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GLOSSARY OF TERMS RELATING TO CEMENT CONCRETE

PART I CONCRETE AGGREGATES

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

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Indian Standard

GLOSSARY OF TERMS RELATING TO CEMENT CONCRETE

PART I CONCRETE AGGREGATES

0. FOREWORD

0.1 This Indian Standard (Part I) 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, compaction, 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 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 I) covers definitions of terms relating to aggregates for cement concrete.

2. DEFINITIONS

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

2.1 Absorption — The process by which a liquid is drawn into and tends to fill permeable pores in a porous solid body; also, the increase in weight of a porous solid body resulting from the penetration of a liquid into its permeable pores.

NOTE — In the case of concrete and concrete aggregates, unless otherwise stated, the liquid involved is water, the increase in weight is that which does not include water adhering to the outside surface, the increase in weight is expressed as a percentage of the dry weight of the body and the body is considered to be 'dry' when it has been treated by an appropriate process to remove uncombined water, such as drying to constant weight at a temperature between 100 and 110°C.

*Definitions and terminology relating to hydraulic cement.

†Glossary of terms relating to pozzolana.

2.2 Aggregate — Granular material, generally inert, such as natural sand, manufactured sand, gravel, crushed gravel, crushed stone, and air-cooled iron blastfurnace slag which when bound together into a conglomerated mass by a matrix forms concrete or mortar.

2.3 Aggregate, All-in — Material composed of a mixture of coarse aggregate and fine aggregate.

2.3.1 *Ballast, All-in* — Aggregate containing a substantial proportion of all sizes (including sand) below a stated maximum, as obtained from a pit, river-bed or seashore.

2.3.2 *Crusher-Run Stone* — Rock that has been broken in a mechanical crusher and has not been subjected to any subsequent screening process.

2.4 Aggregate Coarse — Aggregate most of which is retained on 4·75-mm IS Sieve and containing only so much of finer material as is permitted by the specification.

OR

Portion of an aggregate retained on the 4·75-mm IS Sieve.

NOTE 1 — The definitions are alternatives to be applied under differing circumstances.

NOTE 2 — Coarse aggregate may be described as:

a) *crushed gravel* — coarse aggregate produced by crushing gravel (*see* **2.28**);
b) *crushed stone* — coarse aggregate produced by crushing of hard stone (*see* **2.29**);
c) *uncrushed gravel* — coarse aggregate resulting from natural disintegration of rock;
d) partially crushed gravel or stone when it is a product of the blending of (a) and (b); and
e) manually broken stone, that is produced by breaking hard stone manually with hammers.

2.5 Aggregate, Dense Graded — Aggregates graded to produce low void content and maximum weight when compacted.

2.6 Aggregate, Fine — Aggregates most of which passes 4·75-mm IS Sieve and containing only so much coarser material as is permitted for various grading zones in the specification. Fine aggregate may be described as in **2.6.1** to **2.6.3**.

2.6.1 *Natural Sand* — Fine aggregate resulting from the natural disintegration of rock and/or which has been deposited by streams or glacial agencies.

2.6.2 *Crushed Stone Sand* — Fine aggregate produced by crushing hard stone.

2.6.3 *Crushed Gravel Sand* — Fine aggregate produced by crushing natural gravel.

2.7 Aggregate, Gap Graded — Aggregate having a particle size distribution where one or more sizes are missing.

2.8 Aggregate, Graded — Aggregate comprising of a proportion of all sizes from a given nominal maximum to 4·25 mm. When these sizes are so proportioned as to give a definite grading, it is a well graded aggregate.

2.9 Aggregate, Heavy Weight — Aggregate of high specific gravity, such as barite magnetite, limonite, ilemenite iron, or steel used to produce heavy concrete or high density concrete specially for shielding against nuclear radiation.

2.10 Aggregate, Light Weight — Aggregate of low bulk specific gravity, such as expanded or sintered clay, slate, slag, fly ash, vermiculite, or pumice or natural pumice and scoria used to produce light weight concrete.

2.11 Aggregate, Maximum Size of — The largest size of aggregate particles present in sufficient quantity to influence the physical properties of concrete, generally designated by the standard sieve nearest to the sieve size on which over 10 percent weight is retained.

2.12 Aggregate, Reactive — Aggregate containing substances capable of reacting chemically with the products of solution or hydration of the Portland cement in concrete or mortar under ordinary conditions of exposure, resulting in some cases in harmful expansion, cracking, or staining.

2.12.1 *Alkali Reactivity (of Aggregate)* — Susceptibility of aggregate to alkali-aggregate reaction.

2.13 Aggregate, Refractory — Materials having refractory properties which when bound together into a conglomerate mass by a matrix, from a refractory body.

2.14 Aggregate, Single Sized — Aggregate the bulk of which passes one sieve on the normal concrete series and is retained on the next smaller size.

2.15 b/bo — Dry rodded bulk volume of coarse aggregate per unit volume of concrete; the ratio of the solid volume of coarse aggregate particles per unit volume of freshly mixed concrete to the solid volume of the coarse aggregate particles per unit volume of dry rodded coarse aggregate.

2.16 Ballast — Stone or gravel mixture of irregular unscreened sizes which may also contain smaller material and sand.

2.17 Blastfurnace Slag — Blastfurnace slag is non-metallic product consisting essentially of glass containing calcium and magnesium silicates and alumino silicates and other bases, which is developed simultaneously with iron in blastfurnace or electric pig iron furnace.

2.17.1 *Ball-Slag* — Blastfurnace slag which has been allowed to solidify in the ladle.

2.17.2 *Bank-Slag* — Blastfurnace slag which has been poured in a molten state on a bank and allowed to solidify.

2.17.3 *Pit-Slag or Modified Pit-Slag* — Blastfurnace slag which has been poured in a molten state into prepared pits, canals or large moulds and allowed to solidify therein.

2.18 Blastfurnace Slag, Air-Cooled — The material resulting from solidification of molten blastfurnace slag under atmospheric conditions. Subsequent cooling may be accelerated by application of water to the solidified surface.

2.19 Blastfurnace Slag, Expanded or Foamed — The light weight cellular material obtained by controlled processing of molten blastfurnace slag with water, or with water and other agents, such as steam or compressed air or both; and crushed and graded as required. It consists chiefly of alumino silicates of lime and magnesia in a glassy, partly crystalline or crystalline condition.

2.20 Blastfurnace Slag, Granulated — Granulated slag is obtained by further processing the molten slag by rapidly chilling or quenching it with water or steam and air. Granulated blastfurnace is used for the manufacture of hydraulic cement.

2.21 Bloated — Swollen, as certain light weight aggregates as a result of processing.

2.22 Bulking — Increase in the bulk volume of a quantity of sand in a moist condition over the volume of the same quantity dry or completely inundated.

2.23 Bulking Curve — Graph of change in volume of a quantity of sand due to change in moisture content.

2.24 Bulking Factor — Ratio of the volume of moist sand to volume of the sand when dry.

2.25 Chips — Broken fragments of marble or other mineral aggregate screened to specified sizes.

2.26 Cinder — Well burnt furnace residue which has been fused or sintered into lumps of varying sizes. The same material in a finely powdered form is found to possess some pozzolanic activity.

2.27 Cobble — A rock fragment between 64 and 256 mm in diameter as applied to coarse aggregate for concrete, the material in the nominal size range 75 to 150 mm.

2.28 Crushed Gravel — The product resulting from the artificial crushing of gravel with substantially all fragments having at least one face resulting from fracture.

2.29 Crushed Stone — The product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation.

2.30 Dry Rodding — In measurement of the weight per unit volume of coarse aggregates, the process of compacting dry material in a calibrated container by rodding under standardized conditions.

2.31 Dry Rodded Volume — The volume occupied by an aggregate compacted dry, under standardized conditions used in measuring unit weight of aggregate.

2.32 Dry Rodded Weight — Weight per unit volume of an aggregate compacted dry by rodding under standardized conditions.

2.33 Fineness Modulus — An empirical factor obtained by adding the total percentages of a sample of the aggregate retained on each of a specified series of sieves, and dividing the sum by 100.

NOTE — The sieves used are: 150-micron, 300-micron, 600-micron, 1·18-mm, 2·36-mm, 4·75-mm, 10-mm, 20-mm, 40-mm and larger increasing in the ratio of 2 to 1.

2.34 Flat Piece — One in which the ratio of the width to thickness of its circumscribing rectangular prism is greater than a specified value.

2.35 Free Moisture — Moisture not retained or absorbed by aggregate.

2.36 Fuller's Curve — An empirical curve for gradation of aggregates; also known as the Fuller-Thompson Ideal Grading Curve. The curve is designed by fitting either a parabola or an ellipse to a tangent at the point where the aggregate fraction is one-tenth of the maximum size fraction.

2.37 Gap Grading — A particle size distribution in which particles of certain intermediate sizes are wholly or substantially absent.

2.38 Gradation — *See* **2.45.**

2.39 Grading — *See* **2.45.**

2.40 Grading Continuous — A particle size distribution in which all intermediate size fractions are present, as opposed to gap grading.

2.41 Gravel

a) Granular material predominantly retained on the 4·75-mm IS Sieve and resulting from natural disintegration and abrasion of rock or processing of weakly bound conglomerate; or

b) That portion of an aggregate retained on the 4·75-mm IS Sieve and resulting from natural disintegration and abrasion of rock or processing of weakly bound conglomerate.

NOTE — The definitions are alternative to be applied under differing circumstances. Definition (a) is applied to an entire aggregate either in a natural condition or after processing. Definition (b) is applied to a portion of an aggregate. Requirements for properties and grading should be stated in specifications.

2.42 Grading Curve — A graphical representation of the percentages of different particle sizes in a material obtained by plotting the cumulative or separate percentages of the material passing through sieves in which the aperture sizes form a given series.

2.43 Gravel, Pea — Screened gravel most of the particles of which will pass a 10-mm IS Sieve and will be retained on a 4·25-mm IS Sieve.

2.44 Particle Shape of Aggregate — The particle shape of aggregate, such as angular, cubical, elongated and flaky.

2.44.1 *Angular* — The particles of aggregates possessing well defined edges formed at the inter-section of roughly planer faces.

2.44.2 *Cubical* — Angular aggregate most of its particles have length, breadth and thickness approximately equal.

2.44.3 *Elongated Piece* — The particle of aggregate in which the ratio of length to width of its circumvent rectangular prism is greater than specified value.

2.44.4 *Elongation Index* — Elongation index of an aggregate is the percentage by weight of particles whose greatest dimensions (length) is greater than one and four-fifths times their mean dimension.

2.44.5 *Flaky Material* — Particles in aggregate which are usually angular and, of which the thickness is small relative to the width and/or length.

2.44.6 *Flakiness Index* — The flakiness index of an aggregate is the percentage by weight of particles in it whose least dimension (thickness) is less than three-fifths of their mean dimension.

2.44.7 *Irregular Aggregate (or Partly Rounded Aggregate)* — Aggregates the particle of which are naturally irregular, or partly shaped by attrition and have rounded edges.

2.44.8 *Rounded Aggregate* — Aggregate, the particles of which are fully water worn or are completely shaped by attrition.

2.45 Particle Size Distribution — The distribution of particles of granular material among various sizes; usually expressed in terms of cumulative percentages larger or smaller than each of a series of diameters (sieve openings) or the percentages between certain ranges of diameters (sieve openings).

2.46 Petrography — The branch of petrology dealing with description and systematic classification of rocks aside from their geologic relations, mainly by laboratory methods largely chemical and microscopical also loosely, petrology or lithology.

2.47 Petrology — The science of rocks, treating of their origin, structure, composition, etc, from all aspects and in all relations.

2.48 Plum — A large random shaped stone dropped into freshly placed mass concrete.

NOTE — For cyclopean concrete, the weight of each stone may not be less than 50 kg. For rubble concrete the stone may be such that one man can handle.

2.49 Rubble — Rough stone of irregular shape and size, broken from larger masses by geological process or by quarrying.

2.50 Sand

a) Granular material passing the 10-mm IS Sieve and almost entirely passing the 4·75-mm IS sieve and predominantly retained on the 75-micron IS Sieve, and resulting from natural disintegration and abrasion of rock or processing of completely friable sandstone; or

b) That portion of an aggregate passing the 4·75-mm IS Sieve and predominantly retained on the 75-micron IS Sieve, and resulting from natural disintegration and abrasion of rock or processing of completely friable sandstone.

NOTE — The definitions are alternatives to be applied under differing circumstances. Definition (a) is applied to an entire aggregate weather in a natural condition or after processing. Definition (b) is applied to a portion of an aggregate. Requirements for properties and grading should be stated in specifications. Fine aggregate produced by crushing rock, gravel, or slag commonly is known as 'manufactured sand'.

2.51 Sand Equivalent — A measure of the amount of clay contamination in fine aggregate.

2.52 Scalper — A screen for removing oversize particles.

2.53 Shingle — Rounded or waterworm stone of irregular size occurring in river beds or opened beaches.

2.54 Sieve Analysis — Determination of the proportions of particle lying within certain size ranges in a granular material by separation on sieves of different size openings.

2.55 Sieve Correction — Correction of sieve analysis to adjust for deviation of sieve performance from that of standard calibrated sieve.

2.56 Silt — A granular material resulting from the disintegration of rock, with grains largely passing a No. 200 (47 micron) sieve; alternatively, such particles in the range from 2 to 50 microns diameter.

2.57 Spall — A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the larger mass.

2.58 Specific Gravity, Saturated Dry-Basis — The bulk specific gravity of aggregate determined after complete immersion in water for 24 hours and removing surface water.

2.59 Stone Sand — *see* **2.6.2**.

2.60 Surface Saturated Dry-Aggregate — A condition of the aggregate attained after complete immersion in water and removing the superficial water by soaking with cloth.

2.61 Surface Water — Free water retained on surfaces of aggregate particles and considered to be part of the mixing water in concrete, as distinguished from absorbed moisture.

(*Continued from page* 2)

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