100	---	
26.5 mm	55-90	70-100	100	
9.50 mm	35-65	50-80	65-95	
4.75 mm	25-55	40-65	50-80	
2.36 mm	20-40	30-50	40-65	
0.425 mm	10-25	15-25	20-35	
0.075 mm	3-10	3-10	3-10	
<b>CBR Value (Minimum)</b>	<b>30</b>	<b>25</b>	<b>20</b>	





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### GRADING FOR COARSE-GRADED GRANULAR

#### SUB-BASE MATERIALS

IS Sieve	Per cent by weight passing the IS sieve		
	Grading I	Grading II	Grading III
75.0 mm	100	---	---
53.0 mm		100	---
26.5 mm	55-75	50-80	100
9.50 mm			
4.75 mm	10-30	15-35	25-45
2.36 mm			
0.425 mm			
0.075 mm	<10	<10	<10
<b>CBR Value(Minimum)</b>	<b>30</b>	<b>25</b>	<b>20</b>

**Note:** The Material passing 425 micron (0.425 mm) sieve for all the three gradings when tested according to IS: 2720

(Part 5) shall have liquid limit and plasticity index not more than 25 and 6 per cent respectively.



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### Annexure-8

#### Requirement of grading of broken Burnt Brick Coarse aggregate

IS Sieve Designation	Percent Passing
75 mm	100
37.5 mm	95-100
19.0 mm	45-75
4.75 mm	0-5

#### General Notes:

- 1) This Field Quality Plan is not to limit the supervisory checks which are otherwise required to be carried out during execution of work as per drawings/Technical specifications etc.
- 2) All materials under supply contract should have D.I. before they are erected.
- 3) Contractor shall be responsible for implementing/documenting the FQP. Documents shall be handed over by the contractor to BSPTCL after the completion of the work.
- 4) Project incharge means over all incharge of work. Site Incharge means incharge of the Site. Site Engr means incharge of the section.
- 5) In case of deviation the approving authority will be one step above the officer designated for acceptance in this quality plan subject to minimum level of Site incharge.
- 6) Acceptance criteria and permissible limits for tests are indicated in the Annexures. However for further details/tests BSPTCL specification and relevant Indian standards shall be referred.
- 7) Tests as mentioned in this FQP shall generally be followed. However E.I.C. reserves the right to order additional tests wherever required necessary at the cost of the agency.
- 8) All counter checks/tests by BSPTCL shall be carried out by BSPTCL's officials' at least at the level of Site. Engr.
- 9) The authorized dealer means the dealer whose names are listed in the main producer's web site or certified by the main producers.
- 10) Accepting Authority for testing Laboratory shall be BSPTCL-HQ.



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- 11) Mobile testing Labs owned by the contractor may also be acceptable if their facilities meet the testing requirements and the testing equipments are properly calibrated at Third Party Labs where testing/calibration is to be carried out should be accredited by NABL or an agency operating in line with ISO/IEC 17011 and having full membership & MRA of ILAC/APLAC, subject to approval of project Incharge.
- 12) **READYMIX CONCRETE (RMC) IS ACCEPTABLE FOR USE. HOWEVER, SITE INCHARGE SHALL APPROVE THE SOURCE OF MATERIALS TO BE USED FOR RMC .The documentation to be maintained shall be as per IS 4926:2003 i.e i) Information to be supplied by the purchaser (clause 7)**
  - ii) **Information to be supplied by the producer (clause 8)**
  - iii) **Sampling for concrete strength should be one set of 3 nos of cubes for every 50 cu.m or part thereof for each day of concreting and 28 days compressive strength shall be tested in line with IS:456.**
- 13) Epoxy coating on reinforcement steel wherever required shall be done as per IS 13620.
- 14) Cement is to be used in the order it is delivered (ie. First in First Out). Cement bought to works shall not be more than 6 weeks old from the date of manufacture.in case the cement remains in storage for more than 3 months, the cement shall be retested before use and shall be rejected, if it fails to conform to any of the requirements given in the relevant Indian Standard. Cement shall be packed in bags and stored in accordance with the provisions in IS -4082.
- 15) If e-mail facility is not available in BSPTCL approved Lab, report may be collected directly by BSPTCL /Speed Post / Register Post / UPC.
- 16) In case any Laboratory refuses to allow BSPTCL representative for witnessing the test, same shall be taken in writing and approved by BSPTCL HQ.
- 17) **Bidders should thoroughly go through the QAP, MQP & FQP prior to submission of proposal of bids. No extra claim on account of implementation of this QAP, MQP & FQP under any circumstances shall be entertained. All destructive tests, wherever required in compliance of the MQP & FQP shall be done by the contractor without extra cost implications. These MQP & FQP shall be applicable for all the contracts. However the BSPTCL reserves the rights to waive off any testing at its discretion in the interest of the progress of the projects.**