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GLOSSARY OF TERMS
RELATING TO CEMENT CONCRETE

PART III CONCRETE REINFORCEMENT

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BUREAU OF INDIAN STANDARDS
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Indian Standard

GLOSSARY OF TERMS RELATING TO CEMENT CONCRETE

PART III CONCRETE REINFORCEMENT

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0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 25 February 1972, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Cement concrete is one of the most versatile and extensively used building materials in all civil engineering constructions. There are a number of technical terms connected with the basic materials for concrete, as well as the production and use of concrete which quite often require clarification to give precise meaning to the stipulations in the standard specifications, codes of practices and other technical documents. It has, therefore, become necessary to standardize the various terms and definitions used in cement and concrete technology and thus avoid ambiguity in their interpretations. The Sectional Committee has, therefore, decided to bring out a series of glossaries of terms relating to concrete and concrete materials.

0.3 For convenience of reference, the ' Indian Standard Glossary of terms relating to cement concrete ' has been grouped into the following twelve parts:

- Part I Concrete aggregates
- Part II Materials (other than cement and aggregate)
- Part III Concrete reinforcement
- Part IV Types of concrete
- Part V Formwork for concrete
- Part VI Equipment, tools and plant
- Part VII Mixing, laying, compacting, curing and other construction aspects
- Part VIII Properties of concrete
- Part IX Structural aspects
- Part X Tests and testing apparatus
- Part XI Prestressed concrete
- Part XII Miscellaneous

0.3.1 In addition to the above, two separate Indian Standards have been brought out concerning terminology relating to hydraulic cement and pozzolanic materials. These standards are IS : 4845-1968* and IS : 4305-1967†.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following publications:

BS 2787 : 1956 Glossary of terms for concrete and reinforced concrete. British Standards Institution.

BS 4340 : 1968 Glossary of formwork of terms. British Standards Institution.

ASTM Designation: C 125 Definitions of terms relating to concrete aggregate. American Society for Testing and Materials.

ACI No. SP-19 (1967) Cement and concrete terminology. American Concrete Institute.

ACI 617-1968 Recommended practice for concrete formwork. American Concrete Institute.

1. SCOPE

1.1 This standard (Part III) covers definitions of terms relating to concrete reinforcement.

2. DEFINITIONS

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Auxiliary Reinforcement — In a prestressed member, any reinforcement in addition to the reinforcements participating in the prestressing function.

2.2 Average Bond Stress — The force in a bar divided by the product of its perimeter and its embedded length.

2.3 Axle Steel — Steel from carbon-steel axles for railway carriage or automobiles.

2.4 Axle Steel Reinforcement — Plain or deformed reinforcing bars rolled from axle steel.

2.5 Band — Small bars or wire encircling the main reinforcement in a member to form a peripheral tie.

*Definitions and terminology relating to hydraulic cement.

†Glossary of terms relating to pozzolana.

- 2.6 Band Iron** — Thin metal strap used as form tie, hanger, etc.
- 2.7 Bar** — A metal member used to reinforce concrete.
- 2.8 Bar Bender** — A tradesman who cuts and bends steel reinforcement; or a machine for bending reinforcement.
- 2.9 Bar Chair** — A rigid device used to support and/or hold reinforcing bars in proper position to prevent displacement before or during concreting.
- 2.10 Bar, Deformed** — A reinforcing bar with manufactured surface deformations which provide a locking anchorage with surrounding concrete.

NOTE — IS : 1139-1966* and IS : 1786-1966† define the deformed bar as below:

Deformed Bar — A bar of steel provided with lugs, ribs or deformations on the surface of the bar to minimize the slippage of the bar in concrete, and for which the bond strength calculated from the load at a measured slip of 0.025 mm in accordance with IS : 2770 (Part I)-1967‡ exceeds that of a plain round bar of the same nominal size by 40 percent or more.

2.10.1 Nominal Size of Deformed Bar — The nominal size of a deformed bar is equivalent to the diameter or side of a plain bar having the same weight per metre run as the deformed bar.

2.11 Bar Mat — An assembly of steel reinforcement composed of two or more layers of bars placed at angles to each other and secured together by welding or ties.

2.12 Bar Support — See 2.9.

2.13 Bending Schedule — A list of reinforcement prepared by the designer or detailer of a reinforced concrete structure showing the shapes and dimensions of every bar and the number of bars required.

2.14 Bent Bar — Longitudinal reinforcement bent to pass from one face to the other of a member, to use steel efficiently for resistance of moment and diagonal tension, or for anchorage of the bar.

2.15 Billet Steel — Steel, either reduced directly from ingots or continuously cast, made from properly identified heats of open-hearth, basic oxygen, or electric furnace steel, or lots of acids Bessemer steel and conforming to specified limits on chemical composition.

2.16 Bond — Adhesion and grip of concrete or mortar to reinforcement or to other surfaces against which it is placed, including friction due to

*Specification for hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcement (revised).

†Specification for cold-twisted steel bars for concrete reinforcement (revised).

‡Methods of testing bond in reinforced concrete: Part I Pull-out test.

shrinkage and longitudinal shear in the concrete engaged by the bar deformations; the adhesion of cement paste to aggregate; adherence between plaster coats or between plaster and a substrate produced by adhesive or cohesive properties of plaster or supplemental materials; also in United Kingdom the arrangement of units in masonry and brickwork so that vertical joints are discontinuous.

2.17 Bond Length — The length of grip of a reinforcing bar.

2.18 Bond Strength — Resistance to separation of mortar and concrete from reinforcing steel and other materials with which it is in contact; a collective expression for all forces such as adhesion, friction due to shrinkage, and longitudinal shear in the concrete engaged by the bar deformations that resist separation.

2.19 Bond Stress — The force of adhesion per unit area of contact between two bonded surfaces, such as concrete and reinforcing steel or any other material, such as foundation rock; shear stress at the surface of a reinforcing bar, preventing relative movement between the bar and the surrounding concrete.

2.20 Bundle — Two or more coils or a number of lengths properly bound together.

2.21 Bundled Bars — A group of parallel reinforcing bars (not exceeding four) in contact with each other and enclosed in stirrups or ties and used as a reinforcing element.

2.22 Cage — A rigid assembly of reinforcement ready for placing in position.

2.23 Chair — See 2.9.

2.24 Compression Reinforcement — Reinforcement designed to carry compressive stresses.

2.25 Contact Splice — A means of connecting reinforcing bars in which the bars are lapped and are in direct contact.

2.26 Corner Reinforcement — Plaster reinforcement used at re-entrant or internal angles to provide continuity between two intersecting plaster planes; also reinforcement provided in reinforced concrete slab for torsion at unrestrained corners.

2.27 Corrosion — Disintegration or deterioration of concrete or reinforcement by electrolysis or by chemical attack.

2.28 Coupler

- a) A device for connecting reinforcing bars or prestressing tendons end to end, also known as end connector or lock splice.
- b) A device for locking together the component parts of a tubular metal scaffold (also known as a clamp).

2.29 Cover Block — Device which maintains reinforcement bars in proper position and at proper distance from each other and from the forms before and during concreting; or a device which keeps wall forms at a given distance apart before and during concreting.

2.30 Crack-Control Reinforcement — Reinforcement in concrete construction designed to prevent opening of cracks, but often effective in limiting them to uniformly distributed small cracks.

2.31 Crimped Wire — Wire which is deformed into a curve which approximates a sine curve as a means of increasing the capacity of the wire to bond to the concrete; also welded wire fabric crimped to provide an integral chair.

2.32 Cold Twisted Deformed Bar — A bar of steel produced by cold twisting a hot rolled bar and which has lugs, ribs or deformations on its surface in accordance with definitions for deformed bars in 2.10.

2.33 Deformed Bar — *See* 2.10.

2.34 Deformed Tie Bar — Deformed bar used to hold two slab elements in close contact.

2.35 Diamond Mesh — *See* 2.41.

2.36 Edge-Bar Reinforcement — Tension steel sometimes used to strengthen otherwise inadequate edges in a slab, without resorting to edge thickening.

2.37 Effective Area of Reinforcement — The area obtained by multiplying the normal cross-sectional area of reinforcement by the cosine of the angle between the direction of the reinforcement and the direction in which the effectiveness is required.

2.38 Effective Area of Reinforcement in Diagonal Bends — The area obtained by multiplying the normal cross-sectional area of the reinforcement by the cosine of the angle at which the band is inclined to the direction for which its effectiveness is considered.

2.39 Effective Reinforcement — Reinforcement of a section assumed to be active in resisting the applied stresses.

2.40 Elastic Limit — The limit of stress beyond which the strain is not wholly recoverable.

2.41 Expanded Metal — A metal network, often used as reinforcement in concrete construction, formed by suitably stamping or cutting sheet metal and stretching it to form open meshes, usually of diamond shape.

- 2.42 Field Bending** — Bending of reinforcing bars on the job rather than in a fabricating shop.
- 2.43 Hairpin** — A light hairpin shaped reinforcing bar used for shear reinforcement in beams, tie reinforcement in columns, or prefabricated column shear heads.
- 2.44 Heavy-edge Reinforcement** — Wire fabric reinforcement, for highway pavement slabs, having one to four edge wires heavier than the other longitudinal wires.
- 2.45 High Bond Bar** — *See 2.10.*
- 2.46 High Strength Steel** — Steel with a high yield point; in the case of reinforcing bars generally greater than 42 kgf/mm².
- 2.47 Hook** — A bend in the end of a reinforcing bar.
- 2.48 Hooked Bar** — A reinforcing bar with the end bent into a hook to provide anchorage.
- 2.49 Lap** — The length by which one bar or sheet of fabric reinforcement overlaps another.
- 2.50 Lapping** — The overlapping of reinforcing steel bars, welded wire fabric, or expanded metal so that there may be continuity of tensile or compressive stress in the reinforcing when the concrete member is subjected to flexural or tensile or compressive loading.
- 2.51 Lap Splice** — A connection of reinforcing steel made by lapping the ends of the bars.
- 2.52 Lateral Reinforcement** — Usually applied to the transverse hoops, links, or helical reinforcement in columns.
- 2.53 Load Transfer Assembly** — Most commonly, the unit (basket or plate) designed to support or link dowel bars during concreting operations so as to hold them in place, in the desired alignment.
- 2.54 Longitudinal Bar** — Reinforcement essentially parallel to the long axis of a concrete member or pavement.
- 2.55 Longitudinal Reinforcement** — *See 2.54.*
- 2.56 Main Bar** — Steel reinforcement designed to resist stresses resulting from design loads and moments, as opposed to reinforcement intended to resist secondary stresses.
- 2.57 Main Reinforcement** — *See 2.56.*
- 2.58 Mat** — *See 2.11.*

2.59 Mechanical Bond — The bond between concrete and reinforcing bars, attributed to keying or interlocking action other than adhesion.

2.60 Mesh — A series of longitudinal and transverse wires arranged substantially at right angles to each other and welded together at all points of intersection.

2.61 Mesh Reinforcement — Welded-wire fabric in either sheets or rolls, used to reinforce concrete.

2.62 Mill Scale — The oxide layer formed during the hot rolling of metals, such as that formed on hot-rolled reinforcing bars.

2.63 Negative Reinforcement — Steel reinforcement for negative moment.

2.64 Non-prestressed Reinforcement — Ordinary or high tensile strength reinforcing steel, as used in prestressed concrete construction, and subjected to no prestressing nor post-tensioning.

2.65 Offset Bend — Any bend in a reinforcing bar that displaces the centre line of a section of the bar to a position parallel to the original bar, in which the displacement is relatively small; commonly applied to column verticals.

2.66 Pencil Rod — Plain metal rod of about 6 mm diameter.

2.67 Plain Bar — A reinforcing bar without surface deformations, or one having deformations that do not conform to the applicable requirements.

2.68 Positive Reinforcement — Reinforcement for positive moment.

2.69 Proof Stress — The stress which is just sufficient to produce, under load, a non-proportional elongation equal to a specified percentage of the original gauge length; conventionally* the specified percentage is fixed at 0.1 or 0.2 percent.

2.70 Rail Steel Reinforcement — Reinforcing bars hot-rolled from standard T-section rails.

2.71 Reinforcement — Metal bars, wires, or other slender members which are embedded in concrete in such a manner that the metal and the concrete act together in resisting forces.

2.72 Reinforcement, Cold-Drawn Wire — Steel wire made from rods that have been hot rolled from billets, cold-drawn through a die; for

*IS : 1786-1966 ' Specification for cold-twisted steel bars for concrete reinforcement (revised) ' specifies this limit as 0.2 percent.

concrete reinforcement of small diameter, such as in sizes not less than 2 mm nor greater than 16 mm.

2.73 Reinforcement, Cold-Worked Steel — Steel bars or wires which have been rolled, twisted, or drawn at normal ambient temperatures.

2.74 Reinforcement Displacement — Movement of reinforcing steel from its specified position in the forms.

2.75 Reinforcement, Distribution Bar — Small-diameter bars, usually at right angles to the main reinforcement, intended to spread a concentrated load on a slab and to prevent cracking.

2.76 Reinforcement, Dowel-Bar — Short bars, extending approximately equally into two abutting pieces of concrete, to increase the strength of the joint.

2.77 Reinforcement, Expanded Metal Fabric — A form of reinforcement made by slitting a rolled steel sheet and then stretching it to form a diamond-shaped mesh.

2.78 Reinforcement, Four-Way — A system of reinforcement in flat slab construction comprising bands of bars parallel to two adjacent edges and also to both diagonals of a rectangular slab.

2.79 Reinforcement, Helical — Steel reinforcement forming a helix.

2.80 Reinforcement, High Tensile — Concrete reinforcing bars having a minimum yield strength or 0.2 percent proof stress above a specified value, such as 42 or 52 kgf/mm².

2.81 Reinforcement, Hoop — Binders in the form of rings (other than helical) round the main reinforcement in columns and piles.

2.82 Reinforcement, Lateral — Usually applied to the transverse hoops, links, or helical reinforcement in columns.

2.83 Reinforcement, Mesh — An arrangement of bars or wire normally in two directions at right angles, tied or welded at the intersections, or interwoven (*see also 2.78*).

2.84 Reinforcement Ratio — Ratio of the effective area of the reinforcement to the effective area of the concrete at any section of a structural member.

2.85 Reinforcement, Secondary — Reinforcement other than main reinforcement.

2.86 Reinforcement, Spiral — Coiled wire or bar held to a definite pitch or spacing.

2.87 Reinforcement, Transverse

- a) Links or helical reinforcement for columns.
- b) Reinforcement at right angles to the main reinforcement.

2.88 Reinforcement, Twin-Twisted Bar — Two bars of the same nominal diameter twisted together.

2.89 Reinforcement, Two-Way — Reinforcement arranged in bands of bars at right angles to each other.

2.90 Reinforcement, Welded — Reinforcement joined together by welding.

2.91 Relaxation (of Steel) — Decrease in stress in steel as a result of creep within the steel under prolonged strain; decrease in stress in steel as a result of decreased strain of the steel, such as results from shrinkage and creep of the concrete in a prestressed concrete unit.

2.92 Shear Reinforcement — Reinforcement designed to resist shear or diagonal tension stresses; dowels are not considered to be shear reinforcement.

2.93 Shrinkage Reinforcement — Reinforcement designed to resist shrinkage stresses in concrete.

2.94 Slab Spacer — Bar support and spacer for slab reinforcement.

2.95 Spacer — Device which maintains reinforcement in proper position, or wall forms at a given distance apart before and during concreting.

2.96 Spiral Reinforcement — See 2.86.

2.97 Splice — Connection of one reinforcing bar to another by overlapping, welding, mechanical end connectors, or other means.

2.98 Standard Hook — A hook at the end of a reinforcing bar made in accordance with a standard*.

2.99 Stirrup — A reinforcing device to resist shear and diagonal tension stresses in a beam, typically a steel bar bent into a U-shape and installed perpendicular to or at an angle to the longitudinal reinforcement, and properly anchored.

2.100 Strand — A prestressing tendon composed of a number of wires most of which are twisted about a centre wire or core.

2.101 Stress Corrosion — Corrosion of a metal accelerated by stress.

2.102 Temperature Reinforcement — Reinforcement designed to carry stresses resulting from temperature changes; also the minimum reinforcement for areas of members which are not subjected to primary stresses or necessarily to temperature stresses.

*See IS : 456-1964 'Code of practice for plain and reinforced concrete (second revision)', IS : 2502-1963 'Code of practice for bending and fixing of bars for concrete reinforcement', and IS : 5525-1969 'Recommendations for detailing of reinforcement in reinforced concrete works'.

2.103 Tensile Strength — The maximum load reached in a tensile test divided by the original cross-sectional area of the gauge length portion of the test piece. Also termed as maximum stress, or ultimate tensile stress.

2.104 Tension Reinforcement — Reinforcement designed to carry tensile stresses such as those in the bottom of a simple beam.

2.105 Tie — Closed loop of reinforcing bars encircling the longitudinal steel in columns; also a tensile unit which holds concrete formwork secure against lateral pressure of unhardened concrete.

2.106 Tie Bar — A deformed bar embedded in a concrete construction at a joint and designed to hold abutting edges together, but not designed for direct load transfer as a dowel.

2.107 Transverse Reinforcement — Reinforcement at right angles to the principal axis of a member.

2.108 Twin-Twisted Reinforcement — *See 2.88.*

2.109 Web Bar — Reinforcement placed in a concrete member to resist shear and diagonal tension.

2.110 Web Reinforcement — *See 2.109.*

2.111 Welded-Butt Splice — A reinforcing bar splice made by welding the butted ends.

2.112 Welded-Wire Fabric — A series of longitudinal and transverse wires arranged substantially at right angles to each other and welded together at all points of intersection.

2.113 Welded-Wire Fabric Reinforcement — Welded-wire fabric in either sheets or rolls, used to reinforce concrete.

2.114 Wire, Cold-Drawn — Wire made from the rods hot rolled from billets and then cold-drawn through dies.

2.115 Wire Mesh — *See 2.112.*

2.116 Woven-Wire Fabric — A prefabricated steel reinforcement composed of cold-drawn steel wires mechanically twisted together to form hexagonally shaped openings.

2.117 Woven-Wire Reinforcement — *See 2.112.*

2.118 Yield Point — That point during increasing stress when the proportion of stress to strain becomes substantially less than it has been at smaller values of stress.

2.119 Yield Strength — The stress, less than the maximum attainable stress, at which the ratio of stress to strain has dropped well below its

value at low stress, or at which a material exhibits a specified limiting deviation from the usual proportionality of stress to strain.

2.120 Yield Stress — Stress (that is, load per unit cross-sectional area) at which elongation first occurs in the test piece without increasing the load during tensile test. In the case of steels with no such definite yield point, the yield stress is the stress under the prescribed testing conditions at which the observed increase in the gauge length is $1/200$ of the gauge length when the rate at which the load is applied is not more than $0.5 \text{ kg/mm}^2/\text{s}$ when approaching the yield stress.

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