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*Indian Standard*

# SAFETY CODE FOR CONSTRUCTION, OPERATION AND MAINTENANCE OF RIVER VALLEY PROJECTS

## PART 6 CONSTRUCTION

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INDIAN STANDARDS INSTITUTION
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## PART 6 CONSTRUCTION

Safety in Construction, Operation and Maintenance of River Valley Projects Sectional Committee, BDC 67

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House No. 472, Sector 6
Panchkula ( Haryana )

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# SAFETY CODE FOR CONSTRUCTION, OPERATION AND MAINTENANCE OF RIVER VALLEY PROJECTS

## PART 6 CONSTRUCTION

## 0. FOREWORD

**0.1** This Indian Standard ( Part 6 ) was adopted by the Indian Standards Institution on 18 April 1983, after the draft finalized by the Safety in Construction, Operation and Maintenance of River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** With large scale increase in construction activity on river valley projects involving hazardous construction jobs, there has been an increase in the number of accidents, both major and minor ones. Further, increased construction activity in the underground jobs has created health hazards for the persons working under such conditions. In order to minimize such accidents and health hazards, it shall be the overall responsibility of the project authorities and contractors to provide necessary measures for the safety and health protection of all employees working on the projects.

**0.3** It shall be the responsibility of the employer, that is government or contractor, to initiate and maintain such programmes in respect of their employees working on a project scheme.

**0.4** Each employer/department, contractor and employee shall comply with the different safety regulations in force on a project and shall be alert at all times to eliminate hazards to himself/herself and/or to others.

**0.5** This standard requires reference to the following standards:

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|---|---|
| IS : 1989 ( Part 1)-1978 | Leather safety boots and shoes: Part 1 For miners ( *third revision* ) |
| IS : 2750-1964 | Steel scaffoldings |
| IS : 2925-1975 | Industrial safety helmets ( *first revision* ) |
| IS : 3696 (Part 2)-1966 | Safety code for scaffolds and ladders: Part 2 Ladders |
| IS : 4041-1967 | Glossary of terms relating to refractory materials |

| | |
|---|---|
| IS : 4770-1968 | Rubber gloves for electrical purposes |
| IS : 6994 (Part 1)-1973 | Industrial safety gloves: Part 1 Leather and cotton gloves |
| IS : 8519-1977 | Guide for selection of industrial safety equipment for body protection |
| IS : 8520-1977 | Guide for selection of industrial safety equipment for eye, face and ear protection |
| IS : 8521 (Part 1)-1977 | Industrial safety face shields: Part 1 With plastics visor |
| IS : 8523-1977 | Respirators, canister type ( gas masks ) |
| IS : 8807-1978 | Guide for selection of industrial safety equipment for protection of arms and hands |

## 1. SCOPE

**1.1** This standard ( Part 6 ) lays down the safety requirements regarding scaffolds, platforms, gangways and runs, ladders, ramps, openings, dangerous corners, forms for concrete, grouting and guniting, structural steel erection, welding, riveting and cutting, painting storage of materials like cement, pipes, poles, steel, sand, gravel, crushed stone, paints, etc.

## 2. FALSE WORK/SCAFFOLDS

**2.1** Suitable scaffolds shall be provided for workmen for all jobs that cannot safely be done from ground, from part of permanent structure, from a ladder or any other available means of access.

**2.2** Scaffoldings or stagings, which are more than 3.25 metres above the ground or floor, swung or suspended from an overhead support or erected with stationary support, shall have a guard rail, properly bolted, braced or otherwise secured at least 1 metre above the floor or platform of such scaffoldings or stagings and shall extend along the entire length of the outside and end thereof with only such openings as may be necessary for the delivery of materials.

**2.3** The scaffoldings or stagings shall be so fastened as to prevent it from swaying away from the structure. Alternatively, the scaffolds shall be so designed as to be self supporting under all live loads.

## 3. PLATFORMS, GANGWAYS AND RUNS

**3.1** Working platforms, gangways and runs shall be so constructed that they do not sag unduly or unequally. If the heights of platform gangways and runs are more than 3·25 metres above the ground level or floor level, they shall be closely boarded and shall have adequate width as specified in IS : 3696 ( Part 1 )-1966* and be suitably fenced as described in **2.2** and **2.3**.

**3.2** The slopes of platforms, gangways and runs shall conform to IS : 3696 (Part I)-1966*.

## 4. LADDERS

**4.1** The ladder may be made of either steel complying with IS : 1977-1975† or wood complying with relevant Indian Standards. Rope for ladder shall conform to the requirements for Grades I ropes as laid down in IS : 1984-1969‡ or IS : 1410-1973§.

**4.2** Suitable hand holds of good quality wood or steel shall be provided, and the ladder shall be given an inclination not steeper than ¼ horizontal to 1 vertical. The steps shall be rigidly fastened at the ends with the supporting steel or timber.

**4.3** To prevent slipping, ladder shall be secured at the bottom end. If this cannot be done, a person shall be stationed at the base, whenever it is in use.

**4.4** If the ladder is used for carrying materials, suitable footholds shall be provided on it.

**4.5** Width between side rails in a rung ladder shall in no case be less than 30 cm for ladders up to and including 3 metres in length. For longer ladders this width shall be increased by at least 6 mm for such additional 30 cm of length.

**4.6** Uniform step spacing shall not exceed 30 cm.

**4.7** Ladders shall extend atleast one metre above the top of the floor or platform, to provide hand hold when stepping on or off the ladder.

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*Safety code for scaffolds and ladders : Part 1 Scaffolds.

†Specification for structural steel ( ordinary quality ) ( *second revision* ).

‡Specification for manila ropes ( *second revision* ).

§Specification for coir rope ( *first revision* ).

## 5. RAMPS

**5.1** Ramps shall be of adequate strength and shall be evenly supported. They shall have railing on the open side(s), and adequate strength to protect workmen, and shall either have a sufficiently flat slope or shall have cleats fixed to the surface to obviate slipping of workmen.

**5.2** Rumps shall be kept free from grease, mud, snow or other slippery materials and also other obstructions leading to accidental fall of the labourers.

**5.3** Ramps meant for transporting materials shall have even surface, sufficient width and be provided with skirt boards on open sides.

## 6. OPENINGS

**6.1** Every opening in the floor of a structure or in working platform shall be provided with suitable means like fencing or railing whose minimum height shall be 1 metre to prevent the fall of persons or materials.

**6.2** Wherever there are open excavations in ground, they shall be fenced off by suitable railing, if necessary, with toe boards.

**6.3** Danger signals shall be installed at night so as to prevent the fall of persons or to prevent persons slipping into the open excavation.

## 7. DANGEROUS CORNERS

**7.1** At all approaches and exits, and dangerous corners, danger and warning signals shall be placed to ensure safety of pedestrians and vehicular traffic.

**7.2** In case of platforms, gangways, runs and ramps, dangerous corners shall be protected with fencing or railing whose minimum height shall be 1 metre; if necessary, they may be protected with toe boards.

**7.3** All dangerous corners shall be well lighted for night work.

## 8. FORMS FOR CONCRETE

**8.1** Formwork shall be designed after taking into consideration spans, setting temperature of concrete, dead load and working loads to be supported and adequate safety factor for the materials used for formwork.

**8.2** All timber formwork shall be carefully inspected before use and all unacceptable material shall be discarded.

**8.3** As timber centering usually takes an initial set when vertical load is applied, the design of such centering shall make allowance for this factor.

**8.4** The vertical supports shall be adequately braced or otherwise secured in position so that these do not fail when the load gets released or when the supports are accidentally hit.

**8.5** In case of timber posts, vertical joints shall be properly designed. The connections shall normally be with bolts and nuts. Use of rusted or spoilt threaded bolts and nuts shall be avoided.

**8.6** Tubular steel centering shall be used in accordance with the manufacturer's instructions. When tubular, steel and timber centering is to be used in combination, necessary precautions shall be taken to avoid any unequal settlement under load.

**8.7** A thorough inspection of tubular steel centering is necessary before its erection and members showing evidence of excessive rusting, kinks, dents or damaged welds shall be discarded. Buckled or broken members shall be replaced. Care shall also be taken to see that the locking devices are in good working order and that the coupling pins are effectively aligned to frames.

**8.8** Sills under the supports shall be set on firm soil or other suitable material in a pattern which assures adequate stability for all props. Care shall be taken not to disturb the soil under the support. Adequate drainage shall be provided to drain away water coming due to rain, washing of forms or during the curing of the concrete, to avoid softening of the supporting soil strata.

**8.9** All centerings shall be regularly inspected to ensure that footings of sills under every post of centering are sound, the centering panels are plumb in both directions and all cross braces are securely in place.

**8.10** During pouring of concrete, the centering shall be constantly inspected and strengthened if required, and wedges below the vertical supports shall be tightened. Adequate protection of centering shall be ensured from moving vehicles or swinging loads.

**8.11** Forms shall not be removed earlier than the limit laid down in the specifications and not until it is certain that the concrete has developed sufficient strength to support itself and all loads that will be imposed on it. Only workmen actually engaged in removing the formwork shall be allowed in the area during these operations. Those engaged in removing the formwork shall wear helmets, gloves and heavy soled shoes, and approved safety belt if adequate footing is not provided above 2 m level. While cutting any wires in tension, care shall be taken to prevent back lash which might hit the body.

**8.12** Dismantling of supports shall be done under the supervision of a competent engineer and the order of dismantling of individual supports laid down in the instruction sheets shall be closely followed.

## 9. GROUTING AND GUNITING

**9.1** Pressure used in grouting must be carefully regulated and shall conform to IS : 6066-1971* at all times during the process of injection.

**9.2** Record gauges for measuring pressure shall always be fixed at the top of the grout hole. They shall be checked frequently against standard water gauge.

**9.3** Grouting equipments shall be in accordance with IS : 6066-1971* and also shall be free from patent defects and kept in good repair condition and working order.

**9.4** Workers engaged in grouting and guniting shall be provided with protective clothing, hand gloves, sleeves, boots, safety hats and safety glasses conforming to the relevant Indian Standards.

## 10. STRUCTURAL STEEL ERECTION

**10.1** During erection, the steel work shall be securely bolted or otherwise fastened and when necessary, temporarily braced to provide for all loads to be carried by the structure during erection including those due to erection equipment and its operation ( *see* IS : 7205-1973† ).

**10.2** No riveting, permanent bolting or welding shall be done until proper alignment has been obtained.

**10.3** Use of hoisting machines, cranes, winches and tackle including their attachments, anchorages, supports and foundations shall conform to the conditions specified in **10.3.1** to **10.3.7.**

**10.3.1** These shall be of good mechanical construction, sound material, of adequate strength, free from defects and shall be kept in good repair condition and working order.

**10.3.2** Every rope used for hoisting or lowering materials or as means of suspension shall be of durable quality, of adequate strength and free from patent defects.

**10.3.3** Every crane driver or hoisting appliance operator shall be qualified for the job and no person under the age of 18 years shall be in charge of any hoisting machine, crane, winch, signalling equipment, etc.

**10.3.4** In case of every hoisting machine and crane, and every chain ring, hook, shackle, shovel and pulley block used in hoisting or as means of suspension, the safe working load shall be marked. No part of any

*Recommendations for pressure grouting of rock foundations in river valley projects.

†Safety code for erection on structural steelwork.

machine or any gear shall be loaded beyond the safe working load except for the purpose of testing.

**10.3.5** Motors, gears, transmissions, electric wirings and other dangerous parts of hoisting appliances shall be provided with efficient safeguards, hoisting appliances shall be provided with such means as will reduce the risk of any part of suspended load becoming accidentally displaced, to the minimum.

**10.3.6** All workers, engineers and suppervisors employed in erection work shall wear safety helmets conforming to relevant Indian Standards and shall be provided with necessary apparels, such as safety clothing, hand gloves, sleeves, boots.

**10.3.7** Unauthorised persons shall be kept away from the work area during erection operations. Red flags, or warning signs shall be strategically posted to assist in cautioning and instructing others. Authorised visitors shall be equipped with safety hats and be accompanied by a guide competent to keep the visitors out of dangerous situations.

## 11. WELDING, RIVETING AND CUTTING

**11.1** Welding and cutting operations shall be done by workmen thoroughly trained for the job or by trainees who are under competent supervision. Workers engaged in welding, riveting and cutting shall be provided with protective clothing, hand gloves, sleeves and boots as per relevant Indian Standards. Workers engaged in welding and cutting shall be provided with protective goggles conforming to IS : 1179-1967*.

## 12. PAINTING

**12.1** Paints containing lead or lead products shall not be used.

**12.2** The face masks in accordance with relevant Indian Standards shall be supplied to workers when paint is applied in the form of spray or when a surface having lead paint is dry rubbed and scrapped.

**12.3** Most paint materials are highly combustible and every precaution shall be taken to eliminate danger from fire. Packages containing paints, varnishes, lacquers or other volatile painting materials, shall be kept tightly closed when not in actual use and shall be placed where they shall not be exposed to excessive heat, spark, flame or direct rays of the sun.

*Specification for equipment for eye and face protection during welding (*first revision*).

## 13. STORING OF MATERIALS LIKE CEMENT, PIPES, POLES, STEEL, SAND, GRAVEL, CRUSHED STONE, PAINTS, ETC

**13.1** No materials on any of the work sites shall be so stacked or placed as to cause danger or inconvenience to any persons.

**13.2** Material shall be stored and stacked in such a way that it shall not slide down and cause hazards or danger to persons ( *see* IS : 7969-1975* and IS : 8989-1978† ).

**13.3** Materials dumped against walls or partitions shall not be stored to a height that will endanger the stability or exceed the resisting strength of such walls and partitions.

*Safety code for handling and storage of building materials.
†Safety code for erection of concrete framed structures.