

DO'S & DON'TS FOR SAFETY IN CONSTRUCTION WORKS



OMS, QA & SAFETY DEPTT., RISHIKESH

THDC INDIA LIMITED
(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

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R.S.T. Sai
Chairman & Managing Director

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THDC INDIA LIMITED

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FOREWORD

Occupational safety is one of the important aspects of any project both during construction and operation. THDC is committed to control and minimize such hazards to protect the health of its employees' and ensure their safety. THDC has already brought out "THDC Safety Manual" in May 2007, and for further improving the working conditions leading to prevention of accidents, this booklet titled as "Do's and Don'ts for safety in construction works" has been prepared by OMS, QA & Safety department to promote easy understanding by all concerned down to workmen engaged by contractors. Adherence to these guidelines would help prevent occupational injuries and accidents.

It is hoped that the booklet will be useful for operators, supervisors and executives actively involved in various activities related to construction.

It is enjoined upon every employee of the Corporation and of the contractors / sub-contractors of THDC to follow these guidelines so as to avoid accidents and other hazards.

(R.S.T. Sai)
Chairman & Managing Director

04th March, 2010
Rishikesh



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A. S. Bisht
Director (Personnel)

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THDC INDIA LIMITED

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MESSAGE

I am happy to know that OMS, QA & Safety department, Rishikesh, after bringing "Safety Manual" in May 2007, have now brought out the booklet titled "Do's and Don'ts for Safety in Construction Works".

Recognizing the fact that the construction of hydro projects involves various hazards and risks during construction and operation, I am sure that these do's & don'ts of safety would prove to be very useful in creating proper awareness of safety during the project construction.

The booklet is handy and very useful for the tradesmen, operators and other staff engaged in various construction activities. This will help them in achieving the goal of accident free execution of projects.

It is hoped that this booklet will not only improve awareness on Safety in Construction, but will also minimize accidents and occupational health hazards, thereby making working environment safe and healthy resulting in boosting the morale of the team members.

(A.S. Bisht)
Director (Personnel)

04th March, 2010
Rishikesh



विद्युत विभाग
फुन्सुकी वरुव
C.P. Singh
Director (Finance)

विद्युत विभाग, मध्य प्रदेश विद्युत विभाग, मध्य प्रदेश **THDC INDIA LIMITED** (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

MESSAGE

I am happy to know that OMS, QA & Safety department, Rishikesh, is bringing out the booklet titled "Do's and Don'ts for Safety in Construction Work" which is an effort towards continual as an effort towards continual improvement in the working conditions leading to prevention of accidents and occupational health hazards.

This booklet covers wide range of Do's & Don'ts pertaining to Safety for different types of activities performed in a construction project and it will be useful for different categories of workmen, supervisors and executives of THDC as well as of contractors / sub-contractors.

Safety is one of the very important aspects in any project, as an accident free work environment boosts the moral of the team members working in any hazardous project. This booklet will improve the awareness level of safety amongst employees and also motivate them for working with better safety precautions to avoid accident during project execution.

(C.P. Singh)
Director (Finance)

04th March, 2010
Rishikesh



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THDC INDIA LIMITED

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(H.L. Arora)
AGM (OMS, AQ & Safety)

PREFACE

Health and safety is one of the most important aspects of an organisation's smooth and effective functioning. Sound health and safety performance ensures an accident free environment. The Occupational Health and Safety Management System needs to be integrated with the project execution in order to (a) minimize risk to employees & others, (b) improve performance, and (c) assist organization to establish a responsible image.

Our objective, therefore, is to continuously improve the working conditions leading to prevention of accidents and to comply with all applicable laws and regulations relating to safety. For this purpose, it is necessary to create an awareness and concern for safety amongst employees (of THDC as well of its Contractors / Sub-Contractors) through their active involvement, participation, continuous training etc.

The idea behind bringing this booklet i.e. "Do's & Don'ts for safety in construction works" is to make available a handy and precise document for implementation and follow-up. However, the basic document will remain the Safety Manual and Safety Provisions laid down in various Acts and Rules like The Factories Act 1948, The Electricity Act 2003, The Electricity Rules 2005, The Building and other Construction Workers Act 1946, Workmen Compensation Act, Explosives Act, Motor Vehicles Act, etc.

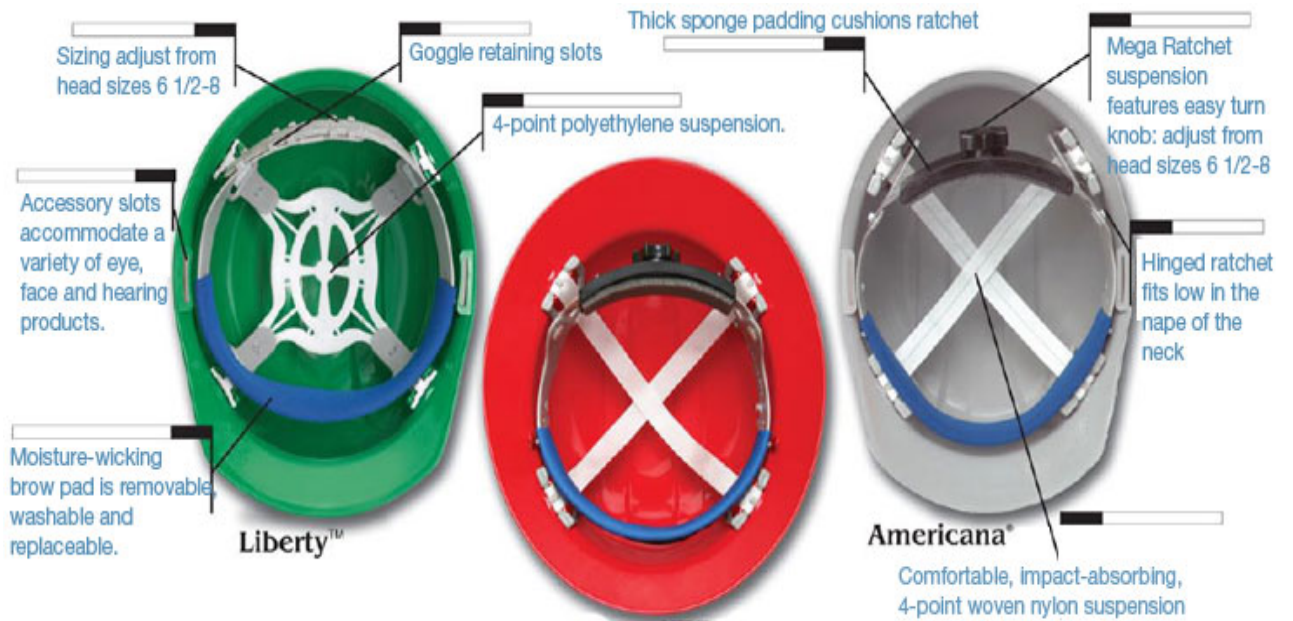
This booklet has been prepared by OMS, QA & Safety department Rishikesh with the help of Sh. S.C. Sharma, Consultant (Ex. G.M. THDC) and inputs received from Safety department Tehri & Koteshwar. This document shall be reviewed and improved upon periodically, incorporating new precautions on activities and new hazards brought to the notice.

(H.L. Arora)
AGM (OMS, QA & Safety)

04th March, 2010
Rishikesh

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Different types of Construction Safety Helmets & Other Personal Protective Equipment (PPE)

DO'S & DON'TS

1.0 GENERAL PRECAUTIONS

The following safety precautions should be strictly followed by all employees of Corporation, Contractors / Sub- Contractors for preventing accidents :-

(A) Do's

- Always remain alert and in proper physical and mental condition.
- Always wear right clothing for the job, wear safety glasses, gloves, footwear, hard hat.
- Develop safety consciousness through regular meetings, films, demonstrations etc.
- Each employee of the contractor / THDC should be provided initial training regarding safety so as to enable him / her to conduct his / her work in a safe manner.
- Always employ a skilled/trained worker for the job.
- First-aid boxes with adequate supplies should be made available at every site.
- Fire fighting equipment be always kept in good condition.
- Use proper tools in proper way (Refer section 12.2 of Safety Manual).
- Guards and railings be provided wherever necessary.
- Do investigate every accident to determine the cause and take remedial action.
- Always adopt safe working practice.
- Take immediate steps to correct any violation of safety rules.
- Do provide safety instructions to each employee before assigning him /her a new job.
- In case of haul and access roads, the road surfaces shall be kept moist.
- Construction areas, aisles, stairs, ramps, corridors etc. where work is in progress shall be adequately lighted with either natural or artificial illumination. On matters related to illumination Section 5.6.2, 7.3.7 and 15.8 of Safety Manual be referred.
- Noise levels should be restricted to the level as per Building and Other Construction Workers Act 1996 and as mentioned in Section 15.7 of Safety Manual.
- The employee must use the standard protection equipment intended for each job. Each piece of equipment should be inspected before and after it is used.
- Always take prompt action to redress the complaints or grievances of the people, wherever possible, on all safety matters.
- Do acquaint yourself with the basic Laws of the Land, respect the laws and observe them, both in letter and spirit. Remember that ignorance of law cannot be an excuse.

- If there are no written instructions or procedural guidelines about various types of work/ functions to be performed and the same are being carried out as per certain practices, it would be desirable to make a humble beginning to streamline those procedures.
- Make surprise and periodical visits to sites, to check works in progress, stores, etc. to ensure implementation of safety measures.
- Follow scrupulously the Conduct, Discipline and Appeal Rules/Standing Orders as laid down for the employees.
- Publicise the Rules and procedures related to Safety as widely as possible in simple words.
- Always remember that Indiscipline and Carelessness start in a small way; it would thus be wise to 'press the brake' at the initial stage itself.
- Remember always that safety is the function of all employees not of safety Department alone.
- Consider safety man as your friend, philosopher & guide and extend him your whole-hearted cooperation.
- An inexperienced worker is the chief casualty in accidents on construction sites. Before recruiting any personnel, he / she should be properly screened for the job he is likely to be entrusted.
- Though it is the duty of the safety department to make the safety process effective, but each section head must hold a short safety session with his section as often as conditions warrant. The workers should be given ample opportunity to participate in the discussions. Sometimes the most effective method of emphasizing safety practices is by demonstration.
- Do remember that many minor injuries can be treated satisfactorily, if first-aid facilities are maintained. Some members of the staff should be trained to provide this treatment and each employee should know how to administer the first aid.
- Regularly maintain plant, machinery & equipment as per manufacturers' guidelines.
- Identify hazards in the system and establish preventive and control measures.
- Give clear safety instructions.
- All work centers including loading and dumping areas and haul roads, should be properly illuminated.
- Good house-keeping is the solution to many safety related problems.
- Maintain proper documents to demonstrate conformity to the accident preventive measures and the results achieved.
- Rescue teams with rescue items should be available immediately in case of an accident.
- Fire extinguishers of right type in right quantity should be installed so as to deal with fire at that particular location.
- Safety Committee should consider the opinion of the workers and other employees on safety matters.
- Always park equipment on firm and level ground
- Accident investigation and analysis are useful tools to reveal hazards. Appropriate corrective action taken on this basis is a keystone to accident prevention.
- Carry out regular safety inspection by a competent person at suitable intervals, of all buildings, work places and operations.

- Ensure proper discipline amongst employees of contractor / subcontractor and THDC on matters of safety.
- Concerned executives/ supervisors / workers should be made responsible on safety matters.
- To have a better control on occupational diseases; abnormalities of temperature and humidity, dampness, defective illuminations, excessive noise, radiation of energy, vibration should be controlled.
- Care should be taken to protect eyes, body, ears, respiratory system, hands and feet.
- Before starting the work with a plant, machinery or an equipment, check all the controls.
- Adequate number of employees, who are trained in first-aid (including those of electrical injuries), fire-fighting, and rescue operation be deployed in each shift, so that their services can be utilized immediately in emergency situations.
- Most paint materials are highly combustible; therefore every precaution should be taken to eliminate danger from fire.
- To avoid respiratory problems during painting, workmen must be provided with an ample supply of fresh air.

(B) Don'ts

- Do not wear ties, loose clothes, rings, watches etc.
- Do not touch moving parts.
- Do not engage a workman without proper training.
- Do not have inadequate or unsuitable illumination.
- Avoid short cut methods.
- Do not adopt unsafe method/process.
- Do not keep moving parts unguarded / inadequately guarded.
- Do not roam around work area without work and without precautions.
- Do not work without proper Personal Protective Equipment (PPE).
- Do not allow violation of safety rules.
- Do not permit employees to remain at work under the influence of any intoxication.
- Don't encourage the contractor or sub contractor to ignore safety in the works / tests etc. on flimsy grounds.
- Don't fail to test check occasionally and report your findings to the concerned authority, on matters related to safety.
- Following are the main sources of injury to operators and others working around Machinery; do not allow occurrence of these hazards during operation and maintenance of equipment:
 - I) Repairing and servicing equipment in dangerous positions.
 - II) Unexpected violent tipping of the machine.
 - III) Leaving earth moving and other equipment unattended in a dangerous position.
- Do not get under the machine unless the engine is turned off and the parking brake is set.
- Do not make sudden stops with raised and / or loaded bucket.

- Do not short circuit the fuse links with wire. Always use proper fuses.
- Do not break any of the interlocks provided unless required under emergency conditions.
- No part of machinery, while in motion or in operation should be examined, lubricated, adjusted or repaired except by a duly authorized person.
- Never allow unqualified people to operate the machine.
- Never check for leaks in a pressuring system with hands.
- Do not smoke and always stop the engine, while refueling the vehicle/ equipment.
- No employee should be given new assignment or work unfamiliar to him without proper introduction regarding hazards, incident thereto.
- Do not allow riding of unauthorized personnel on the vehicles or equipment.
- Do not allow to enter unauthorized personnel into the plant area.
- No person shall take rest or sleep on or near a parked machine.

2.0 CONSTRUCTION EQUIPMENT

2.1 While Using Plant and Machinery

(A) Do's

- Keep hands away from moving parts such as fan, V-belt, gears, drive shafts etc.
- Before operation, make sure you know the equipment signal, flags, sign and markings fully and also from where to get assistance and first-aid.
- Give warning to nearby people that you are about to start up your equipment.
- Follow maintenance precautions as suggested by the manufacturer and laid down in the operator's manual.
- Keep the inside of the cab tidy. Keep windscreens, mirrors and lights clean. Clean any grease, oil etc. off hand rails, footsteps, pedals etc.
- Always keep a safe speed as per working conditions and state of the ground. While towing another piece of equipment, never proceed at high speeds.
- Follow traffic rules.
- Always use proper tools and they should be free of dirt, grease and oil and properly maintained. Tools should never be dropped, tossed around the work area.
- A sufficient safety clearance should be kept from aerial electrical lines.
- Before excavation, precise position of buried cables should be determined.
- When not using, bucket, mold board, boom etc. is to be put on ground.
- Equipment should be well maintained and kept in good working condition. Equipment should be carefully inspected at regular intervals.
- Guards and covers be opened when the power train does not run.
- Maintenance work must not be performed during operation of the equipment.
- Shovels and cranes must not be charged by loads exceeding the admissible loads.

- Boom cranes be operated in such a way that their stability against tilting remains safeguarded. If required, they can be supported by stabilizing equipment, using outriggers. Curves be negotiated at very low speed.
- Operator should be aware of what other equipment are in operation at the work site.
- Plant and equipment must be deployed only for designated purpose and operated and maintained in accordance with the manufactures instructions.
- Always wear safety helmet and other PPEs as per site condition when working in a quarry, tunnel or in similar environment.
- Safety goggles or face shield be used when drilling, grinding or hammering metals. Welder gloves, goggles, and an apron or other protective garments be used when welding or cutting. Safety shoes be used at all the times during these type of works.
- Always park or place the equipment or machine on a level area away from traffic. The vehicles should be securely supported on jack stands or rigid blocks at frame to ensure that it cannot roll forward, backward or fall.
- While working with a crane, a related danger is shock loading. Sudden lifting or panic braking greatly increases the load on the boom. This is especially dangerous capacity lifts.
- If crane operator cannot see all parts of the load and its path clearly, a signal-man should guide in case of the crane operator and load and ensure that the load not pass over any worker.
- In a continuous operation, wire should be inspected every day. Check it for broken strands and excessive wear, and also check inside of the rope.
- Always lower the load to the ground before leaving the crane for any reason. Never depend on the brake to hold a load suspended unless the operator is in the cab, at the control.
- Even if the crane is equipped with one hook on the jib and one on the main boom, never use both to lift loads at the same time. A loaded jib hook puts stresses on the main boom which seriously affects its capacity to bear loads.
- Before working on hydraulic system, make sure that hydraulic pressure is released.
- Before putting any machinery into use on the job, it should be thoroughly inspected for safe operating condition.
- Load the machinery within safe limits.
- Periodically inspect the machinery to ensure its safe operating conditions and proper maintenance.
- On arrival of any new equipment both the operation and the repair staff should be trained in its use under the supervision of the erection personnel deputed by the firm.
- The operator should be encouraged to report any abnormal indications / noise promptly to the Unit Level maintenance staff.
- Follow the safety measures prescribed by the suppliers of the plant or machinery.
- Schedules for preventive and electrical maintenance are quite effective and should be employed for various kinds of machines.
- Make all adjustments and repairs with the parking brake set, engine inoperative, hydraulic systems not under pressure, and block the wheel when parked on grades.
- Make sure that all the pressure, temperature and other gauges are operative, before commencing the work.

- Make sure that the area behind the machine is clear, before reversing.
- Face or look in the direction the machines are travelling.
- Watch for workers in the vicinity of the machine, before setting it in motion.
- All gears, revolving shafts, couplings and all other dangerous parts of machinery shall be effectively guarded unless they are so constructed, installed or placed as to be as safe as if they were guarded.
- Fencing of dangerous parts of machinery shall not be removed while the machinery is in use or in motion and when removed, it shall be replaced as soon as practicable and in any case before the machinery is again brought into use.

(B) Don'ts

- Do not allow unqualified people to operate the machine. Operator should be familiar with the capabilities and limitations of the equipment.
- Do not carry your load above the heads to other people when driving a shovel.
- Do not check for leaks in a pressurized system with your hands, as this may drive oil through pores and under the skin.
- Do not smoke when refueling and always stop the engine.
- Do not run the Diesel or Petrol engines in confined or poorly ventilated areas, since their exhaust gases are poisonous.
- Do not allow unauthorized personnel to ride on any equipment.
- Do not allow smoking during refueling.
- Do not run the engine while it is being refueled.
- Do not use a naked flame to inspect battery for any leakage.

2.2 While Using Heavy Earth Moving Machinery (HEM)

Additional precautions which the operators of specific equipment should keep in mind, are as follows :

1) **Bulldozers & Tractors :**

Do's

- When working on slopes with a dozer, operate straight up and down. Driving a bulldozer or sides reduces stability and could cause the unit to roll over.
- During transportation of the load, speed of the dozer should be kept slow enough to enable the operator to keep full control over the dozer.
- Ridger, curbs, logs, or railroad tracks should be avoided while traveling.
- Operator should keep the dozer away from the edges of banks and pits, as these can cave in or the machine can lose its footing and slide over the edge.

- Check the position of other workmen before starting the machine.

Don'ts

- Do not leave the machine unattended with the engine running. When it is necessary to park dozers / tractors on slopping ground, they shall be securely blocked and the brakes set.
- Do not use the bulldozer blade as brakes except in case of emergency.
- Do not drive the blade raised so high that vision ahead of bulldozer is obscured or blocked.
- Do not leave the machine with raised blade.

2) Wheel Loaders :

Do's

- During the loading stage, the operator should keep the loaded bucket close to the ground for stability.
- If an overload causes the loader to tip forward, lower the load.
- During transportation of the load, keep the speed low so that operator is in complete control of the machine.
- While loading materials into trucks, care should be taken to prevent the injury to truck driver or damage the truck.

Don'ts

- Don't use loader bucket for transportation of materials for longer distance.

3) Excavators, Shovels, Draglines etc. :

Do's

- Operator should sure that the attachment of load does not catch on obstructions when lifting or swinging. While loading materials into trucks, care should be taken to prevent injury to the truck driver or damage to the truck.
- Load trucks evenly to avoid overloading rear axles.
- Material should be dropped into the truck only from necessary heights.
- If outriggers are available, utilize them after extending their fullest limit and support them on uniform surface.
- The excavator should be kept away from the edge of excavation to avoid falling into the excavation.
- Regularly check that bucket linkage or slings used to lift the load are of adequate strength.

- While working near gas, water or power lines, extra precautions should be taken.
- Regarding excavation in areas where electric cable, telephone cable or gas pipe lines are likely to be available during excavation, concerned departments must be contacted.
- Particular care has to be applied whenever work is performed close to the cables, such cables, should be exposed first by manual digging.
- Whenever a spark occurs over to the excavator despite precautions; do not leave the operator's cabin and do not allow third persons to touch the excavator, and move the excavator away from the zone of danger.
- When moving over a long distance, position the boom in the direction of travel.
- While traveling up a steep slope, stability can be increased by facing the heavier engine side uphill.
- Use a signal-man while traveling this way.
- When operator leaves the machine, shovel, dippers and dragline buckets should be lowered to the ground.
- Power should be disconnected when repairs are made to electric shovels, draglines. These shall be operated as not to lose their stability.

Don'ts

- Do not swing, hoist or brake unnecessarily fast, as this can cause serious accidents.
- Never swing or position the attachment over ground crew or a truck cab.
- Never exceed the lifting capacity.
- Never exceed the recommended load.

4) Dumpers and Haulage trucks

Do's

- Always keep safe distance from other equipment like dozer, loader etc. working in the area.
- Avoid hitting sharp rocks and shovel overflow.
- During loading, operator should follow the signals of the spotter.
- Dump trucks used for hauling rock or overburden which is loaded by shovels etc. shall be equipped with safe overhead protection for the cab.
- While dumping, the workers shall stand clear of the vehicles.
- Only Competent and licensed persons shall drive motor vehicles.
- Every effort shall be made to avoid loading of motor trucks in a place where there may be danger from materials, such as rocks falling from buckets passing overhead.

- Vehicles being loaded or unloaded shall be effectively braked or blocked.
- When dumping over spoil banks, the dumper should be kept at a safe distance from the edge of the dump area, the transmission should be kept in neutral and the brake applied.
- These should be maintained in good mechanical condition. Special attention should be given to brakes, horn, tyres, steering mechanism and signaling devices.
- Driver should move back up a truck with the assistance of a signal man who should have a clear view of driver and the area behind the truck during each moving back operation.
- As far as possible, loaded trucks should not be moved back on gradients.
- Stumbling blocks must always be put in place to prevent the truck from moving down a gradient.
- Always obey traffic rules.
- No person should be allowed to enter in the vehicle or travel in it without permission of the concerned Engineer.

Don'ts

- Do not leave or enter the cab while the truck is being loaded.
- Do not allow any person to work near dumper while it is being unloaded
- Do not load material into a truck so as to project horizontally beyond the sides of the body, and any material projecting the front or rear shall be indicated by a red flag during the day and a red light during the night.
- Do not allow any person to work with the body in raised position.
- No person shall be allowed to enter in the vehicle or travel in it without permission of the concerned Engineer.
- Do not drive under the state of fatigue, drowsiness or drunkenness.

5) **Parking of Mobile Equipment**

- Park the machine on a firm level supporting surface, away from any unstable ground area or inadequately shored up excavation.
- Apply the brakes.
- Align the attachment with the centre line of machine, retract the cylinder rods fully and dig the bucket or clam teeth in the ground.
- Keep all control levers at dead centre.
- Shut down the engine.
- Relieve pressure in the hydraulic system
- Lock the cab door.

6) **Compactors and Road Rollers**

Do's

- When the road rollers or compactors are not in use, brake shall be applied, engine shall be put into gear and wheels shall be blocked.
- As far as practicable, these shall not be left on a highway or hauling roads after the close of work and, where this is not practicable, reflectors shall be provided at the two ends at night to clearly show the presence of the road roller or compactor on the road.

Don'ts

- No person shall climb a moving road roller / compactor.
- Road rollers and compactors should not be moved down the hill with the engine out of gear.

2.3 **While Using Air Compressors & Pneumatic Tools**

Do's

- Compressors should be securely anchored to firm foundations as the sudden and frequent variations in the load could cause considerable vibrations and impose severe shocks upon the equipment.
- Air receiver should be installed with a pressure gauge and a relief or safety valve and they should be regularly tested.
- A drain pipe should be provided at the lowest point of air receiver.
- Air receiver should be drained and cleaned of oil water regularly.
- When operating under dusty conditions, the relief valve should be checked atleast every month.
- Gauge and valves should be regularly inspected.
- Pressure should be shut off and exhausted from the line before disconnecting the line from any tool or connection.
- Air hose shall be suitable to safely withstand the pressure for which it is intended. Defective hose shall be immediately removed from use.

Don'ts

- Do not operate the Air Compressors at speeds greater than those listed by the manufacturer.
- Do not install an air receiver without a pressure gauge and a relief or safety valve.
- Do not place stop valve in the air line between the compressor and the air receiver unless spring loaded safety valves are installed between the compressor and the stop valve.
- Do not use the compressed air for blowing dust from hands, face or clothing.

2.4 While Using Belt Conveyors

Do's

- All oil and grease cups shall be so located that the oilier can service the cups without exposing himself to danger.
- Whenever the belt crosses over a traveled way, trays should be installed to catch all spillage from the belt.
- Crossways or under passes with proper safeguards should be provided for passage over or under all conveyors.
- Where conveyors are operated in tunnels, pits and similar enclosures, ample room shall be provided to allow safe accessway and operating space for all workers.
- A device for throwing the propelling mechanism into neutral gear should be installed at each end of the runway.
- Baffles should be provided across belts installed on steep gradients to prevent material from rolling or bouncing off.
- All openings to hoppers, chutes, bins etc. should be protected to prevent unauthorized entry of persons from stepping or falling into them.

Don'ts

- Do not overload Belt Conveyor to the point where material fall off the belt.
- Riding on conveyors should be prohibited.

2.5 While Using Ropes, Chains and Slings

Do's

- All chains in continuous use shall be inspected once in a month to check for too much elongation, cracks, reduction in cross section.
- Wire ropes should be carefully uncoiled, coiled or used to prevent kinking. Kinked strands damage the rope permanently.
- Drum sheaves and pulleys should be smooth and free from surface defects such as cracks, kinks, destrands etc.
- Hooks, shackle , rings and pad eyes, U-bolts and other fittings should be of proper size and those showing excessive wear and tear or those, which have been bent, twisted or otherwise damaged, shall be removed from service.
- Slings, their fittings and fastenings, when in use shall be inspected daily for evidence of overloading, excessive wear or damage. Slings found to be defective shall be removed from service.
- Suitable protection shall be provided between the sling and sharp unyielding surface of the load to be lifted.
- The use of ropes, cables and chains shall be in accordance with the safe usage recommended by the manufactures.

Don'ts

- Do not use the chain or rope unless;
 - ✓ It is good in construction, of sound material, adequate strength and free from defects.
 - ✓ Safe working load is plainly marked on it or an identification number is marked on it and the safe working load corresponding to this number is entered in a register maintained by the person in-charge.
- Do not use the chain, which is broken and mended with a bolt, or end of the chain bolted to form a loop.
- Do not knot the chain to chair or twist to shorten it.

2.6 Safety during Crane Operation and other load lifting machines

Do's

- When lifting any load, you must know the safe working load of the crane.
- Check all the controls before starting the work and also check before moving that slinging is alright by lifting the load to about 30 cm from the ground.
- Loading hook should be at the centre of load to be lifted.
- When a load is being lifted, only one man should give signals.
- Follow manufacturer's guidelines about the operation of the crane.
- When static load lifting machinery like cranes, winches, pile drivers and excavators are required to operate on edges of embankments or in boggy areas, the bearing capacity of the soil shall first be tested.
- A standard code of hand signals shall be adopted in controlling the movements of the crane and both the driver and the signaler shall be thoroughly familiar with the signals.
- The driver of the crane shall respond to signals only from the appointed signaler but shall obey stop signal at any time no matter who gives it.
- Before lifting, the load shall be checked to ensure that it is secure.
- When handling loads near to maximum safe working load, crane motions shall be operated with extra care. The load shall initially be lifted just clear of the supporting surface and brought to rest, while the slings, balance of the load, etc. are checked before proceeding. Proper care shall be exercised by the driver, at all times to avoid shock or side loadings on the jib.
- The slinger or other persons shall stand well clear of the load and shall not walk, crawl or stand under the suspended load.

Don'ts

- Never attempt to lift load more than this limit.
- Never stand under the load being lifted.
- Never lift the load with a sudden jerk.
- Never drag the load with the help of crane to bring it under the loading.

- Do not operate the Cranes to make them liable for over-turning particularly because of the following misadventures :
 - ✓ By taking load in excess of the safe working load.
 - ✓ By sudden release of a heavy load.
 - ✓ By pulling loads from the sides.
 - ✓ By positioning the crane at a steep slope.
 - ✓ By braking too hard in order to arrest the descending load.
 - ✓ By operating the crane without sufficient counter weight.

3.0 SAFETY DURING EXCAVATION

Excavation is one of the important phases of construction in any major construction activity. Hazards of excavation arise from the use of heavy equipments, drills, jack hammers and explosives. The other serious hazards in excavation jobs are due to falls and falling of objects. Before undertaking excavation work complete knowledge of underground structures such as waterline sewers, gas mains, electric conduit system etc.) is essential.

3.1 Open Excavation - Earth and Rock

Do's

- The sides of every excavation, where there is a danger of fall or dislodgement of earth, rock or other material forming the side or adjacent to any excavation shall be securely supported by adequately braced timber of suitable quality or other material unless the sides of the excavation are sloping to a safe angle.
- In every excavation work along sloping ground, sides and slopes, excavation shall be maintained in a safe condition by sealing benching or barricading.
- Additional precautions shall be taken to prevent slides, slip or caverns, when excavation is done in locations subject to vibrations from rail-road or highway traffic etc.
- In all trenches 1.5 m or more in depth, ladders should be provided.
- Excavation areas should be adequately lighted for night work.
- During hours of darkness all public sidewalks should be adequately illuminated and warning lights about the excavation should be provided.
- A flagman should be posted to warn the public or approaching trucks and to direct the trucks in and out of the site of excavation.
- Every accessible part of an excavation pit or opening in ground into which a person is liable to fall, suitable barrier should be provided.
- The side slopes and their stability should be carefully examined after every blasting operation.
- Measures should be taken to prevent workers and spectators from approaching the dangerous areas.

Don'ts

- Do not permit the workers to work on steep slopes one above the other.
- No excavation of earthwork below the level of any foundation of a building or structure shall be commenced or continued unless adequate steps are taken to prevent danger to any person from collapse of the structure or fall of any part thereof.

3.2 Underground (Including Tunnel and Shaft) Excavation

- Frequent careful inspection of tunnel walls and roof and thorough sealing or removal of loose rock is necessary to prevent rock falls.
- Ample illumination, good housekeeping, and safe walkways are important factors in the prevention of accidents.
- All persons working (or entering) in the tunnel should wear hard hats and hard toe shoes.
- In every shaft and tunnel, sufficient safe means of access should be provided.
- After every blasting operation, roof and walls of the tunnel and sides of the shaft should be carefully inspected.
- Every vehicle should have head lights on each end. It should also be equipped with whistles or horn.
- The ventilation system should be adequate to maintain circulation of fresh air in all parts of tunnels and shafts.
- All electric wiring shall be extra-heavy insulated and of sufficient capacity supported on insulators and not looped on or tied to spikes or other makeshift supports.
- In case of shaft excavation, all sheaves should be of the proper diameter of the cable or hoist rope and should be amply strong, properly mounted and frequently inspected. All hoisting equipment including ropes and cables should be thoroughly inspected at least once a week and maintained in a good condition.
- Telephone system should be established in the tunnels and shafts.
- Following safety precautions should be followed in case of gaseous tunnels :
 - ✓ Regular checking of methane gas by methane detector.
 - ✓ No entry of lighters, match boxes etc. inside by workers etc.
 - ✓ To detect carbon dioxide formation, safety lamps be provided.
 - ✓ Regular checking of gas at the faces should be done before each shift.
 - ✓ The gas percentage should be checked regularly.
 - ✓ Rescue apparatus shall be provided, and personnels should be trained to handle them.
 - ✓ Welding and cutting by gas should not be allowed inside the gaseous tunnel.
 - ✓ Wait for defuming before entering into the recently blasted area.
- The concentration of fine dust and content of silicon dioxide and noxious gases in all dust producing underground operations should be kept within the specified safe hygienic limits.

Don'ts

- Motor power, other than electric should not be used.
- No inflammable material or oil and grease should be stored inside or near the tunnel or shaft.

3.3 Quarries And Borrow Areas

Do's

- All quarries shall be fenced and signs for warning people of the danger of blasting or otherwise shall be prominently pasted.
- The rock face of the quarry shall be scaled frequently to maintain safe working conditions. Scalers shall wear hard hats and safety belts and be securely tied off while at work.
- Excavating and loading operations on frozen material (quarrying other than rock) or in material sufficiently compacted to stand in vertical or nearly vertical banks, are hazardous and require continuous care and alertness to avoid the possibility of being injured or buried by sliding of falling masses of the material.

Don'ts

- There shall be no undercutting of banks at any time, and any overhanging banks occurring as the result of slides or cavings shall be removed before beginning excavation operations beneath them.

3.4 Demolition

Do's

- During demolition works all electrical cables and water, gas or steam pipes shall be disconnected except those that are used for the operation.
- Adjacent structures shall be surveyed to be sure that demolition will not affect their soundness and stability.
- Adjacent structures and the surrounding streets must be adequately protected from the falling objects.
- All steps should be taken to prevent danger to persons employed from risks.
- Warning signs, red lights adequate barricading shall be placed wherever there is a danger to public.
- During demolition works all electrical cable and water or gas pipes should be disconnected except those that are used for the operation.

- During demolition, all practical steps shall be taken to avoid danger from collapse of the structure, when any part of the framing is removed from a framed or partly framed structure which may endanger life of any person.

3.5 Drilling

Do's

- Holes should be of greater diameter than the diameter of the cartridges of explosives used.

Don'ts

- Loading and drilling should not be carried out at the same time in the same area.
- Drilling should not be resumed after blasts have been fired until thorough examination has been made to make sure that there are no unexploded charges which the drills may strike.

3.6 Loading

Do's

- Bore holes must be cleared of all debris before a cartridge is inserted by air pressure.
- All loaded holes or charges shall be checked and definitely located before firing.
- Holes in the cartridges shall be made with a sharpened wood. Detonators shall be inserted only in a hole in the end through a cartridge prepared specially for that purpose.
- After the loading of a blast is completed, all excess explosives and detonators should be removed to a safe location.
- Loading shall be made with sound and the same dia of Cartridges wood slick.

Don'ts

- No welding shall be done inside the tunnel at the time of loading of the face, till the blast has been taken.

3.7 Blasting

Do's

- The charge should be fired successively.
- Prior to the firing, all persons in the area should be warned of the blast and sent to a safe distance.

- Flagmen with whistles should be posted to stop traffic at access points on each possible route of travel. Blasting should be done at fixed hours and displaced on a Notice Board.
- A loud warning signal shall be given at a proper time before firing a blast, and all clear signal shall be given when the blasting is over.
- After a blast has been fired and firing line is disconnected, a careful inspection should be made by the blaster to determine if all charges have been exploded.

NOTE : For safety while handling explosives, and during drilling and blasting, refer chapter 10 and Section 5.8 & 5.9 of Safety Manual for details.

Don'ts

- Do not fire the charge simultaneously.

4.0 SAFETY WHILE USING EXPLOSIVES

4.1 Handling

Do's

- All operations involved in transportation, handling, storage and use of explosives should be as per Indian Explosives Act, 1884 and Explosives Rules 1940, as amended from time to time.
- Explosive shall be handled by or under the supervision of competent and experience, authorized persons only.
- Following should be observed regarding vehicles used for transport of explosives:
 - ✓ Vehicles must have springs under the body.
 - ✓ All vehicles transporting explosives shall be marked or play carded on both sides and ends with the word 'EXPLOSIVES" in white letters not less than 75 mm tall on a red background.
 - ✓ Smoking should be prohibited during handling and transport of explosives.
 - ✓ Explosives should be protected against theft.

Vehicles used for transporting explosives should be carefully inspected daily to ensure that ;

- ✓ Filled and serviceable fire extinguishers are in position.
- ✓ Electric wiring is well insulated and firmly secured.
- ✓ Chassis, engine and body are clean and free from surplus oil and grease.
- ✓ Fuel tank and feed lines are not leaking.
- ✓ Lights, brakes and steering mechanism are in good working order.

- ✓ Vehicle shall have suspended chain touching ground for Earthing in case of lightening even in moving condition too.

Don'ts

- Do not transport the explosives to the site of operation except in suitable cases or containers which are so made as to prevent any spillage of explosives and any danger or sparks or other sources of ignition during conveyance.
- Detonators and igniters must not be carried in the same vehicle with explosives.
- The vehicle carrying the explosives must not be used to transport workmen or other materials.
- Drivers should not leave the vehicle unattended.
- A motor vehicle carrying explosives should not be refueled except in emergencies and even then only when motor is stopped and other precautions taken to prevent accidents. Such vehicles should invariably have atleast two fire extinguishers placed at convenient points.
- Vehicles transporting explosives should never be taken to repair shop, or parked in congested areas, or stored overnight.
- Explosives should not be transported on a public highway during hours of darkness.
- Persons employed in the transport or handling of explosives should not carry with them or in the vehicles, matches, loaded fire arms, petrol etc.
- Boxes of explosives should be handled carefully and not allowed to fall.

4.2 Storage

Do's

- Before establishing magazine, its drawing (location, design & safety aspects) its drawing should be got approved and then the work should be started.
- The magazine should be kept clean. High explosives like dynamite should be stored in a dry, clean, well-ventilated, bullet-proof and fire-proof building constructed in accordance with Indian Explosives Act, on an isolated well guarded place.
- Sufficient number of lightening conductors should be provided on top of the magazine.
- Separate magazine shoes, without nails, should be kept in the magazine and persons entering the magazine must put on these magazine shoes.
- Light should be obtained from an electric storage battery lantern.
- Adequate fire fighting equipment shall be provided in the magazine.
- Detonator shall be kept in a box made of inside wooden outside steel.

Don'ts

- No person having articles of steel or iron be allowed to enter a magazine.
- Do not take oily cotton rags, cotton waste and other articles liable to spontaneous ignition into a magazine.
- Do not allow packages containing explosives to remain in the sun.

5.0 CONSTRUCTION

Construction industry is inherently hazardous. However, if safety precautions are properly enforced, it will help in minimizing accidental injuries in various construction activities. Safety during construction has been dealt in detail in Chapter 11 of Safety Manual.

5.1 Scaffolds

Do's

- Scaffolds are provided for works that cannot be done from the ground or from part of a permanent structure. Following safety measures should be adopted for scaffolds :
- Every scaffold including supports should be of good construction and of adequate strength for the purpose for which it is used and it should be properly maintained.
- Boards and planks used for the floors shall be of uniform thickness, butt jointed, closely laid, and securely fastened in place.
- In case of suspended scaffolds, supports should be of adequate length and strength. Ropes, chains or other means of suspension should be of good construction, sound material and of adequate strength and properly secured.
- Side screens should be provided on scaffolds erected along passage ways or other thorough fares.

Don'ts

- Persons should not be allowed to work from scaffolds during storms or high winds.
- If several workers are working on the scaffolds, their load should not be concentrated on a particular place and should be distributed on the whole scaffold.

5.2 Platforms, Gangways and Runs

- All working platforms, gangways and runs from which workers are liable to fall more than 2 meters should be :-
 - ✓ of adequate width depending upon the type of work done, and
 - ✓ provided with suitable guard rails of adequate strength.
- Every platform, gangways, run or stairs should be kept free from any unnecessary obstruction, material, rubbish etc.
- Each supporting member used in the construction of run-ways, platforms, ramps and scaffolds should be securely fastened and braced. Supporting member should be placed on a firm, rigid and smooth foundation of a nature that will prevent lateral displacement.
- Cantilever of scaffold planks should be avoided.
- Where planks are butt joined, two parallel putlogs must be used, giving each plank sufficient support.

5.3 Ladders

Do's

- Ladder should be of good construction, sound material and adequate strength.
- Whenever a platform is of height 1.5 m or more above the ground, a ladder or stairway should be provided. Every ladder used for a vertical height of more than 9 meters height should be provided with an intermediate landing.
- The materials and tools should wherever practicable, be pulled up with a rope, and should not be taken by ladders.

Don'ts

- No ladder with defective or missing rung or with any rung which depends for its support solely on nails, spikes etc. should be used.
- Do not paint wooden ladders as paint covers up the defects.
- Do not place the ladder upon a box, barrel or other movable insecure object. The slipping of a ladder at either end should be carefully guarded against where the supporting surfaces are smooth and vibrating.

5.4 Form-Work

Do's

- All forms or form panels that are to be used or reused should have U-bolts, sufficient in number and size, to carry the weight of forms or form panels.

- All form-raising operations should be conducted in a safe and orderly manner and only experienced workmen should be allowed on this type of work.
- All form raisers shall use safety belts when required to go over the sides unless scaffolds are in place on the form.
- All frames should be designed and maintained to withstand all loads imposed upon them. All head and tail jacks should be maintained in good working order. Tail jack fasteners of sufficient length and size should be securely anchored in the concrete.
- All form stripping should be conducted in a safe and orderly manner and in accordance with the rules for good housekeeping. All stripped lumbers should be placed in piles or removed immediately from the work area.
- All protruding nails for superfluous bolts or studs used fasten the shuttering should be cut or bent down soon after stripping.
- Boatswain's chairs, safety belts, and ropes should be used where workmen are exposed to falling hazards of stripping operations and should be protected from falling objects.

Don'ts

- Safety hazards in form-work construction are :
 - ✓ Poor house-keeping,
 - ✓ Leaving materials and tools where they may fall and cause injuries.
 - ✓ Tops of forms used as walkways not equipped with standard guardrails, and
 - ✓ Failure to properly secure forms of scaffolds.

5.5 Concreting

Do's

- All employees engaged in placement of concrete should wear hard hats, rubber boots with trouser legs outside, and gloves. Since water in freshly mixed concrete contains lime and alkali's and may cause severe and painful damage to skin and eyes, protective clothing, goggles etc. should be worn. If this (concrete) comes in contact, wash it with sufficient water.
- Only men in good physical condition should be employed to operate vibrators.
- All mixer gears, chains and sockets of the concrete mixers and batching plants should be guarded.
- Walkways, platforms, stairways and ramps of mixing plants should be well built and protected.
- In mixing plants, an air exhaust system should be installed to remove cement and other dusts from the inside of the plant. Respirators should be worn when necessary.
- The concrete pipe line should be anchored at all curves near the end. Air release valves should be installed at high points to release entrapped air. This will assist in preventing line plugging which in turn reduce accident possibilities.

- If and when necessary to open a pipe to clear it of an obstruction, the work must be carefully done in order that workmen may not be injured by concrete blown out by air pressure in the pipe.
- All workmen, when working in the vicinity of a pumpcrete machine should wear the goggles.
- When it is necessary to get inside mixer of batching plant or ice- flake plant for cleaning, repairs or inspection, the control switches shall be locked and notice to this effect pasted on it to prevent inadvertent starting.
 - Workmen engaged in handling bulk cement in confined places shall wear tight fitting goggles, approved respirators and protective clothing that fits snugly around the neck, wrists and ankles. Hand cream or petroleum jelly shall be provided for the use and protection of men handling cement.

5.6 Grouting, Guniting & Shotcreting

Do's

- Many of the hazards of these operations are common to concreting operations, and therefore above precautions are applicable in these operations also.
- Only experienced men shall be employed for these operations, being a special type of concrete work.
- The nozzle men and helper shall be provided with cup type safety goggles, and shall use them as protection against rebound material.
- All other workmen shall be excluded from the immediate working area.
- If working on heights the workmen shall use safety belt and fall arrester.

5.7 Structural Steel Erection

Do's

- All employees working in places where they are exposed to falling hazards shall use safety belts and fall arresters.
- Whenever workmen are exposed to unusual falling hazards from which it is impracticable to prevent them by temporary floors or scaffolds, a safety net and fall arrester shall be suspended below the place where men are working.
- Hard hats shall be worn by employees working on or around erection operation and shall be worn with chin straps fastened.
- Gloves of a suitable type shall be worn when handling steel cables or other rough or sharp edged materials.
- Goggles shall be worn when grinding, chipping, scrapping, caulking, cutting etc.
- Good footwear shall be worn by all employees and the soles shall be kept free from mud and grease. Safety toe shoes shall be worn at all times.
- All other precautions as mentioned in Clause 11.8 of Safety Manual shall be followed during structural steel erection.

5.8 Welding and Cutting

Do's

- All welding and cutting shall be done by thoroughly trained workmen.
- Welders and helpers shall wear non-combustible helmets and gloves during welding operations.
- They shall wear clothing free from grease, gasoline, oil and other flammable materials.

- For detailed safety precautions in respect of welding and cutting operation, Section 11.9 of Safety Manual be referred.
- All welding operations should be carried out in a well ventilated space, and wherever required, exhaust system should be installed.

Don'ts

- Welding and cutting shall not be done in the immediate proximity of flammable materials.
- Do not keep the gas cylinder near the naked flame and never lubricate its valve or other fittings.

6.0 ELECTRICAL WORKS

Do's

- Install lightening arrestors in high structures.
- Provide Circuit Breakers with over current and instantaneous trip mechanism.
- Regularly check oil level in transformers.
- Keep safe clearance from electrical aerial lines.
- Use fuse wires of proper amperage according to the load on the line.
- Use gloves while working on lines having high current.
- Ensure that the ironclad equipment such as the main switch, the section isolators and junction boxes are in perfect working order.

- Ensure that the electrical installations safely carry the electric load without over heating the installation.

- Ensure that the broken fittings and enclosures are immediately repaired.

- All the equipment should be perfectly grounded with proper double Earth Line and these equipment should never be overloaded.

- Ensure that proper contacts are established by the switches.

- All terminal connections should be tight to avoid arching.

- Avoid joints in the wiring. All necessary joints should have proper tapes / insulation.
- Provide proper earthing in all buildings, machines, and electrical appliances.
- Dim or flickering lights, sparks, buzzing sound from electrical appliances are signs of potential hazards, in such case contact qualified electrician immediately.
- Do wear rubber soled shoes while operating on electrical lines & equipment
- Use wires compatible with the equipment rating, maintain sufficient margin.
- Keep electrical cords away from sources of heat.
- After completing electric wiring, insulation resistance should be measured with the help of megger and reported in the Test Report.
- Use a dry chemical fire extinguisher or baking soda to arrest an electrical fire. If it's safe to do so, unplug the appliance first.
- In case of fire from electrical circuits, switch off the supply immediately and use sand, carbon dioxide or dry powder extinguishers. Do not use water.
- Call the local emergency number if you see a person receiving an electrical shock and who is seized on an appliance or a wire.

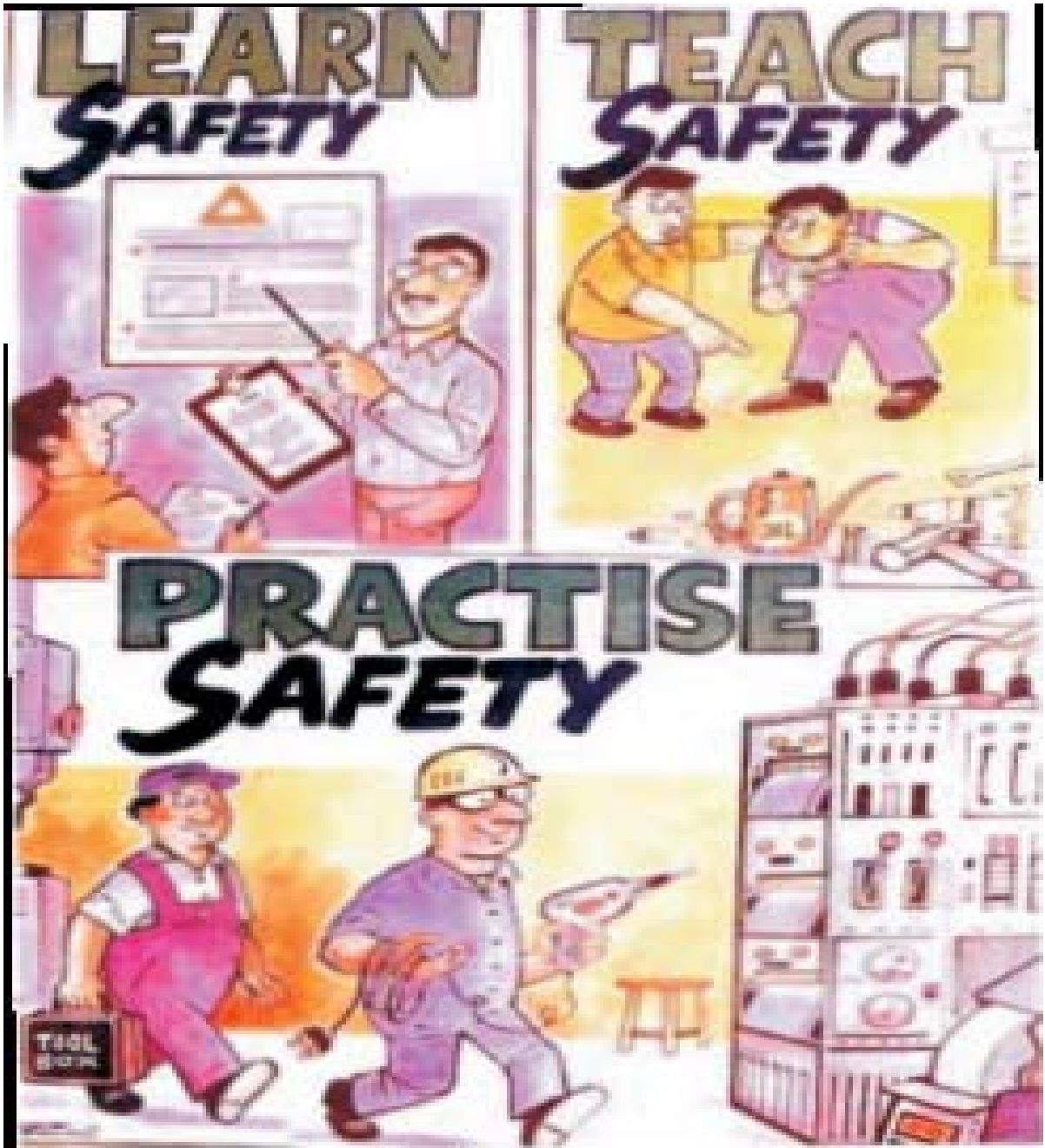
Don'ts

- Do not make temporary connections with loose or hanging wires around.
- Do not make loose connections. Do not insert naked wires into socket. Use proper plug for each equipment with earth connections.
- Never use metallic ladders in electric work or near the electrical equipment.
- For lighting the welding torch flame do not use a matchstick, always light it with a friction lighter.
- Do not have poor insulations, misuse or over loading.
- Fuses should never be bridged.
- Don't use appliances that have damaged electrical cords – there's a risk of shock.
- Don't run cords under carpets.
- Don't use any appliance, heater, electric iron, cooler without proper earthing.
- Don't use higher size fuse wire than the prescribed size.
- Don't insert more than one plug in socket. While removing pin from plug socket, pull the plug top and not the wire.

- Do not allow electric wires, lamps holders, switches and other accessories to get wet or damp.
- Do not provide switches in vibrating places because vibrations may make the connections loose.
- Do not touch a person receiving electric shocks. Switch off the supply and then remove him either with cloth, paper or wood. Keep the person warm and give him artificial respiration and immediately consult a doctor.
- Do not touch electric pole, climb the tower or try to remove foreign objects from overhead lines.
- Do not wear metallic belts, chain, buttons, ornaments or keep metallic tools, knife etc. in your pockets while working on electrical equipment / lines.
- Don't use water on the electrical equipment, to extinguish the fire, switch OFF the supply.



Different types of Construction Safety Belts



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