ANNEXURE-XIX

SAFETY CODE FOR CONTRACTORS

1.0 GENERAL

1.1 Safety is the responsibility of every employee, individually and collectively.

1.2 Head of the Dept/Division should ensure that a copy of this Contractor's Safety Code is handed over to every Contractor working under his control and he should in turn prominently display all rules on the office/site notice board for the benefit of all the men working under him.

1.3 The Contractor shall in connection with provide adequate guards, illumination, fencing and watch wherever necessary at the construction site & working area, for the safety & convenience of general public.

1.4 Fire extinguishers adequate in number and with proper validity shall always be kept by the Contractor at the site of works, where there is risk of fire hazard, especially near the site stores.

1.5 Adequate washing facilities with proper drainage shall be provided and properly maintained near the place of work but at a safe distance from railway tracks and busy roads.

1.6 Whenever work is to be undertaken near a place, where there is a risk of drowning, arrangements to be made for safe barricading of such areas. All necessary equipment shall be provided and kept ready for use and necessary steps taken for prompt rescue of any person in danger and adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work, in case of a mishap.

1.7 To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Contractor shall be open to inspection by

the Safety Engineer, the Labour Officer, Engineer-in-charge of the concerned Department or their representatives.

1.8 Notwithstanding the above clauses, there is nothing in these to exempt the Contractor from the operation of any other Act or Rule in the Republic of India for the safety of men and materials.

1.9 An injury sustained in the plant, must be immediately reported to the First-Aid Station or next higher Supervisor/Officer in-charge, no matter how minor the nature of the injury.

1.10 In case of a fatal accident, the Contractor must inform the Engineer in-charge of the department for which he is working and a report in writing should be made, clearly explaining the sequence of events leading to the accident.

1.11 Smoking or use of naked lights is strictly prohibited near gas lines, valves and any other equipment linked to the gas distribution networks.

1.12 Smoking and carrying of matches, lighters and other spark producing devices is strictly prohibited within the area where inflammable liquids are stored, handled or used or where loading or unloading operations are performed. Any tank or container containing inflammable liquid should be properly grounded for preventing ignition due to static electricity charges. Contractor should ear-mark such areas and provide necessary signage and warning signals.

1.13 Contractors should ensure that employees do not report to work while under the influence of intoxicants. Any employee found on duty under the influence of liquor or of intoxicating drugs, will be liable to severe disciplinary action.

1.14 Work surroundings should be kept clean, free from oil, grease and other obstructions or fallen objects like nuts bolts etc.

1.15 After a job or work is completed, all left-over junk and other scrap materials should be cleared from the area immediately.

1.16 Drums or other make-shift arrangement must not be used in place of ladders or as work benches or supports for any job.

1.17 Employees shall not walk through or cross any operating units unless their duties require them to do so, or they are authorised.

1.18 Compressed air should not be used for removing dust from one's clothes and deliberately directed or used on any person as it is likely to cause serious injury.

1.19 If an employee, in the course of his work, encounters conditions of unusual hazard with which he is not familiar, he should contact the supervisor for advice before proceeding further. He should also inform the Contractor as well as the Engineer in-charge.

1.20 Contractors should particularly ensure that they or their employees do not meddle with any equipment they are not concerned or unfamiliar with and see that they should generally keep away from such equipment.

1.21 It should be ensured that no one takes rest/shelter below any under cut pit/excavation or near any stock-pile of materials.

1.22 For any work involving repair & maintenance underground, the Contractor shall follow the safety procedural orders/instruction issued by the Purchaser.

1.23 The Contractor shall ensure supervision of such jobs by competent persons within the meaning of Factories Act & Rules.

1.24 All persons engage on such jobs shall have to have before hand proper training instructions as required under Factories Act & Rules.

2.0 SAFETY MEASURES IN CONTRACT WORK

Whereas, it is necessary to take steps to ensure safety at work sites by the executing contractual agency, it is incumbent of the Purchaser to introduce all measures to guide, induce, train and bind the agencies concerned to adopt remedial steps to

prevent accidents. Problem gets aggravated in contractual zones due to lack of training, in-adequate supply of personal protective equipment, shortage of skilled labour changing deployment of works etc. Accordingly, the following measures are intended to be introduced and the salient clauses will be included in the contract documents.

2.1 The Contractor shall take all safety precautions and provide adequate supervision in order to carry out the job safely and without damage to men & equipment.

2.2 Any special safety precautions, if required to be followed by the Contractor, such clauses shall be added.

2.3 The executing department would take necessary shut-downs wherever there are hazards of gases, electricity, moving machinery etc. The Contractor shall ensure that the shut-down/clearance are taken before deploying workers to such locations.

2.4 The Contractor shall supply safety appliance such as safety shoes, safety belts, helmets, gloves, harness etc. to his workers depending on working conditions and life saving jackets shall always be kept in readiness at the site. The Contractor shall not deploy any workmen without safety shoes and safety helmet and the safety applicable to the specific work conditions.

2.5 Before starting the day's job, the Purchaser's Supervisor/representatives will ensure that safety briefing has been done to the Contractor's supervisor who has previously been imparted safety induction training.

2.6 Head/Zonal in-charge will nominate Engineer in-charge of the contractual work under reference who will be fully responsible for the safe execution of the work at site.

2.7 In case of injury to persons, the Contractors shall first take the injured person to nearest hospital with the necessary forms. In no case the Contractors are allowed to take injured persons directly to their own Doctors.

2.8 The Contractor shall abide by the provisions of Factories Act, State Factory Rules, Workmen's Compensation Act, Payment of Wages Act, Contract Labour (Regulation)

Act etc., and keep the Purchaser indemnified of provision the above Acts and Rules.

2.9 The Head of Department. executing the contract upon the satisfaction that the Contractor is not conforming to the Safety requirements may direct stoppage of work and require the Contractor to remedy the defects. The Contractor shall not proceed with the work until he has complied with each directions to the satisfaction of such Head of the Department.

2.10 The Contractor shall be fully responsible for accidents caused due to him or his agents or workmen's negligence or carelessness in regard to the observance of the safety requirements and shall be liable to pay compensation for injuries.

2.11 Without prejudice to the right conferred by the above clause, for stoppage of work for violations of safety requirements the Contractor shall be liable for penalty as deemed fit for violation of safety rules & regulations upto first two instances. For the third violation he shall be liable to be debarred from further contracts upto a period of one year from the date of issue of debarring notice.

2.12 The Head of the Safety Engg. Deptt. or the Head of the Deptt. executing the contract will assess the penalty amount having regard to the circumstances, in particular, the nature and gravity of the violation. After issuing a notice to the Contractor to show cause why the amount specified therein shall not be imposed as a penalty and considering the cause shown by the Contractors, if any, he shall pass final orders which shall then be final and binding on the Contractor. The penalty amount will be recoverable from any bill and/or EMD/SD of the Contractor without any further reference to him.

2.13 Whenever work, at heights is involved, Contractor must obtain necessary permissions and clearances from the Safety Engg. Dept. for such persons required to do work at height.

2.14 Contractor must insure all the workmen under the "Workmen Compensation Act."

2.10.17 Before erection of any equipment on a foundation, the Bidder shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.

2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Bidder.

2.10.19 It shall be the responsibility of the Bidder to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.

2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the safe operation of valves will be arranged by the Bidder.

2.10.21 For civil, structural and architectural works, Volume II-G/1 & II-G/2 may be referred. For Instrumentation and Electrical works, Volume. II-E and Volume. II-F/1 & F/2 may be referred.

2.11.00 **Safety**

2.11.01 Safety and overall cleanliness of work site shall be given top priority. The Bidder shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.

2.11.02 The Bidder shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be handled and the Bidder shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.

2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Bidder.

2.11.04 The Bidder shall be responsible for safe storage of his and his sub-Bidder's radioactive sources.

2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be periodically done by the Bidder. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.

2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.

2.11.07 The Bidder shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Bidder at site during the entire period of the Contract.

2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Bidder shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.

2.11.09 All workmen of the Bidder working in construction site shall wear safety helmets, safety boots and safety belts. The Bidder shall take appropriate insurance cover against accidents for his workmen as well as third party.

2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Bidder for proper working environment during night times.

2.11.11 Adequate number of temporary toilets/urinals (men & women separate) shall be provided at work places with soak pits. Adequate drinking water facilities and rest rooms shall be provided for workers to take food and rest.

2.11.12 All safety precautions shall be taken for welding and cutting operations as per IS-818.

2.11.13 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

2.12.00 **Taking Delivery & Storage**

2.12.01 The Bidder shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the materials so issued shall be submitted to the Owner.

2.12.02 The Bidder shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.

2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be dealt as per clause 2.12.0 Section – 2 of Vol IB.

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SECTION-XIX

GUIDELINE
FOR
SAFETY REQUIREMENTS FOR CONSTRUCTION WORKS

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VOLUME: II-G/2
PART-B

SECTION-XIX

GUIDELINE
FOR
SAFETY REQUIREMENTS FOR CONSTRUCTION WORKS

1.00.00 GENERAL

This specification deals with the subject matter of safety and protection to be observed in the Civil Construction. This shall be followed along with all related statutory requirements/obligation including Governmental byelaws, codes, ordinance of local or central authorities related to the construction work.

In case of complicated work like deep excavation, intricate shuttering and formwork, excavation in loose soil and below water table, stacking of excavated earth etc., work plan with necessary drawings and documents have to be prepared by the Bidder and got approved by the Engineer.

Necessary reference shall be made to the following Indian Standard Codes on safety requirements for various type of work :

Indian Standard

5916	Construction with Hot Bituminous Materials.
4130	Demolition of Buildings.
3764	Excavation Work
5121	Piling & Other Deep Foundations.
4014 - (P-II)	Scaffolding, Steel Tubular.
3696 – (P-I & P-II)	Scaffolds and Ladders.
6922	Structures Subject to Underground Blasts.
4756	Tunneling Work.
5499	Underground Air-raid Shelters in Natural Soil.
4138	Working in Compressed Air.
7293	Working with Construction Machinery
8989	Erection of Concrete Framed Structures.

2.00.00 EXCAVATIONS

2.01.00 Sides of all excavations must be sloped to a safe angle, not steeper than the angle of repose of the particular soil. If it is not possible to give a proper slope, the sides of the excavation where there is a danger of fall or dislodgement of earth or any material, shall be securely supported by timber or other type of shoring.

2.02.00 No excavation or earth work below the foundation level of an adjoining building shall be taken up unless adequate steps are taken to prevent damage to the existing structure or fall of any part.

2.03.00 Every accessible part of an excavation, pit or opening in the ground into which there is a danger of persons falling shall be suitably fenced with a barrier upto a height of one metre suitably placed from the edge of the excavation as far as practicable.

2.04.00 No material or load shall be placed or stacked near the edge of the excavation or opening in the ground. The excavated material shall not be placed within 1.5 m of the trench or half of the depth of the trench whichever is more.

2.05.00 Cutting shall be done from top to bottom. No undercutting of sides of excavation shall be allowed.

2.06.00 All narrow trenches 1.2 m or more depth, shall at all times be supplied with atleast one ladder for each 30m in length or fraction thereof. Ladder shall be extended from bottom of the trench to atleast one metre above the surface of the ground. The side of the trenches which are 1.5 m or more in depth shall be stepped back to give suitable slope, or securely held by planking, strutting and bracing so as to avoid the danger of side collapse.

2.07.00 Materials shall not be dumped against existing walls or partition to a height that may endanger the stability of the walls.

2.08.00 While withdrawing piled materials like loose earth, crushed stone, sand, etc., from the stock piles, no over hanging shall be allowed to be formed in the existing dump.

2.09.00 No material on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or public or any other agency at work.

3.00.00 DEMOLITION

3.01.00 On every demolition job, danger signs shall be conspicuously posted all round the structure and all doors, openings giving access to the structure shall be kept barricaded or marked except during the actual passage of workmen or equipment. However, provision shall be made for at least two independent exits for escape of workmen during any emergency.

3.02.00 During night, red lights shall be placed on or about all the barricades.

3.03.00 Where in any work of demolition it is imperative, because of danger existing to ensure that no unauthorised person shall enter the site of demolition out-side working hours, a watchman shall be employed. In addition to watching

the site he shall also be responsible for maintaining all notices, lights and barricades.

3.04.00 All the necessary safety appliances as per IS ;4130 shall be issued to the workers and their use explained. It shall be ensured that the workers are using all the safety appliances while at work.

3.05.00 The removal of a member may weaken the side wall of an adjoining structure and to prevent possible damage, these walls shall be supported until such time as permanent protection is provided. In case any danger is anticipated to the adjoining structure the same shall be got vacated to avoid any danger to human life.

3.06.00 The power on all electrical service lines shall be shut off and all such lines cut or disconnected at or outside the property line, before the demolition work is started. Prior to cutting of such lines the necessary approval shall be obtained from the electrical authorities concerned. The only exception shall be any power line required for demolition work itself.

3.07.00 All gas, water, steam and other service lines shall be shut off and capped or otherwise controlled at or outside the building line, before demolition work is started.

3.08.00 All the mains and meters of the building shall be removed or protected from damage.

3.09.00 If a structure to be demolished has been partially wrecked by fire, explosion or other catastrophe, the walls and damaged roofs shall be shored or braced suitably.

3.10.00 Walkways and passage ways shall be provided for the use of the workman who shall be instructed to use them and all such walkways and passageways shall be kept adequately lighted, free from debris and other materials.

3.11.00 All nails in any kind of lumber shall be withdrawn, hammered or bent over as soon as such lumber is removed from the structure being demolished, and placed in piles for future cleaning or burning.

3.12.00 All the roads and open area adjacent to the work site shall either be closed or suitably protected.

3.13.00 No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electricity charged.

3.14.00 All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

4.00.00 VEHICLE

4.01.00 No person shall board any vehicle or equipment when it is in motion.

4.02.00 Suitable blocks shall be placed against the wheels of a vehicle when it is used for tipping materials into excavation or a pit or over the edge of any embankment or earthwork to avoid the danger of its running over the edge.

4.03.00 All workers shall stand clear of the vehicle while it is dumping. If the material being dumped is very heavy or sticky, dump hooks shall be used or dumper shall be clamped to prevent any danger of its tripping.

4.04.00 Materials shall not be allowed to be loaded in a vehicle so as to project horizontally beyond the sides of the body of the vehicle. All materials projecting beyond the front or rear shall be indicated by a red flag in the day and with red light in the night.

4.05.00 Driver of the truck or any heavy vehicle shall not reverse it unless assisted by a signal man who shall have a clear view of the driver and the area beyond the truck during reversing operation.

4.06.00 Maximum speed of a heavy vehicle must not exceed 15 km. per hour.

5.00.00 SCAFFOLDING, GANGWAYS, LADDERS & SHUTTERING

5.01.00 For all work that cannot be done from the ground level or from part of any permanent structure or from other available means of support, soundly constructed scaffoldings of adequate strength shall be used as a safe means of access to places of work.

5.02.00 All scaffolding shall be securely supported or suspended and wherever necessary be properly braced to ensure stability.

5.03.00 Chains, ropes or other lifting materials used for the suspension of scaffoldings must be of adequate strength and shall be of tested quality.

5.04.00 All such chains and ropes used for the suspension of scaffoldings shall be properly fastened to safe anchorage points.

5.05.00 The platform of a suspended scaffolding shall be sufficiently wide. Suspended scaffolding shall have hand rail on 3 sides of about 1.0 m height.

5.06.00 All working platform and stages from which workers are liable to fall shall be of adequate width depending on the type of work done and closely boarded and planked.

5.07.00 Scaffolding or staging more than 3.5 m above the ground or floor, suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured atleast 1

m high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure. The platform shall also be provided with toe boards of atleast 150 mm high so placed as to prevent the fall of materials and tools from there.

5.08.00 All platforms or gangways, runways and the stairs shall be kept free from unnecessary obstructions, materials or junk.

5.09.00 Working platforms, gangways & stairways shall be so constructed that they shall not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.5 m above ground level or floor level they shall be closely boarded, shall be of adequate width and shall be suitably fenced.

5.10.00 Every opening in the floor of a building or in a working platform shall be provided with suitable fencing or railing whose minimum height shall be 1 m to prevent the fall of persons or materials.

5.11.00 Every ladder shall be securely fixed at top and bottom. A ladder more than 5 m long shall have a prop.

5.12.00 All ladders used shall be of good construction, sound materials and adequate strength. Ladders with defective or missing rungs shall not be brought into use. The spacing of rungs shall not exceed 30 cm and these shall be recessed atleast 12 mm into rails.

5.13.00 All ladders or rungs used for vertical height of more than 10 m shall have an intermediate landing. All such intermediate landings shall be provided with guard rails to a height of atleast 1 m.

5.14.00 Every ladder shall be securely placed so that it cannot move either at the top or at the bottom and it shall rise to a height of atleast 1.2 m above the place of landing.

5.15.00 No portable single ladder shall be over 8 m in length.

5.16.00 Spacing between the side rails of the ladder shall not be less than 300 mm for ladders upto 3 m in length. For longer lengths, this shall be increased at 6 mm for each additional 0.3 m of length.

5.17.00 Metal ladders must not be used for electrical work or near electric circuit of equipment.

5.18.00 All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use.

5.19.00 Unfinished scaffolding which is under construction shall be prominently marked as unsafe and any access points shall be closed.

5.20.00 All Planking and Decking on walkways and scaffolds shall be adequately supported at each end of the plank and intermediately if necessary. Planks shall not be allowed to cantilever beyond the last support but shall be overlapped if necessary on to the next plant.

5.21.00 Shuttering

The above remarks shall be applicable for this also. Shuttering, particularly for slabs, shall be treated as a scaffold. Unfinished shuttering shall be marked as dangerous similarly the finished formwork shall be adequately supported, care being taken to avoid trap door effects.

6.00.00 MOBILE LIFTING APPLIANCES

6.01.00 No mobile lifting appliances shall used on a sloping surface unless adequate precautions are taken to ensure stability.

6.02.00 Adequate precautions shall be taken to see that jib of the mobile crane does not come in contact with overhead electric transmission line.

6.03.00 Only one person shall give signals to the operator of mobile lifting appliances.

6.04.00 Maximum load to be lifted by lifting appliances shall be marked in a position where it can be clearly seen by the crane driver and the operator.

6.05.00 No load shall be raised, lowered or suspended from a chain or rope having a knot in any of the part.

6.06.00 No chain which is joined to another chain by means of bolt and nut shall be used for raising, lowering or suspending any load.

6.07.00 All chains, ropes and lifting gears shall be carefully examined and tested by a competent Maintenance Engineer at least once in every quarter.

6.08.00 When the work is stopped or when the mobile lifting equipment is not in operation, the boom must be lowered to the horizontal position and tied securely in place to prevent accidental drop.

6.09.00 No person shall walk under a load which is swinging by a lifting equipment.

Guide rope must be attached to the load to prevent its swinging.

6.10.00 The foot blocks of the crane before starting work shall be securely supported and firmly anchored to prevent its movement in any direction.

6.11.00 Use of Hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards of condition.

6.11.01 These shall be of good mechanical construction, sound material and adequate strength and free from defect and shall be kept in good working order.

6.11.02 Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength and free from patent defects.

6.11.03 Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in charge of any hoisting machine or give signals to the operator.

6.11.04 In case of every hoisting machine and every chain ring hook shackle swivel and pulley block used in hoisting or lowering or as means of suspension the safe working load shall be ascertained by adequate means, every hoisting machine and all gears referred to above shall be plainly marked with the safe working load. In case of hoisting machine having a variable safe working loading, each safe working load of the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing. Mobile cranes shall have the working load and the radius of jib for the load marked on it.

6.11.05 The top pulley for hoisting a load shall be opened monthly and the spindle inspected to see if any undue wear has taken place and for greasing.

6.11.06 In case of departmental machine, the safe working load shall be notified by the Engineer concerned. As regards bidder's machines the Bidder shall notify the safe working load of the machine to the Engineer whenever he brings any machinery to site of work and get it verified by the Engineer concerned.

6.12.00 Motors, gearing, transmission, electric wiring and other dangerous part of hoisting appliances shall be provided with efficient safeguards. Hoisting appliances shall be provided with such means as shall reduce to the minimum, the risk of accidental descent of the load. Adequate precautions shall be taken to reduce to the minimum, risk of any part of a suspended load becoming accidentally displaced.

7.00.00 RIVETTING, WELDING & GAS CUTTING & STEEL ERECTION

7.01.00 Rivetting

7.01.01 Bolts covered with wet or slippery compounds shall not be used in fabricating structural work.

7.01.02 The rivet heater must keep the rivet heating equipment as near as possible to the place of work.

7.01.03 A pail of water shall always be kept ready for quenching fire when stopping rivetting work.

7.01.04 Hot rivet shall not be thrown across aisles and shaftways.

7.01.05 Metal buckets for catching hot rivets must have false wooden bottoms to prevent rivets from rebounding.

7.01.06 All rivets, bolts, nuts, and other tools must be kept in boxes and not let loose, (For any further safety measures relevant Indian Standards and safety specifications of structural section shall be referred to).

7.02.00 Welding & Gas Cutting

7.02.01 All cylinders must be used and stored in upright position only.

7.02.02 Cylinders must be stored away from open flames and other source of heat.

7.02.03 Oxygen cylinders must not be stored near other cylinders containing gas or oil, grease or other combustible materials.

7.02.04 While the cylinder is in use, the cylinder valve key or wrench must be placed on the valve spindle.

7.02.05 Before a cylinder is moved, the cylinder valve must be closed.

7.02.06 Gas cutting torches must be lighted by means of friction flames or similar other methods and not with matches.

7.02.07 When torches are being changed or welding stopped for some time valves for all cylinders must be closed.

7.02.08 Thecoloured lenses used for welding or gas cutting must be of proper shade for the work being done.

7.02.09 Suitable eye protection equipment such as goggles, hand shields etc., must be used by persons engaged in welding or gas cutting operations.

7.02.10 Before any heavy structural member is gas cut, make sure that it is cleared and supported by ropes, cables, chains or any other means to prevent its dropping or swinging.

7.02.11 Cylinder valves and connections are not to be lubricated. All oily or greasy substances must be kept away from cylinders.

7.02.12 Substantial and incombustible screen must be used below or near the welding operations, if there is a possibility of a spark falling on other workmen engaged in work closely.

7.02.13 All air pipe lines and air hoses must be frequently inspected. Air hoses shall not be used for dusting or for cooling purposes.

7.03.00 Steel Erection

7.03.01 All persons shall stand clear when a crane is sorting or shifting steel girders or other structural materials.

7.03.02 No person shall stand, walk or work beneath any suspended load.

7.03.03 Guide rope must be used for guiding lifting loads.

7.03.04 When guiding a beam or fabricated structure or erection it shall be so held that the employees hands do not get jammed against other objects.

7.03.05 Safety belts equipped with suitable life lines must be used by persons working at heights and standing on structural members. Life line must be tied to an independent support. For any further safety measures, for Structural Steel Works, IS : 7205 shall be referred to.

8.00.00 SAFETY APPLIANCES

8.01.00 Workers employed on mixing asphaltic materials, cement and lime mortars, shall be provided with protective footwear and protective goggles.

8.02.00 Those engaged in white washing and mixing or stacking of cement bags or any materials which is injurious to the eyes, shall be provided with protective goggles.

8.03.00 Those engaged in welding works shall be provided with welder's protective eye-shields.

8.04.00 Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

8.05.00 When workers are employed in sewers and manholes which are in use, the Bidder shall ensure that the manhole covers are opened and chambers are ventilated atleast for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public.

8.06.00 The Bidder shall not employ men below the age of 18 and women on the work of painting with products containing lead in any form. Whenever men above the age of 18 are employed on the work of lead painting the following precautions shall be taken :

8.06.01 No paint containing lead or lead products shall be used except in the form of paste or ready made paint.

8.06.02 Suitable face mask shall be supplied for use by them when paint is applied in the form of spray on a surface having lead paint dry rubbed and scraped.

8.06.03 Overalls shall be supplied by the Bidders to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.

8.07.00 The workers going into inspection chamber shall have gas masks, gum boots and rubber gloves while working inside. After coming out they shall have some disinfectant from the first aid box for proper washing

8.08.00 All necessary personnel safety equipment such as safety helmets, safety boots, safety belts, leather gloves for welders, clear glass safety goggles etc., as considered adequate by the engineer have to be kept available for the use of persons employed at the site of work and maintained in condition suitable for immediate use and Bidder shall take steps to ensure proper use of equipment by the workers.

8.09.00 All the persons entering the tunnel shall be provided with protective wear, such as helmets, steel toe safety shoe, gum boots or other suitable type of protective foot wear. In the case of steeply inclined tunnels and inshafts, safety belts shall also be provided.

8.10.00 Sign boards 1 x 1.5 m in size with the following wording shall be erected at the access to these areas. "CONSTRUCTION AREA, HELMET REQUIRED BEYOND THIS POINT"

8.11.00 No loose garments or ragged clothing shall be worn by the personnel engaged in tunneling operation.

8.12.00 A telephone system shall provided to ensure a positive and quick method of communication between all control location inside tunnel and portal of the tunnels when longer than 500 m and for shafts when longer than 50 m

8.13.00 Irrespective of length and bends in the tunnel, arrangements shall be made for transmitting of warning signals by any one of the following means.

8.13.01 By electrically operated bells, operated by battery/dry cells with the bell placed outside the tunnel and the position of the switch shifting with the progress of the tunneling work. The position of the operating switch although temporary shall be so chosen as to ensure proper accessibility and easy identification.

8.13.02 By the use of two field (magnet type) telephone.

8.13.03 Any other suitable arrangement like walkie-talkie.

8.14.00 Arrangement for rendering prompt and adequate first aid to the injured persons shall be maintained at every work site under the guidance of a medical officer-in-charge of the project. Depending upon the magnitude of the work the availability of an ambulance at a very short notice (at telephone call) shall be ensured.

8.15.00 First-aid arrangements commensurate with the degree of hazard and with the number of workers employed shall be maintained in a readily accessible place throughout the working hours. At least one experienced first-aid attendant with his distinguishing badge shall be available on each shift to take care of injured persons. Arrangements shall be made for calling the medical officer, when such a need may arise. It is recommended that foreman/assistant foreman/supervisor/ permanent workmen who are normally present at each working phase in each shift are given adequate training on first-aid methods to avoid employment of a separate attendant.

8.16.00 Stretchers and other equipment necessary to remove injured persons shall be provided at every shift.

8.17.00 Where there are more than 50 persons working in a shift, effective artificial respiration arrangements shall be provided, with trained men capable of providing artificial respiration.

9.00.00 ELECTRICAL

9.01.00 Onlyauthorised persons shall handle or otherwise interfere with electrical equipment. Any person detecting electrical apparatus being handled by an unauthorised person or equipment in unsafe condition must report the matter to the Engineer concerned.

9.02.00 No person shall work on any live electric conductor or apparatus and no person shall assist such person on such work, unless he is authorised in that behalf.

9.03.01 After isolating the equipment from the source of supply before the work begins, a sign 'DONT'T SWITCH ON' must be hung on or near the switch to avoid its being accidentally or inadvertently switched on when persons are working.

9.03.02 Take out the fuses and keep in safe custody.

9.03.03 The switch may be locked if locking arrangement exists.

9.03.04 Earth the equipment, before work, to discharge it and short the terminals as a precautionary measure against accidental switching ON.

9.03.05 After the work is finished take out Earthing and shorting link.

9.03.06 Remove all tools and materials from the site of work. Replace the fuses and unlock the switch.

9.03.07 The switch shall only be put 'ON' by the person who switched it 'OFF' or by the person authorised by him in writing.

9.04.00 When working on live equipment use one hand only whenever possible, it is advisable to keep the other hand behind the back. Shocks from hand to hand are most dangerous.

9.05.00 All persons handling electrical gear in elevated position must use safety belts. Even a slight shock may cause loss of balance and fall.

9.06.00 No one shall attempt to extinguish a fire on or near a live electrical apparatus with water. Water is a good conductor of electricity. Use extinguishers wherever provided. Use sand and blankets etc., if available.

9.07.00 No person shall use any part of electrical equipment for storing or hanging clothes, umbrellas or other articles. Serious accidents occur from this practice.

9.08.00 For attending the work on O.H. lines or equipment use wooden ladders. Metallic ladders shall not be used.

9.09.00 Use insulated tools and ensure the insulation is in proper condition periodically at least once in three months. Use rubber gloves wherever possible.

9.10.00 As far as possible verbal instructions shall be avoided in case of pre-arranged shut-down of electrical apparatus.

9.11.00 When workers are employed for electrical installations which are already energised, insulating mats, wearing apparel such as gloves, sleeves and boots as may be necessary shall be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

10.00.00 MISCELLANEOUS

10.01.00 The Bidder shall provide necessary fencing and lights to protect the public from accident.

10.02.00 Fire extinguishers adequate in number shall be kept by the Bidder at the site of works where there is risk of fire hazard.

10.03.00 Adequate washing facilities shall be provided near the place of work.

10.04.00 When the work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provisions shall be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

10.05.00 These safety provisions shall be brought to the notice of all concerned by displaying on a Notice Board at a prominent place at the work spot. The

persons responsible for compliance of the code shall be named therein by theBidder.

10.06.00 To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Bidder shall be open to inspection by the Engineer and Owner.

10.07.00 Not withstanding the above clauses there is nothing in those to exempt the Bidder from the operations of any other Act or Rule in force in the Republic of India.

10.08.00 All storage, handling and use of flammable liquids shall be under the supervision of qualified persons. Flammable liquid shall not be stored inside the tunnel

10.09.00 All sources of ignition shall be prohibited in areas where flammable liquids are stored, handled and processed. Suitable warning and 'NO SMOKING' signs shall be posted in all such places. Receptacles containing flammable liquids shall be stacked in such a manner as to permit free passage of air between them.

10.10.00 All combustible materials shall be continuously removed from such areas where flammable liquids are stored, handled and processed. All spills of flammable liquids shall be cleared up immediately. Containers of flammable liquids shall be tightly capped.

11.00.00 REPORTING OF ACCIDENT

All accidents, major or minor must be reported immediately. The Bidder, shall provide first aid to the injured person immediately and the injured person shall report to the first aid station along with the 'INJURED ON WORK' form duly filled in quintuplicate and submit to the Medical Officer of the First Aid Station".

Serious Injury

In case of serious injury, the following procedure shall be adopted by the Bidder :

1). Provide First Aid at his own First Aid Station.

2). Take the injured person to the Hospital along with the "INJURED ON WORK" form duly filled in.

3). Reporting the accident to the Owner/Engineer by the Bidder.

Fatal Accident

Fatal accident must be reported immediately to the Engineer/Owner as well as to the Police.

Penalty

Failure to observe the Safety Rules shall make the Bidder liable to penalty by way of suspension of work, fine and termination of bid.

12.00.00 GENERAL SAFETY PROVISIONS FOR COOLING TOWER AND CHIMNEY:

There are numerous safety aspects to consider in construction; they are affected not only by the structural and environmental aspects of the form and scaffold system in use, but also by the strength and stability of the partially completed structure.

The early age of the concrete is a critical item and can control the rate of progress. Similarly, the design, manufacture, and installation of anchorages in the young concrete are important items. Jump form systems rely heavily on strengths of previous lifts to resist construction loads and moments; vertical slip forms do not typically apply eccentric loads to lifts below but are dependent on the strength of concrete at very early ages.

Training of personnel is important to the safe operation of any construction system. It is a critical item in the use of jump form and slip form systems. The sequencing and execution of the many procedures involved can affect the overall safety of the system, including the partially completed structure. The bidder shall implement safety inspection procedures which shall be part of the field records. Personnel shall be made aware of the interrelationships of the various system components and be cautioned as to the critical elements.

Access ways shall be available for use at all times, without restrictions caused by debris or other items. Alternate routes must be made available in the event normal access is interrupted. Ladders between work levels shall be secured and available at all times; access hatches shall be clearly marked and available at any time.

CONSTRUCTION REVIEWS

Preconstruction reviews can be useful in acquainting jobsite personnel and other associated personnel with planned construction methods, form and scaffold systems, materials delivery systems, schedules, and overall operating procedures. Compliance officers can be informed of safety procedures to be in effect and notified of persons responsible for reporting. Preliminary discussions shall include basic construction procedures and schedules, as well as design loading criteria for the form and scaffold system. More specific procedures, schedules, and loads can be provided with design drawing submittals at a later time, but prior to starting construction.

Critical conditions or loads shall be clearly noted; key operations shall be denoted and appropriate safety measures put into effect.

Regular or periodic construction meetings can be effectively used to review progress of construction and to discuss changes to operating procedures, equipment, and/or personnel.

Specific bench marks shall be established for all key operations; these shall include, but not necessarily be confined to, minimum concrete strength for form removal, minimum concrete maturity, minimum size and number of anchor bolts, and their proper placement, sequence of operation, maximum deck loads, minimum size and number of scaffold connections, maximum concrete casting rates and size and spacing of form ties.

Inspections shall be adequate to assure the bench marks are being met. Job site records can be satisfactorily used to review many items. Some items will require detailed inspections to be performed.

There are a number of key factors influencing the overall structural integrity of moving formworks used in the construction of cooling towers and chimneys. The principal forming systems, which have been addressed in the respective sections, cannot be treated independently of the partially completed structure. The forms, scaffolds, moving mechanisms and the structure combine to form an interactive construction system in which the safety of individual components is affected by the design and operation of other components.

A working knowledge of the operational aspects of the systems will ensure meaningful field evaluation of system safety by compliance officers. Among critical safety items, the capacity of partially matured concrete to resist imposed construction loads with an adequate margin of safety shall receive foremost priority.

The minimum factor of safety shall be maintained at a level consistent with the design of concrete structures for occupancy loads for two important reasons.

First, service loads and fully developed concrete strength are more predictable than construction loads and the strength of concrete at early ages. Second, the consequences of a construction failure in terms of human casualties would be quite severe owing to the fact that moving form systems are generally well-populated and inherently limited in providing the exit ways for emergency evacuation of personnel in the event of structural distress.

In addition, where the partially cured concrete supports loads transmitted by scaffolds and other work platforms, its strength requirements shall be consistent with the safety factors prescribed by the construction safety regulations.

The compliance officer shall expect to find field records which will show, above all else, that the construction system is well-conceived and structurally sound with regard to the maintenance of a minimum factor of safety on component strengths. The engineer's records shall be sufficiently comprehensive to indicate, through a detailed set of specifications, critical

benchmarks for the movement of forms and imposition of loads on partially cured concrete.

The field logs shall show these bench marks are being met. The proper implementation of these items is the key requirement contained in regulations. Many of the safety hazards found in cooling tower and chimney construction are universal in application.

Access ways must be available at all times, without blockage by debris or other items. All structural connections of the scaffolding and forming systems must be sound and adequate for the intended loads. Any signs of distress in the system, such as cracking, peeling, bending, etc., shall be noted and remedial measures taken immediately. Structural engineering consultants may be needed in the evaluation of certain moving form systems which incorporate relatively complex mechanisms (such as catheads used in conjunction with flexible cables to transport concrete to the top of the tower) capable of producing extraordinary loads on the partially matured concrete structure.

13.00.00 CHECK LIST FOR INSPECTION OF JUMP FORM SYSTEM

REFERENCE DOCUMENTS

REVIEWED

Tower drawings
Formwork drawings
Formwork calculations
Sequence of moving cycle
Criteria for form movement
Concrete records
Material test records
Maintenance records

GENERAL	YES	NO
Overall formwork condition adequate	----------	----------
Routine maintenance performed	----------	----------
Regular inspections performed:		
Concrete ---------- ----------		
Anchorages	----------	----------
Access ways	----------	----------
Forms	----------	----------
Training provided for personnel	----------	
Form movement criteria observed	----------	----------
Signs of overload or structural distress	----------	----------
If answer is yes, explain further.		

CONCRETE	DESIGN	OBSERVED
28-day compressive strength	----------	----------
Max. slump, in.	----------	----------
Max. water/cement ratio	----------	----------
Min. compr.str. for form movement	----------	----------
Min. comp. str. for placing concrete in succeeding lift	----------	----------

General Comments:

ANCHORAGES	DESIGN	OBSERVED
Design working load (in concrete, with safety factor)	----------	----------
-		
Shear	----------	----------
Tension	----------	----------
Nominal size of embedment	----------	----------
Nominal size of anchor bolt	----------	----------
Min. anch.bolts per strongback	----------	----------

General Comments:

ACCESS/EGRESS	DESIGN	OBSERVED

Level 1 (Top) scaffold (…….. simple…….. braced……. Cantilevered)

Live load	----------	----------
Spacing of scaffold brackets	----------	----------
Nom.bolt sizes	----------	----------

Level 2 Scaffold (……. Simple…….. braced…… cantilevered)

Live load	----------	----------
Spacing of scaffold brackets	----------	----------
Nom. bolt sizes	----------	----------

Level 3 Scaffold (…….. simple…….. braced…… cantilevered)

Live load	----------	----------
Spacing of scaffold brackets	----------	----------
Nom. bolt sizes	----------	----------

Level 4 Scaffold {…… simple…… ….braced…….. cantilevered)

Live load ---------- ----------
Spacing of scaffold brackets ---------- ----------
Nom. bolt sizes ---------- ----------
Miscellaneous Comments:
Ladders: _____
Stairs: _____
Elevators: _____
Guardrails: _____
Toe boards: _____
Maintenance: _____
General Comments: _____

HOISTING SYSTEM	DESIGN	OBSERVED
Main hoist line		
Min. sheave size	----------	----------
Min. line size	----------	----------
Static line		
Min. sheave size	----------	----------
Min. line size	----------	----------
Max. tension	----------	----------
Max. hoist load	----------	----------

General Comments:

_____

RAISERS	YES	NO
Mechanical components checked regularly	----------	----------
Safety mechanism operating properly	----------	----------
Regular maintenance performed	----------	----------

General Comments:

_____

CHECK LIST FOR INSPECTION OF SLIP FORM SYSTEM

REFERENCE DOCUMENTS	REVIEWED
Chimney / silo drawings	----------
Formwork drawings	----------
Formwork calculations	----------
Criteria for slipping rate	----------
Concrete records	----------
Material test records	----------
Maintenance records	----------

GENERAL	YES	NO
Overall formwork condition adequate	----------	----------
Routine maintenance performed	----------	----------
Regular inspections performed	----------	----------
Concrete	----------	----------
Climbing rods	----------	----------
Anchorages	----------	----------
Access ways	----------	----------
Forms	----------	----------
Training provided for personnel	----------	
Form slipping criteria observed	----------	----------
Signs of overload or structural distress	----------	----------

If answer is yes, explain further_____

CONCRETE	DESIGN	OBSERVED
28-day compressive strength----------	----------	
Max. slump in.	----------	----------
Max. water/cement ratio	----------	----------

CLIMBING RODS	DESIGN	OBSERVED
Diameter of rods	----------	----------
Unbraced length	----------	----------
Dist between climbing rods	----------	----------

General Comments: _____

ANCHORAGE (climbing mast system)	DESIGN	OBSERVED
Design working load (in concrete, with safety factor) --------		----------
Shear	----------	----------
Tension	----------	----------
Nominal size of embedment	----------	----------
Nominal size of anchor bolt	----------	----------

General Comments:

_____

ACCESS/EGRESS	DESIGN	OBSERVED
Main work deck Live load, psf	----------	----------
Level I (TOP) scaffold (…….. ..simple……braced……cantilevered)		
Live load	----------	----------
Spacing of scaffold brackets	----------	----------
Nom. bolt sizes	----------	----------
Level 2 scaffold (… simple…….. Braced……cantilevered)		
Live load	----------	----------
Spacing of scaffolds brackets	----------	----------

Nom. bolt sizes ---------- ----------

Level 3 scaffold […….. simple……Braced……cantilevered)
Live load ---------- ----------
Spacing of scaffold brackets ---------- ----------
Nom. bolt sizes ---------- ----------
Miscellaneous Comments:
Ladders: ---------- ----------
Stairs: ---------- ----------
Elevators: ----------
Guardrails: ---------- ----------
Toe boards: ----------
Maintenance: ---------- ----------
General Comments:
_____

YOKES/HYDRAULIC JACKS YES NO

Level controls ---------- ----------
adequate Safety mechanisms ---------- ----------
operating properly ---------- ----------
Regular maintenance performed ---------- ----------
General Comments:_____