

Sub: Construction Management System - Circular No. - 17.

Ref: Guidelines for safety during execution of works.

In addition to the Cost, Time & Quality, the safety is also one of the important components of the construction management. The safety should not be compromised in any construction activity. The term "Safety" is defined as "A thing is provisionally categorized as safe if its risks are deemed known and, in the light of that knowledge, judged to be acceptable".

The most important ingredient in a safety program is the quality of the people and quality of their training. Safety is habit that can only be developed through repetition. Good habits are only developed by constant trainings in task in correct manner until the act is performed in a safe manner. It is therefore envisaged that stress shall be given on complying safety measures during construction and on-site training for the working staff.

1. Safety in Excavation and trenching

- (a) All trenches, 1.5 metres or more in depth shall at all times be supplied with at least one ladder for each 30 metres in length or fraction thereof.
- (b) Ladder shall be extended from the bottom of the trench to at least 1 metre above surface of the ground. Sides of a trench which is 1.5 metres or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides collapsing. Excavated material shall not be placed within 1.5 metres of the edge of a trench or half of the depth of the trench, whichever is more.
- (c) Cutting shall be done from top to bottom. Under no circumstances shall undermining or undercutting should be done.
- (d) **Minimum Check and Clear Edge of Trench** -There is a tendency to dump the excavated material just on the edge of the trench when excavation is done manually. The material may slide back into the trench or apply additional load on shoring. A provision of clear berm of a width not less than one third of the final depth of excavation is recommended. In areas where this width of the berm is not feasible, the reduced berm width of not less than one metre should be provided. It is always better to provide substantial toe board to prevent 'roll back' into the trench.

Plant and Machinery

- (e) The excavation equipment should be parked at a distance of not less than the depth of the trench, or at least 6 metres away from excavated sides for trenches deeper than six metres.
- (f) With the use of power shovels and draglines, the banks of trenches become unstable and thus dangerous for persons working nearby. These conditions should be watched and suitably remedied.
- (g) The vehicles should not be permitted to be driven too close to the pit. Care should be taken for locating roads leading to or from the pit. While loading manually, the vehicle should not be taken too near the wall of the pit. Use of

post legs will reduce the risk of accidents where the vehicle is reversed for loading.

- (h) Workers should be provided with proper tools. Overlooking the importance of providing the right tools and protective gears for the job is perhaps the most serious risk to workers.
- (i) Workers using tools should guard against the danger arising out of the sudden movement of material which may throw them off balance. They should be adequately spaced to avoid being accidentally struck by tools of others working nearby.

Fencing

- (j) Where deep excavation is going on and there is likelihood of the public or cattle frequenting the area, suitable protective fencing should be erected and also sufficient number of notice boards and danger signals should be provided to prevent accidents by falling in excavated trenches/pits.
- (k) For excavated sites close to public roads/pathways, the area notice boards should have lights during darkness hours.
- (l) Barriers or covering should be provided to excavations, shafts, pits and openings having a vertical fall distance of more than 2 metres, except during the period necessary for the access of persons and movement of plant, equipment and materials.

Shoring

- (m) As far as possible, the installation of shores should be done from the surface.
- (n) The trench jack or horizontal braces should never be used as a ladder for getting in or out of a trench as they are not designed to take vertical load.

Removal of shoring

- (o) When the removal of shoring is planned, the possible collapse of trench sides should be anticipated. The newly installed utility line will then be safeguarded in the normal course by being covered with loose or compact fill before the shores are removed. If the trench is likely to cave in on removal of the shores, it can be filled up to the bottom with horizontal brace. It is a safe way for the worker to go down on the ladder and remove this brace, after which additional trench space can be filled up to the next horizontal brace or screw jack.
- (p) If the trench is to stay after the removal of shoring, the ladder should not be removed till all work within the trench is completed and the newly installed utility line has been protected or covered.

Access and Escape

- (q) The workers should be able to escape fast in the event of any mishap during excavation. It is recommended that one ladder should be provided for every length of 15 metres or fraction thereof in the case of relatively less hazardous work.
- (r) Quite often the pathways become slippery due to accumulation of mud, sand or gravel. This should be avoided. Further, the pathways should be strong enough to withstand the intended use.

Additional Precautions

- (s) The precautions should be taken of the power lines, cables during excavation and other operation. The alignment should be checked properly prior to excavation for any power cable etc.

- (t) Ignorance and carelessness are major causes of accidents. Tendency to employ cheaper unskilled workers for jobs requiring proficiency and skill can lead to accident. This should not be permitted.
- (u) Water for construction activities, rain water and water flowing in the drains are major cause of slides. Proper arrangement of diversion/ bailing out of such water should be done.

2. Barricading, diversions, display boards for safety

The adequate & proper barricading shall be provided at site to have proper safety and facilitation to traffic / inhabitants in their day to day activities and should be decided by the Engineer in-charge to follow adequate safety measures based on prevailing site conditions.

It should be ensured that the barricading has been carried out properly and display boards for diversion, warning, work in progress, schedule of completion of activity in the area are displayed at required places and proper lighting arrangement at work sites are made during night for convenience & safety of the public.

3. Safety during Execution of Overhead Civil Works.

The Over head works should be pre-planned and properly supervised in respect of safety. Adoption of pre-determined safety measures will not only prevent or reduce accidents but also promote quicker and risk-free working of labour resulting in increased efficiency along with reduced costs of construction.

(a) General safety requirements

- i. All workers shall be physically and psychologically fit and have the necessary knowledge and experience for such work. They shall be provided with safety helmets, safety boots and proper clothing when work at higher elevations is in progress.
- ii. Nylon safety-mesh shall enwrap working platforms of high-rise structures like overhead service reservoirs etc.
- iii. Over head works should not be carried on in-weather conditions that threaten the safety of workers.
- iv. Elevated workplaces should be provided with safe means of access and egress such as stairs, ramps or ladders.
- v. Elevated workplaces, including roofs more than 2 m or as prescribed, above the floor or ground should be protected on all open sides by guard-rails and toe boards. If guard-rails are not practicable, persons employed at elevated workplaces including roofs should be protected by means of adequate safety nets/ safety sheets or platforms, or be secured by safety harnesses with lifelines securely attached.
- vi. Crawling boards, walkways and roof ladders should be securely fastened to a firm structure.
- vii. Scaffolds shall be provided for all work that cannot be safely performed from the ground, or from solid construction or other equally safe and suitable provision should be made.
- viii. "Men working overhead" signboards shall be placed around structures on which work is in progress at higher elevations.
- ix. The construction site should be properly managed for storage of materials and equipment; and removal of scrap, waste and debris at appropriate intervals.

(b) Scaffolding:

Scaffolding and lifting appliances for e.g. hoists, cranes etc. are essential construction equipment for overhead civil works which needs to be designed, installed and operated properly.

The scaffolding needs compliance of certain safety practices not only for the security of the men employed on the scaffolds but also for the safety of those who may be working or passing below. The accidents from the scaffolds are generally caused either as a direct collapse of the scaffold or as a result of workmen or any material falling down. Great care is therefore necessary in the erection, use and dismantling of scaffolds with respect to its various components. The following safety norms and precautions should be taken while using the scaffolds and lifting appliances:

- i. Every scaffold of suitable and sound material and of adequate size and strength should be properly designed, constructed, erected and maintained so as to prevent collapse or accidental displacement when properly used.
- ii. Scaffolds should be inspected before being taken into use and at least at an interval of 15 days / after any alteration, interruption in use, exposure to weather or seismic conditions / any other occurrence likely to have affected their strength or stability.
- iii. The scaffold may be constructed either of timber or metal. Timber used in the construction of the scaffolds should be reasonably straight, sound, free from splits, shakes and large cracks, large knots, dry rot, worm holes and other prohibited defects and shall be conforming to IS: 3629-1966. Metal scaffolds shall conform to IS: 2750-1964.
- iv. The use of barrels, boxes loose tile blocks or other unsuitable objects as supports for working platforms shall not be permitted.
- v. Every platform, gangway, run or stairs shall be securely fastened in place and be kept free from any unnecessary obstruction, material, rubbish and projecting nails.
- vi. The use of cross braces or framework as means of access to the working surface shall not be permitted.
- vii. The supporting member shall be placed on a firm, rigid, smooth foundation of a nature that will prevent lateral displacement.
- viii. If scaffolds are to be used to a great extent or for a long period of time, a regular plank stairway wide enough to allow two people to pass shall be erected. Such stairways shall have handrails on both sides.
- ix. Grease mud, paint gravel or plaster or any such hazardous substances shall be removed from scaffolds immediately. To prevent slipping on the platforms, either sand or saw dust or other suitable material shall be spread.
- x. Ladders, boards and planks used in scaffolds should not be painted so that any defects are visible.
- xi. Where persons are required to work or pass underneath a scaffold upon which men are working, a screen or canopy should be provided for their protection from falling objects. Such overhead screens should be of adequate strength and dimensions.
- xii. Scaffolding materials should not be thrown from scaffolds or from heights.



xiii. **Metal scaffolds** should not be erected in closer proximity than 5m to **overhead electricity** transmission lines equipment. It should be ascertained that no un-insulated electric wire exist within 3m from working platform, gangway ,etc, of the scaffold.

xiv. While carrying bars, rods or pipes of any kind conducting material of length greater than 3 m, in the vicinity of electric wires, special care shall be taken that these do not touch the electric wires.

xv. Care shall be taken to see that no part of a scaffold is struck by a truck or other heavy moving equipment.

(c) Means of Access:

During construction of overhead structures, a safe and convenient means of access should be provided to all platforms. The means of access may consist of (a) Ladder (b) Ramp (c) Stairway. The following safety norms should be followed while using means of access:

i. Portable Ladder should be placed at the angle of approximately 75° from the horizontal. The top and bottom of Portable Ladder should be secured to prevent displacement. The ladder rails should be extended at least 1 m above the top landing.

ii. Fixed ladders should be provided for flights above 4 m. The width of the ladder should not be less than 30 cm and the rungs shall be spaced not more than 30 cm.

iii. Stairways are the safest means of access for scaffolds exceeding 4 m height. Treads and risers of stairways, in any one flight, should be of uniform width and height. The minimum width of stairway shall be 1.0 m. There should be no unbroken vertical rise of more than 4 m. The maximum angle of ascent should be 50 degrees.

(d) Lifting Appliances:

In case of overhead structures, the lifting appliances are generally used for transportation of material. Hoists and Cranes are main lifting appliances used in the overhead structures. Following norms should be followed installation, operation and dismantling of lifting appliances:

Hoists

i. The complete hoist-way throughout its height shall preferably be enclosed with wire mesh in order to contain the accidentally dislodged material from the hoist platform.

ii. There must be only one operating position for the hoist and the driver must be trained in the job, able to see the platform of the hoist throughout its travel.

iii. All materials carried on the platform must be so placed as not to be dislodged and any moveable equipment, wheel-barrows etc. must be stopped.

iv. The safe working load must be plainly marked on the hoist and never exceeded.

v. Every hoist must be fitted with an automatic device which will support the platform in the event of any failure of the ropes or gear.

vi. Every hoist must be inspected once a week and wire ropes of hoist should be checked frequently.

Cranes

- vii. No crane should be used unless a competent person has inspected and tested it and furnished a certificate specifying the maximum safe working load.
- viii. Access to and exit from the operator's stand should be safe from any position of the crane.
- ix. Cranes should not be used to pullout fixed objects, with a slanting pull, drag objects or move vehicles.
- x. Before being put into use for the first time, jib cranes with variable radius should undergo tests of stability and of all movements such as travel, swinging, raising and lowering the load, braking the crane and braking the load.
- xi. Jib cranes should not be operated in dangerous proximity to electric power lines.

4. **Safety in Construction during Monsoon.**

Almost in all packages, excavation and refilling of earth are common activities, which if not carefully executed may pose problems to the safety of works as well as passerby's and road users during the impending Monsoon. Normal to heavy rainfall event may affect our ongoing works in different manners. It should be our endeavor to ensure that such events do not prove to be problematic to people and structures in particular. A separate circular should be sent to all contractors to ensure safety of citizens and works during rainy season citing provisions of Agreement and BIS. During monsoon EE IPIU should ensure that any further excavation work is taken up only after ensuring that the earlier work is in safe stage. It is desired that ACM-DSC & EE IPIU should inspect all sites during rains. Some of the probable occurrences are discussed below.

(a) **Water Supply and Wastewater Works**

- i. The settlement in refilled trenches of sewerage and water supply lines may occur during monsoon. ACM DSC and EE IPIU should inspect all sites and oversee the arrangements to effectively deal with the eventuality after a storm to identify such reaches and take immediate corrective action by refilling and compacting. The contractor should be asked to designate an engineer / supervisor by name to look after this activity during monsoon.
- ii. The contractor's crew should be equipped with vehicle, gum boots, raincoats and T&P to tackle such situation during and after rains. Adequate quantities of earth, debris and gravel should be stacked at strategic places so that no time is lost in procuring such material.
- iii. In trenches where pipe laying has been done and duly tested and approved, refilling should be done soon after and all surplus material relocated to safe disposal sites such that it does not obstruct traffic or waterways.
- iv. The execution of works having deep excavation in smaller lanes and congested areas should be completed well before monsoon. The works of deep excavation during monsoon should not be preferably taken up or extensive care should be taken for execution of such works.
- v. All open ends of WS and WW pipelines should be firmly plugged to prevent debris from entering the pipeline. Manhole covers of sewer lines should be fixed in place to avoid any harm to road users.

(b) Drainage works

- i. Any unutilized construction material lying in the body of the drain should be relocated to allow free passage of storm water.
- ii. Wherever diversion of flow is being done, more pumps should be installed with adequate standby pumps to cater to increased flow.
- iii. All surplus earth should be suitably and immediately be relocated to give smooth passage to rain water in drain and also to prevent debris and earth from falling into the drain so that choking does not occur.
- iv. Culverts and CD works should be completed on priority for smooth flow and disposal of the storm water.
- v. There should not be any sudden or abrupt transition in constructed walls and floors at the point of discontinuity. The niches and depressions should be temporarily filled with rubble to provide smooth transition to prevent eddy formation.

(c) Buildings, Roads & other works

- i. Proper drainage arrangements should be ensured in and around buildings for speedy disposal of storm water in a manner that any loss to already constructed works and adjoining property is minimized.
- ii. Culverts and CD works should be completed on priority or to be raised to safe levels in a manner to eliminate any hazards to road users and adjoining property.
- iii. Any rain cuts observed after rains should be immediately attended and restored to original condition.

(d) Storage of Steel & Cement

- i. These are very vital ingredients for quality construction work but in absence of proper storage, especially during monsoon, cement and steel may rapidly decline in quality and strength.
- ii. Care should be taken to protect these materials during wet weather by proper storage and use of any exposed material should be allowed only after conducting fresh tests. use of any apparently affected material should be done after permission of EE IPIU.

5. Site Clearance

The surplus material lying at site after completion of the work creates inconvenience to the citizens. The incharge package should specifically ensure that after completion of work no surplus material is there and in the ongoing works the surplus material is properly placed. It should be clearly understood that there should be no hindrance in the public safety and traffic convenience and the Contractor shall be compelled to ensure that no public inconvenience is caused due to excavation, stacking of excavated material, storage of material during execution etc.

6. In house and on-site Trainings

DSC's should conduct trainings monthly at every work contract for assurance of quality, safety and environmental & social safeguards. The staff of IPIU; supervising staff of DSC & Contractor, technicians, operators and labour at site should be given on site training so that the personnel engaged on the supervision of the contract should be fully conversant with the safety parameters and

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environmental & social safeguards, its documentation and techniques of supervision.

7. Reporting the Occurrence of Accident

- (a) Where any dangerous occurrence or an accident leading to the death of a worker takes place at a construction site, the site in charge should report this occurrence or fatal accident as the case may be, within 4 hours of the happening, by telephone, special messenger or telegram, to EE IPIU; Asstt. Construction Manger of town & Team Leader DSC; District Magistrate or Sub-Divisional Magistrate in whose jurisdiction the site lies; The Officer in-charge of the nearest police station; Workmen's Compensation Inspector, or in his absence the Factories Inspector concerned and; the nearest relative of the deceased person, in the case of fatal accident. The notice so given should be confirmed by the site in charge to the authorities mentioned above within 12 hours of the taking place of any such accident or occurrence.
- (b) If in the case of an accident, the injured person subsequently dies due to such accident, the information of his death, wherever known, should be sent by the site in charge to the earlier mentioned authorities, within 24 hours of the death. This procedure will also apply where an accident results in loss of any part of the body or any limb, severe burns or scalds or unconsciousness.
- (c) Whenever a worker reports that he has received an injury at the work place, the site engineer should take the following action:
- ✓ Arrange to render first aid on the spot and make an entry in the first aid register as well as the accident register.
 - ✓ If the injury received is serious i.e. crushing, burning, breaking of any limb or any part of the body, unconsciousness, danger of loss of any part of the body or a limb etc.
 - Render first aid and make entry in the first aid register as well as the accident register.
 - Send the injured person to the Medical Officer/dispensary/hospital in a vehicle/ambulance, accompanied by another person.
 - Report the accident to the four prescribed authorities within 12 hours.

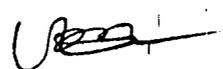
This circular should be abided by all the members of PMU, IPIU, IRMC and DSC.

4-11-08
(Karni Singh Rathore)
Project Director

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Copy to following for information and necessary action:

1. Addl. PD -I & II/ FA/ Dy. PD (T)/ Dy. PD (Adm.)/ SE (WW)/ WS / PO (all)/ Sr. AO / All APOs / AAO/ PA to PD PMU, RUIDP, Jaipur.
2. Chief Engineer, PIU, Bisalpur, RUIDP, Jaipur.
3. SE Jodhpur, Executive Engineer/APO's, IPIU, RUSDIP (Concerned), Alwar, Baran-Chhabra, Barmer, Bharatpur, Bundi, Chittorgarh, Churu, Dhaulpur, Jaisalmer, Jhalawar-Jhalarapatan, Karauli, Nagaur, Rajsamand, Sawai Madhopur and Sikar.
4. Team Leader IPMC, DSC-I, Bharatpur, DSC-II, Nagaur, DSC-III, Jhalawar, RUSDIP.
5. DSC-I, Alwar/ Dhaulpur/ Karauli/ Sawai Madhopur, DSC-II, Churu/ Jaisalmer/ Barmer/ Sikar and DSC-III, Chittorgarh/ / Rajsamand/ Bundi/ Baran, RUSDIP.
- ✓ 6. ACP, RUIDP, Jaipur to send by e-mail and put up the Guidelines on the website.


Dy. Project Director (T)