

Construction work procedure for FOOTING LOAD TEST

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1. SCOPE:

The purpose of the footing load test is to study the load-settlement behavior of the type of soil encountered at the site for shallow foundation resting on soil.

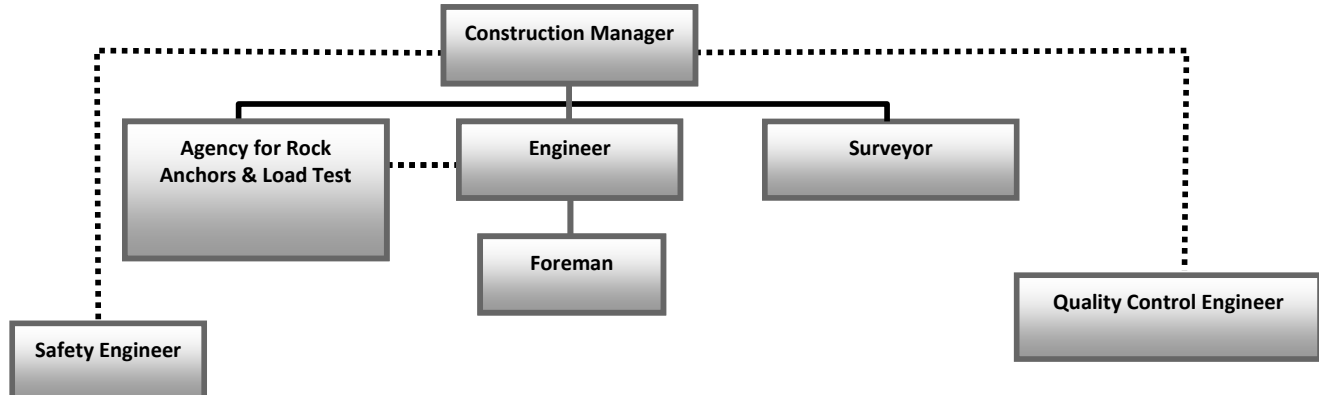
The test location is as under:-

Corridor	Location	Coordinates		NGL in RL (m)	Size of Footing	Test Depth R.L.(m) -3m from NGL
		N	E			
III	Between Nagole to Uppal	1924902.877	240317.267	480.439	2m x 2m	477.439

The test consists of measuring settlement up to load intensity of 100t/m^2 . The load shall be applied in ten equal increments on a rigid footing of $2\text{m} \times 2\text{m}$ at the above specified test level. The load shall be applied by means of hydraulic jack; Rock anchors along with structural frame shall be used as a reaction for the jack.

2. REFERENCE DOCUMENTS:

3. ORGANISATION CHART:



4. STAFF RESPONSIBILITIES:

4.1. CONSTRUCTION MANAGER:-

- Reports to the project Head.
- Co-ordinates with all concern departments for technical and administrative help.
- Involve himself in preparation of Construction Work Procedure
- Takes initiatives to obtain the statutory permits from GHMC & Traffic Police.
- Arrangement of resources (Specialised Agency for Rock anchors and load test, Machine, tools, Area Lighting, All Consumable materials).

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- Monitors optimum utilization of Machine, equipment engaged
- Involves in Safety and Quality Pep talks regularly.
- Monitors the Program vs. Progress of his work and analyses work difficulties, critical path if any as per the set Target.
- Monitors mandatory safety requirements for workmen and work environment.

4.2. ENGINEER:-

- Reports to the Construction Manager for day to day activities.
- Interacts with the LTMRL Representatives and generates RFIs for inspection.
- Execute the job thru specialised agency and give the feedback about the progress to Construction Manager.
- Liaison with internal departments like Planning cell, Quality control cell, Plant & Machinery department, Safety department and Stores for
- Ensures to implement all mandatory safety requirements within his work limits.
- Responsible for optimum utilization of resources.
- Submits his requirements of materials & other resources for his work to the CONSTRUCTION MANAGER well ahead of schedule.
- Prepares his work schedule based on Project schedule.
- Closely monitors to achieve the set program.
- Follows the Inspection, Test plans and submits records to LTMRL for their reviews and approval through EDMS.

4.3. SURVEYOR:-

- Reports to the Construction Manager.
- Marks the coordinates for the rock anchor bore hole positions and Footing Layout.
- Check invert Levels of test pit before & after excavation, Plain Cement Concrete Top, & Footing Top.

4.4. FOREMAN:-

- Reports to the Site Engineer and follow his instruction.
- Responsible for assembling and erection of Scaffolding including fixing of rock anchors.
- Supervise adequately for any safety lapses and ensure the right way of handling of Heavy equipment / materials.

4.5. AGENCY FOR ROCK ANCHORS & LOAD TEST:-

- Reports to the project manager
- Carry out drilling of rock hole, Rock anchoring, load testing, records the test readings.

4.6. SAFETY ENGINEER:

- Reports to EHS Manager as well as acts as a site safety coordinator.
- Involves in regular safety pep talks, periodical demonstrations of safe practices in work.
- Helps to provide necessary safety materials as per work requirements.

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- Implement EHS systems at site, Supervise for the safety lapses before commencement of work.
- Organize training programmes for safety awareness.
- Coordinates with site administration, first-aid center, doctors & hospitals during emergency.

4.7. QUALITY CONTROL ENGINEER:

- Reports material engineer as well as acts as a site quality coordinator.
- Involves in regular quality pep talks, periodical demonstrations of best practices in work,
- Arranges routine testing for the consumable construction materials like cement grout cubes, concrete cubes, witness calibration of testing & measuring equipment /tools like pressure gauges, deflection gauges.
- Checks the right material used at right place.

5. MATERIALS:

Sl. No	Name	Brand / Source	Conforms to	Quantity Required
1	HYSO Steel TMT Bars	M/s AFPL	IS: 1786	0.332MT
3	Lime Powder	Locally available	----	20kg
2	Concrete 1:3:6	Hand mixed	IS:456	0.400M ³
3	Concrete M30 Grade	BMR Ready Mix	IS: 456	3.800 M ³
4	HT Strands of 12.7mm	D P wires , Ratlam, MP	IS: 6006	(25M x 10nos x
5	HDPE Pipe of 16mm ID	Locally available	----	175Mtr
6	Fixed Anchor	Locally fabricated	IS:10270 Cl.6.4	
7	Epoxy Hardener Lapox K-46, Epoxy Resin Lapox B-47,	ATUL Chemicals, Valsad, Gujrat	-----	4nos x2.5 kg
8	Anchor Head MF1205	India Components (P)	IS:10270,	4nos
9	Wedge	Rudra Metal Industries	-----	50nos
10	PVC spacer plate of 100mm dia and 6mm thick)	Locally made	Drawing Annexure-A	10
11	Bar Binding wire (22	Locally manufactured	IS: 432	10.000 kg
12	Shutter oil	SWC/ SIKA /	IS:4990,Annx-C3	2.000 ltr
13	Non shrink admixtures for Cement grout	SIKA / FOSROC	ASTM C 1107	1500 gm
14	Cement	PENNA SUPER, ULTRATECH, OPC 43/53 Grade	IS: 8112 / IS:12269	1.4 MT
15	Foam strips 6mm thick	Locally available	----	20 M
16	Putty / sealant	Locally available	-----	3kg
17	Water	Portable type	IS: 456	Adequate
18	Hessian cloth	Locally available	-----	12m ²

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6. MANPOWER:

Sl.No	Category	Nos. Required	Remarks
1	Drilling machine operator	1	
2	Supervisor	1	
3	Rigger	4	
4	Tractor compressor operator	1	
5	Hydraulic Jack Operator	1	
6	Traffic marshal / Flag men	2	
7	Un skilled work man	4	
8	Quality Control Technician	1	

7. MACHINE, EQUIPMENT, TOOLS & TACKLES:














Sl.No	Type of Machine, Tools & Tackles	Nos. Required	Calibration	Remarks
1	Safety cones	12	-----	
2	Safety Barricading board	14	-----	
3	Blinkers	10	-----	
4	PVC Traffic Barrier	10	-----	
5	Barricading board fixing nails	60	-----	
6	Total station	01	Calibrated	
7	Level measuring instrument	01	Calibrated	
8	Hydraulic Rock Drilling Machine	01	----	
9	Dewatering Pump 5hp	01	----	
10	Plate compactor	01	----	
11	Hand compactor	01	----	
12	Tyre mounted Hydraulic Crane 12MT	01	----	
13	Concrete pouring chute 3m long	01	----	
14	Tractor Compressor	01	----	
15	Kentledge (Fabricated Structural Steel beams with four rock anchors)	01	----	
16	Pneumatic Jack Hammer	01	----	
17	Hydraulic pump with Jack of 500MT capacity (Orione make)	01	Manufacturer's Test Certificate (MTC)	
18	Hydraulic pressure gauge 1000Kg/cm ² capacity	01	Calibrated up to 700Kg/cm ² from	

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Sl.No	Type of Machine, Tools & Tackles	Nos. Required	Calibration	Remarks
			NABL Accredited Laboratory.	
19	Multi strand stressing jack	01	-----	
20	Deflection measuring gauge (50mm range with precision of 0.01mm)	04	Calibrated from NABL Accredited Laboratory.	
21	Deflection measuring gauge (25mm range with precision of 0.01mm)	04	Calibrated from NABL Accredited Laboratory.	
22	Concrete (needle) Vibrator	01	----	
23	Concrete Vibrator needle 60mm dia	02	----	
24	Steel / Ply wood shutters	08 SQM	----	
25	Pickaxe	2	----	
26	Spade	2	----	
27	Measuring (steel) tape 3m	1	-----	
28	Plumb	1	-----	
29	Sounding chain for depth measuring (25m)	1	-----	
30	Steel fabricated Ladder of 2.2m long.	2	-----	
31	Gas cutting set	1	-----	

8. Sequence of work:

-  Obtaining statutory work permissions.
-  Educating team about Construction Work Procedure (CWP).
-  Marking of test pit co-ordinate and area of excavation.
-  Marking of "Footing load test" area for safety barrication.
-  Placing road safety cautionary boards.
-  Marking of rock anchor drilling holes.
-  Drilling of rock anchor holes.
-  Inserting rock anchoring strands to the drilled holes.
-  Grouting of strands.
-  Excavation, compaction and level check of test pit.
-  Disposal / preservation of excavated soil.
-  Placing PCC
-  Cutting & Bending of rebar

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- ✚ Tying of Rebar at the foundation location
- ✚ Shuttering of concrete footing.
- ✚ Placing of concrete.
- ✚ Stripping out of shutters.
- ✚ Curing of footing load test concrete structure.
- ✚ Setting of anchor frame.
- ✚ Cement grout cube test.
- ✚ Initial stressing for Slack removal of strands.
- ✚ Calibration of pressure gauges & deflection gauges.
- ✚ Fixing of Hydraulic jack, pressure gauge and deflection gauges.
- ✚ Concrete cube testing.
- ✚ Setting of level measuring instrument and Reduced Level measuring.
- ✚ Load testing
- ✚ Recording the observations of settlement against pressure/ Load and Time.
- ✚ Unloading of pressure.
- ✚ Dismantling & demobilization of test arrangements.
- ✚ Back filling of test pit.
- ✚ Road restoration.
- ✚ Removal of barricading boards, safety cones etc.
- ✚ Opening of Barricading area to Traffic.

9. **WORK PROCEDURE:**

- 9.1 The work shall be commenced after obtaining statutory permits from the Traffic police department and Greater Hyderabad Municipality Corporation, and other Government bodies.
- 9.2 The construction team shall be educated about the approved Construction Work Procedure (CWP) by Construction manager.
- 9.3 As per the coordinate given in the table given in section 1.0 'scope', keeping the coordinate as the center of foundation, area of excavation (2.5m x 2.5m) shall be marked by lime powder.
- 9.4 The footing load test area (12.0m x 8.0m) shall be marked and barricaded with 16 nos steel fabricated boards (L=2.0m x H=2.4m each). These barricades shall be firmly secured by nailing down into the ground. Four nos of red blinking lights shall be fixed as hazard signals along and at the top of barricading line. Other road safety cautionary boards shall be provided facing towards the approaching Traffic. Traffic marshals shall be deployed to control the traffic during the entire procedure of footing load test.
- 9.5 Four nos. of 150mm diameter bores drilling shall be carried out at all four anchoring positions as per the drawing as annexure - A. Depth of each drill hole shall be 20.0m minimum from EGL to ensure 10m of hard rock anchoring (Fixed Length). The boring depth shall be measured by using sounding chain. Each hole shall be capped tight immediately after boring completed to protect from falling of any foreign material. Before inserting the Low relaxation high tensile steel strands into the hole each hole shall be flushed with compressed air to ensure the bore is clean from water, any loose and foreign material. 10 nos of 15.2mm diameter strands of 24m each in a group

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shall be inserted by providing 10nos of PVC spacer plates at 1m c/c placed throughout the fixed length, so that the strands are not entangled to each other while inserting into the drilled bore hole. An Anchor head shall be fixed at the end of strand group and a guide bulb shall be made at the cut end before inserting of strands using Epoxy (mix of Hardener Lapox K-46 and Resin Lapox B-47) grout.

- 9.6 A High Density Poly Ethylene (HDPE) pipe of 16mm ID and 25m in length shall be inserted through the center of the spacer plates up to the bottom for pouring cement grout to anchor the strands in the rock hole. All of the strands inside the bore hole above the 10m rock socketing for the free length shall be inserted thru individual HDPE Pipes of 16mm ID to keep the strands free from contact with moisture and soil around.
- 9.7 Grout shall be prepared by mixing Cement and water uniformly using a mechanical mixer to a water-cement ration of 0.40 per bag of cement, water to be added is 20lts) which shall be pumped in to the anchor hole through the centrally placed HDPE pipe. A suitable pressure grout pump capable to pump the above cement grout shall be used to pour the grout. 6nos or more of grout cubes of dimension (100mm x 100mm x 100mm) shall be cast to ascertain the age at which a minimum strength of 30Mpa is achieved. Grout shall be filled up to the fixed length (Bottom 10.0m) portion i.e. up to the rock socketing length. Confirmation of filled depth shall be measured by using sounding chain. The free length (11.50m minimum from the grout top) of the anchor is kept free to elongate for stressing effect during load test.
- 9.8 Dismantling of the concrete median, hard top road surface shall be done by pneumatic pavement breaker and the excavated material shall be disposed off in a suitable disposal area.
- 9.9 The underneath layers shall be excavated manually by using pickaxe and spade. Excavation shall be done up to 3mtr below the existing ground Level. Excavated material shall be kept aside for backfilling of the test pit. The base of the test location shall be leveled and compacted with the light duty plate compactor. A 75mm thick Plain Cement Concrete 1:3:6 shall be placed over the excavated, leveled & compacted to the dimensions given as per the drawing in Annexure-A.
- 9.10 A brick masonry / solid precast concrete block wall of height 150-200mm shall be made around the test pit at the existing ground level to protect the test area from surface rain water entering in.
- 9.11 Cutting, bending, and tying of Reinforcement bars for the footing shall be carried out as per the Bar Bending Schedule. Adequate water tightness of shuttering for the RCC footing shall be ensured by using the foam strips and sealant (putty). The RCC footing shall be cast-in-situ at test location with M30 grade concrete. Subsequently a central RCC column of dimension 0.75m x 0.75m x 1.26m shall be cast with M35 grade concrete. 6nos or more of concrete cube (150mm x 150mm x 150mm) shall be cast to check compressive strength. Water Curing shall be started after 24 hours of concreting by covering the footing with hessian cloth and sprinkling of water on it, Curing shall be done up to a period of 14 days and simultaneously care shall be taken to prevent flooding around the footing also.
- 9.12 The steel beam structure for kentledge shall be lifted by crane and positioned centrally over the support blocks. The grout cubes shall be tested for compressive strength. Once the strength

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achieved is more than 30N/mm² but not before 14days, strand groups from each rock anchors shall be stressed one by one using a multi strand jack to remove slackness if any. The required pressure to remove the initial slackness shall not be more than 0.72MT.

- 9.13 As given in the drawing (Annexure – A), the arrangements of placing Datum bars, and Hydraulic Jack, fixing of two set of deflection measuring gauges of 50mm travel (4nos) and 25mm travel (4nos) with the datum bars, setting up pressure / Load measuring gauge shall be done. Once loading commences, readings shall be observed from the 50mm deflection gauges (First set of dial gauges) for the settlement of footing. After the deflection (settlement) reaches about 45mm travel another set of dial gauges of 25mm travel (Second set of dial gauges) shall be set to its zero position and subsequent readings shall be started. In a similar manner if the settlement reaches 20mm (in the second set of dial gauges), again the previous 50mm gauges shall be kept ready for the next settlement reading. The observations in settlement shall be continued until the final load of 400MT is reached.
- 9.14 As an additional measure to check elongation of strands comparing with yield of ram of jack, four level instruments shall be set with a paint mark on each set strands before loading started. The survey instrument shall be used to note the change in reduced level on each increment of loading, immediately and after elapse of 60minutes. This shall provide a relation between the elongations of strand; pressure applied and yields of ram of jack.
- 9.15 Concrete cube sample shall be tested at the age of 14days or later to check the compressive strength of concrete is achieved more than 30Mpa. And once the concrete achieved the compressive strength the activity for the load test shall be taken up. Initially minimum seating load of 2.80T shall be applied and removed before starting of the load test. The loading patterns in terms of pressure shall be calculated based on the RAM diameter of jack at site. Then footing shall be loaded to a maximum load of 400MT and the design load intensity of 100MT/m². This is done in 10 equal increments. Settlement will be observed for each increment of load after an interval of 1.00, 2.25, 4.00, 6.25, 9.00, 16.00 and 25.00 minutes and thereafter at hourly intervals to the nearest of 0.01mm. Each load increment shall be kept for not less than 1hour or up to a time when the rate of settlement is appreciably reduced to a value of 0.02mm/min. the next increment of load then be applied and the observations repeated. The loading shall be continued to a maximum load intensity of 100MT/m² subjected to three consecutive hours through which no change observed in settlement. Considering free length of strands as 11.500m, expected elongation of strands shall be as under:

Load applied in MT	Loading in %	Elongation in mm)
40	10	5.98
80	20	11.96
120	30	17.93
160	40	23.91
200	50	29.88
240	60	35.86
280	70	41.83
320	80	47.81
360	90	53.78
400	100	59.76

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- 9.16 Reading of dial gauges shall be taken by getting down from existing ground level to the top of footing level, but outside the footing through the steps made from two opposite barricaded sides as in the sketch as Annexure-D . In each side of top of footing there is a clearance of 1.2m in between datum bars. Care shall be taken that datum bars must not be touched or disturbed during dial gauge reading.
- 9.17 Upon completion of loading, unloading shall be done in 10 equal decrements. After reaching the ultimate load, the settlement shall be observed for such three hourly readings where there is no further settlement (less than 0.02mm/min) is noted or elapse of 24 hours, whichever is earlier. After each decrement of load 15min observation time shall be allowed for recovery in settlement and recorded.
- 9.18 After completion of test, the testing instruments (Pressure gauge, Deflection gauges) shall be removed, packed and sealed carefully and shall be stored at Quality Control Department. Other Kentledge arrangement shall be distressed and dismantled by using crane and demobilized from site by next two days. Strands from the anchor holes shall be cut 150mm below the hole top and the hole shall be filled with crushed rock sand followed by full water saturation and 150 mm concrete capping.
- 9.19 Back filling of the test pit shall be carried out as per the Construction Work Procedure and there by road shall be restored. At last the barrication and road safety Cautionary boards shall be removed and opened to traffic.

10. WEATHER LIMITATIONS:

Season	Risk Analysis	Preventive Measures
Rainy	a) Heavy rain may cause flooding inside the test pit. b) Raining during test	a) Test pit barricading wall shall be checked for any water leakage from outside. b) Test pit shall be shaded by covering with Tarpaulins to avoid any kind of interruption in testing.
Winter	Setting and strength gaining in concrete requires sufficient time and may cause delay in testing schedule.	Suitable adjustment shall be done in mix design of concrete to get required strength in time.
Summer	Concrete temperature may exceed the temperature limit of 40°C max. and may cause Evaporation loss in concrete.	Concreting temperature shall be controlled by adding chilled water at mixing plant or, concreting during peak heat period of the day shall be avoided.

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11.INSPECTION PLAN

Sl. No.	Description of Operation	QHP	QCP	Documentation
1	Layout of test pit and anchor hole positions	----	√	Sketch footing Load Test Location
2	Safety Barrication	----	√	Traffic safety barrication plan
3	Drilling of rock anchors	----	√	Check List before Homing of Rock Anchors
4	Lowering of Strands Grouting of rock anchors	----	√	Rock anchor grouting report
5	Excavation & Level check after excavation & PCC	----	√	Check list for PCC for concrete structures
6	Shuttering of footing, placing and fixing of Re-bars	----	√	Bar Bending Schedule
7	Concreting of footing & column	----	√	Concrete pour card
8	Arrangement of kentledge	----	√	-----
9	Hydraulic Jack Performance	----	√	Manufacturer's Test Certificate
10	Calibration of Pressure Gauge	----	√	Calibration Report, RFI
11	Calibration of Deflection Gauges	----	√	Calibration Report, RFI
12	Load testing on footing	√	√	Footing load test record & Footing load test reading

12.TEST PLAN:

Sl.No.	Test type	Code of practice	Frequency of testing	Specification requirement
1	Cement Test	IS:4031	One per Batch (Review of MTC)	AS per IS:8112 & IS:12269
2	Concrete Slump Test	IS:1199	One / Transit mixer Load	100±25mm
3	Concrete Cube Test	IS:516 , IS:456	One sample / 5m ³	>30N/mm ²
4	Cement Grout Cube test	IS:10270 / BS EN: 447	Two samples(6cubes) / day	>30N/mm ²

Note:All the test reports as in Test Plan are available with the Quality Control Engineer.

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13. MANDATORY SAFETY REQUIREMENTS:

- ✚ Every workman must be engaged after Screening, Safety induction & medical test.
- ✚ Every workman shall be allowed to work with Personal Protective Equipment(safety shoes, Safety Helmet, Reflective Jackets, hand gloves, nose musk, ear plug, safety goggles).
- ✚ Area of work shall be barricaded with Boards with proper anchoring, bolting and weight to be kept for stability of barricades.
- ✚ While planning excavation of test pit , it is important to plan against the following:
 - Collapse of the sides,
 - Material falling on the people working in the excavation,
 - People and vehicles falling into the excavation,
 - People being stuck by plant and machinery,
 - Access to the excavation,
 - Fumes, Toxic gas
 - Underground utilities
 - Incidents to members of the public.
- ✚ Certified crane & vehicle shall only be deployed for the job
- ✚ Operator of valid license shall be permitted to operate the crane.
- ✚ Proper access and working platform should be provided to reach the work spot.
- ✚ Safety warning signs shall be places to provide adequate warning.
- ✚ Where natural lighting is not adequate, working light fittings or portable hand-lamps shall be provided at workplace on the construction site. In the working spot illumination shall be 110 lux.

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RISK ASSESSMENT FORM SAF-20

CONTRACTOR NAME:				RISK ASSESSMENT FOR: Foundation Load Test Activity					
Originator Name (Print):				Contract:					
Signature:				Date:					
KEY:		L = Likelihood			S = Severity		R = Risk (Likelihood x Severity)		
RISK RANKING:		L = Low priority to be implemented when resources allow.			M = Medium priority to be scheduled as soon as practicable.		H = High priority to be acted on immediately.		
Task/Element	Potential Hazards	Population at Risk	Risk Rating			Control Measures	Revised Rating		
			L	S	R		L	S	R
Setup for survey at proposed area/ location/ points	Work below HT or LT live line –Electrocution due to accidental contact of leveling staff with HT/LT line.	Surveyors / Survey Asst. / helpers.				<ol style="list-style-type: none"> 1. All persons should be screened and inducted. 2. All persons must have all PPEs 3. Before starting the work, prior to inspect all area properly. 4. Any OH line must be identified. 5. All workmen & staff must be use reflective jacket compulsory. 6. Using of fiber/PVC or wooden leveling staff. 7. While raining nobody should stand or allocated near/ nearby the OH live lines. 			

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					<p>8. Regular Tool Box Talk at site.</p> <p>9. All persons must be aware about the potential hazards.</p> <p>10. Allocated area has been barricaded and ensures the vehicular movements were clear from.</p>			
	Road accident- Moving of persons across the road.	Surveyors / Survey Asst. / helpers.			<p>1. All traffic precautionary measure has been taken while setup like safety cone, barrier, sign board etc.</p> <p>2. One flag man has been deployed in front.</p> <p>3. While crossing of the road, flag men must be guided the crew.</p> <p>4. Ensuring the traffic movement was low, mean time maximum crossing shall be allowed.</p> <p>5. All workmen & staff must be use reflective jacket</p> <p>6. Special training has been given for survey teams while induction.</p> <p>7. All survey persons have been frequently subjected for medical check-up.</p> <p>8. Be alert while walking over road and other traffic movement areas.</p>			
Loading / Unloading of barricading boards	Toppling / Falling of materials from vehicles.	Helpers &khalasi			<p>1. All necessary checking about the fitness of the vehicles to be conducted before starting of operation.</p> <p>2. All the lifting tools & tackles must be tested and certified,</p> <p>3. Tag rope should be used for any lifting loads.</p>			

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					<p>4. Nobody should work under suspended load at any circumstances.</p> <p>5. Materials shall be properly secured on the vehicle.</p> <p>6. The whole handling operation will be carried out under authorized / competent supervisor.</p> <p>7. During positioning & placement of load care should be taken to avoid injuries due to press in-between.</p> <p>8. Materials should not be overloaded.</p> <p>9. Correct rigging practice must be followed.</p>			
Fixing of Barricading board on the road	Unbalancing / toppling while board fixing	Helpers/ khalasies/ Public.			<p>1. Using of proper tag line while fixing</p> <p>Sufficient workmen shall be engaged for fixing & shifting on the road.</p> <p>2. Use of safety helmets, Shoes, Florescent Jacket, and other relevant PPE's ensured for all workers.</p> <p>3. Flag man must be deputed at site with fluorescent jacket, red flag (Day), whistle & red light baton for night times with other relevant PPE's.</p> <p>4. Workplace Barricades were secured by proper Nailing with 600mm length & 20 dia. Also secured by 70kg concrete block for strengthening the boards (Counter weight).</p> <p>5. All Barricading boards connected by nut bolt</p> <p>6. Traffic safety devices should be properly kept from 15mts buffer zone and advance warning zone was aligned 10mts</p>			

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					<p>from approach transition zones.</p> <p>8. Barricading board kept with blinkers & monitoring boards shall be indicated by reflected tape.</p> <p>9. Traffic marshal & vehicle diversion must be given.</p> <p>10. All barricading boards Should be kept in a straight line for public & vehicle convenience</p>			
Machine shifting from store to site by vehicle	During shifting & Unloading at site	Riggers, khalasi & Helpers			<p>1. Vehicles parked lower level and authorized riggers and workmen were engaged.</p> <p>2. All tools and tackles were checked properly before engaging into the task.</p> <p>3. Area should be separated from public access by barricading the area.</p>			
Drilling	Person injured at the time of drill hammer, bit & rod handling & changing.	Drillers, Helpers, Supervisors			<p>1. Ensure that all the utilities are Isolated/ removed from our work point.</p> <p>2. Ensure that all rotating parts are properly guarded.</p> <p>3. All machineries were properly inspected with P&M & EHS engineer and confirm that all the part is working properly.</p> <p>3. Ensure that the locations are free from HT utilities.</p> <p>4. All places of hose pipe jointing area should be fastened properly.</p> <p>5. Use of safety helmets, Shoes, Florescent Jacket, Ear plug (Due to noise pollution) and other relevant PPE's ensured for all workers.</p>			

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						6. Awaking the drilling persons in periodical interval about the procedure of jointing & removing the drill rod. No bit grinding should be allowed in necked eye.			
HT strands fixing	During placing the HT stand	Supervisor, Helpers & Workmen				<ol style="list-style-type: none"> 1. Be alert while HT strands are loaded on to De-coiler with the help of the F-15 crane. 2. Use shoulder pad for shifting of HT stand 3. Educate the workmen to carry the sharp edged bars front side upward. 4. Ensuring space for working area. 5. Daily housekeeping practice is adopted. 			
Grouting	During handling of materials	Workmen, Masons, Helpers				<ol style="list-style-type: none"> 1. MSDS is briefed to the worked with dos and don'ts. 2. Engage experience person on the job. 3. Use of Rubber Hand gloves, gumboots, Nose mask & Goggles during Grouting work. 			
Excavation Work for Load Test area	<p>Underground utilities</p> <p>Improper Access/egress</p> <p>Materials stacking on the edge of excavation</p> <p>Collapse of sides,</p> <p>Material falling on the people working in the excavation,</p>	Workmen, Operator & Helpers				<ol style="list-style-type: none"> 1. Follow Excavation clearance permit system. 2. Ensure adequate illumination, & danger lighting. 3. No materials shall be stacked at edge of the pit. Min 1.5m clearance shall be given. 4. Barricading with Tape & Hard Barricade with reflective signage. 5. Access ladder shall be so place, that workmen is able to access. 			

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

	People, animals falling into the excavation,					<p>6. Proper slope/Step cutting should be maintained as per norms.</p> <p>7. Excavation should be made from top to bottom and no under cuts should be made.</p> <p>8. Provide adequate emergency access so that workmen can access it at 15m reach out of excavation & Allow only minimum Required number of persons to work at the same time</p> <p>9. Excavated loose earth should be kept from the half depth of the excavated pit to avoid the over loading on the side wall.</p>			
Foundation Casting	During handling of concrete	Workmen, Masons, Helpers				<p>1. MSDS is briefed to the worked with dos and don'ts.</p> <p>2. Engage experience person on the job.</p> <p>3. Use of Rubber Hand gloves, gumboots, Nose mask & Goggles during Grouting work.</p>			
Built-up beam shifting from Fabrication yard to site by new generation Hydra crane & tailor.	During shifting & Unloading at site	Riggers, khalasi & Helpers				<p>1. All necessary checking about the fitness of the vehicles to be conducted before starting of operation.</p> <p>2. All the lifting tools & tackles must be tested and certified,</p> <p>3. Tag rope should be used for any lifting loads.</p> <p>4. Nobody should work under suspended load at any circumstances.</p> <p>5. Materials shall be properly secured on the vehicle.</p> <p>6. The whole handling operation will be carried out under authorized / competent supervisor.</p>			

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Construction work procedure for FOOTING LOAD TEST

					<p>7. During positioning & placement of load care should be taken to avoid injuries due to press in-between.</p> <p>8. Materials should not be overloaded.</p> <p>9. Correct rigging practice must be followed.</p> <p>10. Use of new generation Hydra crane & Vehicle after inspection of Safety & P&M.</p>			
<p>Handling & Erection of Built-up beam and Hydraulic jack & Plashing</p>	<p>Rough/wrong handling of materials, fall of men & materials, Crash/ hit with objects, collapse due to over load/poor fabrication, Failure of lifting tools, tackles & Failure of Hydraulic Jack.</p>	<p>Riggers, Workmen, Operator & Helpers</p>			<p>1. The materials transporting with vehicle should be properly tightened.</p> <p>2. Workmen handling the materials should be wear hand Gloves.</p> <p>3. No man should be stand under the hanging materials.</p> <p>4. Slings, Wire Ropes, Lifting Tackles etc. must be checked as per norms before use.</p> <p>5. Regular Tool Box Talk & adequate supervision should be ensured.</p> <p>6. Jacks and hydraulic connections should be leak proof and regularly checked by P&M. The jack factor of safety 2:1 on material yield. The jack being threaded ram with lock nut, it is a safe & jerk free equipment i.e. during, the loading the jack shall be hydraulically pressurized and mechanically locked.</p> <p>7. Oil leakage from jack should be prevented.</p> <p>8. Trained Operator should operate the pressure pump.</p> <p>9. Hydraulic equipment must have Bypass valve.</p>			

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

						<p>10. No person should stand in the line of jack</p> <p>11. All Lifting gears to be inspected annually by third Party competent Person.</p> <p>12. Lifting gears to be inspected before use.</p> <p>13. Proper access to be provided to the top.</p> <p>14. Ply board to be placed on both side of the Jack.</p> <p>15. Any tilting effect shall be guided by all four support blocks at the end of secondary beams during initial slack removal or loading activity. During loading, the strands of rock anchor which are fixed to the cross beams will be under tension and it prevents cross beams from tilting.</p>			
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Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

Matrix for Risk Assessment:

		SEVERITY				
		1	2	3	4	5
L I K E L I H O O D	1	LOW			MEDIUM	
	2	LOW		MEDIUM		
	3	LOW	MEDIUM		HIGH	
	4	MEDIUM	MEDIUM	HIGH	HIGH	
	5	HIGH	HIGH	HIGH	HIGH	

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

15. TRAINING & EDUCATION:

- a. Daily safety pep talk shall be given by Construction Manager to the staff and workmen.
- b. Before commencement of the work, Construction Work Procedure shall be explained to the staffs.

16. FORMATS & CHECK LIST: (Annexed)

Sl. no.	Format / Check List no.	Format / Check list description
<u>Safety System</u>		
1		Vehicle & Earth Moving Equipment Inspection Checklist
2		House Keeping Inspection Checklist
3		Hydraulic Rig Inspection Checklist
4		Barricading Board Shifting & Fixing Inspection Checklist & Clearance Permit
5		Crane Inspection Checklist
6		Excavation Clearance Permit
7		Tools & Tackles Inspection Checklist
8		Lifting Plan
<u>Quality System</u>		
9		Checklist Before Homing Of Rock Anchors
10		Rock Anchor Grouting Report
11		Check list for PCC for concrete structures
12		Concrete Pour Card
13		Level Check Record
14		Bar Bending Schedule
15		Footing Load Test Record
16		Footing Load Test Readings

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

HOUSEKEEPING INSPECTION CHECKLIST

Name of Project :
 Job No. :
 Inspected By :
 Date :

Sl. No.	Points	Observation	Measures
STRUCTURAL FABRICATION / ERECTION SITE			
1	Walkways, passages kept clear of materials?		
2	Area & roads kept clear for manoeuvring of cranes and material handling equipment?		
3	Scrap, cut-pieces, welding electrode stubs, hand-tools kept tidy in workplace and disposed suitably?		
4	Scrap-bin available in adequate number?		
5	Welding cables, power cables routed properly to avoid run-over by vehicle or tripping hazards?		
6	Compressed gas hoses routed properly?		
7	At least 1 metre on both sides of gantry rails is kept clear of material?		
8	Floor kept clear of water, oil spillage / accumulation?		
CIVIL WORK AREA			
1	All approach, aisle, ingress / egress to and from work area, excavated pits, ramps, walkways kept clear of debris, tools etc?		
2	Scaffolding materials (H-beam, HD tower frames, bracing, clamps) shuttering boards etc. are stacked properly at site?		
3	Stacking of bricks, hollow blocks are done in safe manner?		
4	Nails removed from wooden planks / timber and not protruding out?		
5	Saw dust, wood chips & scrap wood cleared from carpentry shop and disposed suitably?		
6	Debris from demolition and excavated earth cleared from workplace and access?		
Sl. No.	Points	Observation	Measures
ELECTRICAL INSTALLATIONS & BOOTHS			
1	Approach to DB, Panels, Switches kept clear?		
2	Fire extinguishers installed at locations where they are easily accessible?		
3	Welding cables and power cables are routed separately?		
4	Routing of cables are done properly to avoid obstruction & tripping hazards?		
5	Floor of electrical booths kept dry?		
6	Rubber mats are in place at electrical panels?		
STORES			
1	Walkways, entry and exits kept clear?		
2	Materials placed on racks safely accessible?		
3	Compressed gas cylinders are segregated as full or empty and type of gas?		
4	Vertically stored cylinders are secured / chained to avoid toppling and horizontal ones guarded against rolling down?		
5	Flammable storage areas are isolated from store, office and work areas?		
6	Cement bags are stacked in proper gradient safely?		
7	Corrosive material (e.g. acids, alkalis) stored away from other material & kept on		

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

Sl. No.	Points	Observation	Measures
	collection trays to safeguard against accidental leakage?		
8	Storing area for lifting tools & tackles, ropes, wire ropes & PPE is dry, clean & free of corrosive material?		
9	Easy accessibility to installed fire extinguishers ensured in store?		
	GENERAL		
1	Separate scrap yard allocated for the project?		
2	Approach to workstations, offices, time offices, stores, P&M are well laid and demarcated?		
3	Roads are kept clear of stacked material for free & safe vehicular movement?		
4	Heavy materials stacking are taken care of to prevent slips, collapse and rolling?		
5	For housekeeping at elevated workplaces refer to IM-09-A2.		

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

HYDRAULIC RIG INSPECTION CHECKLIST

Area Inspected :

Inspected By :

Date :

Sl. No.	Activities	Observation	Measures
01	Is Rig placed in a levelled surface?		
02	Tripods having proper strength & good condition		
03	Are tripods having proper base plates & stopper?		
04	Is "D" shackle engaged in tripods having good condition		
05	Tripods should be connected with HT nuts & bolts		
06	Condition of the rope guide and pulley in tripods		
07	Ladders are welded with proper materials and spacing shall be maintained 300mm		
08	Rotating part of the machines is guarded properly.		
09	Battery terminals are enclosed from water compounds.		
10	Exhaust & emission is under control		
11	Is any spillage in machine / other accessories		
12	Condition of wire rope used		
13	Condition of the radiator.		
14	Is PUC available in rigs?		
15	Any other relevant information		

Signature of Site EHS Personal

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

CONFIRMATORY BORE HOLES & TRAIL PITS AREA BARRICADING BOARD SHIFTING & FIXING INSPECTION CHECKLIST & CLEARANCE PERMIT

Area / Location :

Date: _____

Nature of the job to be done:

Sl. No.	Points are Checked	Done	Not Reqd.
1	Workplace inspected prior to start of work?		
2	Screening and E-learning for all persons must be ensured before commencement of the job.		
3	All the workers have been explained safe work-procedures?		
4	Use of safety helmets, Shoes, Florescent Jacket, and other relevant PPE's ensured for all workers.		
5	Barricading board shift arrangements are checked?		
6	Any obstruction in the barricading board?		
7	Workplace Barricades were secured by proper Nailing with 600mm length & 20 dia. Also secured by 70kg concrete block for strengthening the boards (Counter weight).		
8	Are all Barricading boards connected by nut bolt ?		
9	Are all barricading boards Should be kept in a straight line for public & vehicle convenience?		
10	Are all approach, access / egress to and from work area, excavated pits walkways kept clear of loose material, flammable material, debris etc.?		
11	Are Traffic safety devices should be properly kept from 15mts buffer zone and advance warning zone was aligned 20mts from working zones?		
12	Flag man must be deputed at site with fluorescent jacket, red flag, whistle & red light baton for day & night times with other relevant PPE's.		
13	Barricading board kept with blinkers & monitoring boards shall be indicated by reflected tape.		
14	Area must be identified & secured by putting traffic cones, barriers for shifting the materials safely.		
15	Adequate illumination ought to be ensured at night shift.		
16	Use of machineries & Vehicle after inspection of Safety & P&M.		

Note: The applicability of this permit for Bore Holes & Trail pits area Barricading board shifting & fixing works. To be filled in and certified by person before starting the job. After checking all the above precautions the work can be carried out in the above area.

Signature of Site In charge Engineer

Signature of EHSO/Site EHS Personal

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

CRANE INSPECTION CHECKLIST

Sl. No.	Points	Observation	Measures
1	Hook and Hook Latch		
2	Over-Hoist Limit Switch		
3	Boom-Limit Switch		
4	Boom Angle indicator		
5	Boom-Limit cut-off switch		
6	Over load limit switch		
7	Condition of boom		
8	Condition of Ropes		
9	No. of load lines		
10	Size and condition of the sling		
11	Stability of crane		
12	Soil Condition		
13	Swing Brake & Lock		
14	Propel Brake & Lock		
15	Hoist Brake & Lock		
16	Boom Brake & Lock		
17	Swing Alarm		
18	Main clutch		
19	Leakage in hydraulic cylinders		
20	Out riggers fully extendible		
21	Tyre pressure		
22	Condition of Battery and Lamps		
23	Guards of moving and rotating parts		
24	Load chart provided		
25	Numbers, position and size of pendant ropes		
26	Reverse horn & Rear view mirror		
27	Validity of Certification by competent authority		
28	Operator's Fitness		
29	Fire Extinguisher in operator's cabin		
30	Caution Boards		
31	Validity of PUC certificate (for tyre mounted)		
32	Validity of Fitness certificate (for tyre mounted)		

Name of Project :

Inspected By :

Date :

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

EXCAVATION CLEARANCE PERMIT

(In respect to(i) Existence of service lines and utilities (ii) In the proximity of existing structures, buildings, foundations, installations like gas, electrical service stations etc. (iii) Any other conditions which may result in serious hazardous consequences.)

Please permit the following excavation job as per sketch enclosed:

Details of excavation: Length.....m Width.....m Depth.....m
Location:.....Performing Agency:.....
Permit valid from (Date):..... to.....Execution Incharge:.....
Tel. No.: Name:
Date: Designation: Signature:

Proj/Mfg/Maint/TS/ES

I ELECTRICAL:

- 1. Details of underground cable present in the area to be excavated.....
2. Electrical isolation of the following required.....
Date: Name & Designation: Signature:

II INSTRUMENTS:

- 1. Details of underground cable present in the area to be excavated.....
2. Precautions to be observed for safe excavation job.....
Date: Name & Designation: Signature:

III COMPUTER SERVICES:

- 1. Details of underground cable present in the area to be excavated.....
2. Precaution to be observed for safe excavation job.....
Date: Name & Designation: Signature:

IV ENGINEERING SERVICES:

- 1. Description of underground facilities existing at the proposed location.....
2. Precaution to be observed for safe excavation job.....
Date: Name & Designation: Signature:

V. FIRE & SAFETY:

- 1. Provide: Cross over.....Barricades..... Road
Blocks.....Shoring.....Others.....
2. Use following safety equipment: Gas Masks.....Eye Protection.....
Wooden Handled Tools.....Others.....
3. Provide following: Approach for the Fire/Emergency Tenders/ Road closure boards/Other
Precautions.....
Date: Name & Designation: Signature:

Remarks if any.....
The Above Mention Job Can Commence.....

Date: Name & Designation: Signature:

ISSUING AUTHORITY

The above mentioned excavation work has been completed satisfactorily.

Date: Name & Designation: Signature:

ISSUING AUTHORITY

Note: The scope of this permit is limited to carrying out the excavation work safely. This permit is not intended / applicable till closing of the excavated area.

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

TOOL & TACKLES INSPECTION CHECKLIST

Name of Project :
 Job No. :
 Area Inspected :
 Inspected By :
 Date :

SI No	Particulars	Observation	Measures
Lifting Tool & Tackles			
1	Slings / Wire Ropes		
1.1	Is any defect on slings / wire rope?		
1.2	Condition of "Eye" used in sling / wire rope?		
1.3	Sufficient number of "U" clamps used as per dia.		
1.4	Are any identification code/ marks on the slings / wire rope?		
2	"D" / Bow shackle		
2.1	Is SWL identified on the shackle?		
2.2	Are any identification code/ marks on the Shackles?		
2.3	Opening width of shackles are ok		
2.4	Seating condition of Shackle pin		
2.5	Any defects are observed on the pin?		
3	"U" Bolts & "Eye" Bolts		
3.1	Condition of "U" / Eye bolt used		
3.2	Any cracks / wear were found		
3.3	Tapper of eye bolt is free from rust.		
3.4	Shape of "U" / "Eye" bolt is regular		
4	Hooks & Chain Pulley Block		
4.1	Is any deformation on the eye portion?		
4.2	Is any crack / wear were found?		
4.3	Condition of hook latch		
Electrical / Automotive Tool & Tackles			
1	Spanners & Screw drivers		
1.1	Condition of Spanners / Screw drivers		
1.2	Is any wear / crack on the head / tip of the tackle.		
1.3	Is spanners are free from rust?		
2	Hammer		
2.1	Condition of the hammer		
2.2	Tightness of the handle		
2.3	Materials used for making handle		
3	Crimpers		

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

3.1	Condition of the crimper used		
3.2	Condition of the insulation		
3.3	Condition of grippers		
3.4	Is any crack on the crimpers		
4	Grinding Machine		
4.1	Condition of Grinding machine		
4.2	Is wheel guard provided properly		
4.3	Wheel having a valid expiry date		
4.4	Is earthing given properly?		
4.5	Condition of the cable connected		
5	Drilling Machine		
5.1	Condition of Drilling machine		
5.2	Is Drill bit fitted properly		
5.3	Use of proper tightening key		
5.4	Is earthing given properly?		
5.5	Condition of the cable connected		
Testers			
1	Earth leakage Circuit Breaker Tester		
1.1	Is polarity showing on the meter is good		
1.2	Accuracy of the meter is acceptable		
1.3	Is calibration required		
2	Surface Resistance Tester		
2.1	Is polarity showing on the meter is good		
2.2	Accuracy of the meter is acceptable		
2.3	Is calibration required		
Any other relevant Information			
1			
2			

Quality Assurance Plan

Construction work procedure for FOOTING LOAD TEST

LIFTING PLAN

Site/location	Footing Load Test between NAGOLE to UPPAL		
Appointed Person carrying out the Assessment:		Date of Assessment:	
Description of lift: Erection of Main Beam & secondary beams , for Footing load test kentledge arrangement.			

Details of Loads	Load Position 1	Load Position 2	Load Position 3
Weight:			
Dimensions:			
Position of C of G:			
Height of lift (worst case)			
Max. radius (worst case)			
Date of lift:			
Time of lift:			
Monetary value of load:			

Details of Cranes	1st	2nd	3rd
Make & model:			
Capacity:			
Jib length:			
Outrigger spread:			
Outrigger load:			
Max. ground bearing			
Counterweight:			
Weight of crane:			

Ground Conditions (Visual assessment)			
Access/Egress for crane & transport:			
Lifting position:			

Lifting Accessories			
Slings (wire rope):		Slings (webbing):	-
Slings (chains):	-	Shackles:	
Other Accessories:			

CHECKLIST FOR INSPECTION BEFORE HOMING OF ROCK ANCHORS

Project :
Client :
Independent Engineer :
Concessionaire :
Contractor :

Anchor Identification:

Date :

Sl. No:	Description	Checked		Not Applicable	Remarks
		Yes	No		
1	Depth of drilled hole				
2	Casing pipe installed				
3	Dia. of each Anchor				
4	Free Length of Anchor				
5	Fixed Length of Anchor				
6	Bursting rebar – spiral provided				
7	Epoxy coat on each anchor fixed / free Length				
8	Free Length HDPE – Pipe fixed				
9	Grout vent fixed at Fixed end				
10	Safe access provided to work place				

ROCK ANCHOR GROUTING REPORT-FIXED LENGTH / FREE LENGTH

Project :
 Client :
 Independent Engineer :
 Concessionaire :
 Contractor :

Anchor Location :		Date of Inspection :		
Anchor Number:		Cable No:		
Date of Anchor Installation:				
Type of cement:				
Week & Year of Cement Manufacture:				
Admixture if added / mix details:				
W / C Ratios:				
Temperature:		Water:		
Equipment:T9 – DDGP - 150		Grout Mixer:		Grout pump:
Hole Diameter:		Cable Diameter:		Cable Length:
Volume of Grout:		Regrouting:		
Pre Grouting Checks:				
Free of Blockage:		Inlet : Yes / No		Outlet : Yes / No
Leakage Observed:		Vents: Yes / No		Yes / No
Grouting Record:				
Cable / Anchor Number	Start Time	Finish Time	Grout Pressure	Remarks / Observation
L&T INFRA IC				L&TMRHL

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FORMAT FOR FOOTING LOAD TEST RECORD

Project :
Client :
Independent Engineer :
Concessionaire :
Contractor :

LOCATION:

Date :

1	Depth / R.L. of Pit :
2	Size of Footing :
3	Dia. of each Anchor
4	Sensitivity of Dial Gauge :
5	a) Sensitivity of Pressure Gauge :
	b) Pressure gauge calibration valid upto :
	c) Pressure gauge number :
6	a) Diameter of Ram of hydraulic jack :
	b) Jack tested against load cell :
7	Relationship between Pressure Gauge reading and Load on Plate 1 Kg / Sq.cm on Pressure Gauge = (Tonnes on Footing)
8	Type of test :
9	Type of strata :

Remarks :

Annexure - A

