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Indian Standard

सीमेंट कंक्रीट — पारिभाषिक शब्दावली

भाग 1 ठोस समुच्चय

(पहला पुनरीक्षण)

Cement Concrete — Glossary of Terms

Part 1 Concrete Aggregates

(First Revision)

ICS 01.040.91

भारतीय मानक ब्यूरो
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Cement and Concrete Sectional Committee, CED 02

FOREWORD

This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

Cement concrete is one of the most versatile and extensively used building material 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. Based on this necessity and to standardize the various terms and definitions used in cement and concrete technology, this standard was published in 12 parts. The other parts in the series are:

Part 2 Materials (other than cement and aggregate)

Part 3 Concrete reinforcement

Part 4 Types of concrete

Part 5 Formwork for concrete

Part 6 Equipment, tools and plant

Part 7 Mixing, laying, compaction, curing and other construction aspects

Part 8 Properties of concrete

Part 9 Structural aspects

Part 10 Tests and testing apparatus

Part 11 Prestressed concrete

Part 12 Miscellaneous terms

In addition to the above, the terminology relating to hydraulic cement and pozzolanic materials are separately covered in IS 4845 and IS 4305.

This standard was first published in 1973. In this revision the necessary changes required have been incorporated in the light of experience gained in its use and also to bring it in line with the latest development on the subject. The significant modifications made in this revision include:

a) Definitions of mixed sand and manufactured sand has been included; and

b) Definitions of various terms have been rationalized.

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 6100-9 : 2007 ‘Building and civil engineering — Vocabulary — Part 9: Work with concrete and plaster’, British Standards Institution

ASTM C125 : 2021 ‘Standard terminology relating to concrete and concrete aggregates’, American Society for Testing and Materials (Revision 21A)

ACI 617 : 1968 ‘Recommended practice for concrete formwork’, American Concrete Institute

ACI CT-23 : 2023 ‘Concrete terminology’, American Concrete Institute

(*Continued on third cover*)

Indian Standard

CEMENT CONCRETE — GLOSSARY OF TERMS

PART 1 CONCRETE AGGREGATES

(First Revision)

1 SCOPE

This standard (Part 1) covers definitions of terms relating to aggregates for cement concrete.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS 4305 : 1967	Glossary of terms relating to pozzolana
IS 4845 : 1968	Definitions and terminology relating to hydraulic cement

3 TERMINOLOGY

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

3.1 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 °C and 110 °C.

3.2 Aggregate — Granular material, generally inert, such as natural sand, manufactured sand, gravel, crushed gravel, crushed stone, and air-cooled iron blast furnace slag which when bound together into a conglomerated mass by a matrix forms concrete or mortar. Granular material such as sand gravel crushed stone or iron blast furnace slag use with cementing medium to form hydraulic cement concrete or mortar.

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

3.3.1 *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.

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

3.4 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.

NOTES

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

2 Coarse aggregate may be described as:

a) Crushed gravel-coarse aggregate produced by crushing gravel (*see* 3.30);

b) Crushed stone-coarse aggregate produced by crushing of hard stone (*see* 3.32);

c) Uncrushed gravel-coarse aggregate resulting from natural disintegration of rock; that is without crushing.

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.

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

3.6 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 3.6.1 to 3.6.3.

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

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

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

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

3.8 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.

3.9 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.

3.10 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 rock used to produce light weight concrete.

3.11 Aggregate, Maximum Size of — The largest size of aggregate particles present ill 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.

3.13 Aggregate, Mineral — Aggregates consisting essentially of inorganic nonmetallic rock materials, either natural or crushed and graded.

3.14 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.

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

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

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

3.17 b/b_o — 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.

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

3.19 Blast Furnace Slag — 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 blast furnace or electric pig iron furnace.

3.19.1 *Ball-Slag* — Blast furnace slag which has been allowed to solidify in the ladle.

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

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

3.20 Blast Furnace Slag, Air-Cooled — The material resulting from solidification of molten blast furnace slag under atmospheric conditions. Subsequent cooling may be accelerated by application of water to the solidified surface.

3.21 Blast Furnace Slag, Expanded or Foamed — The light weight cellular material obtained by controlled processing of molten blast furnace 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.

3.22 Blast Furnace 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 blast furnace is used for the manufacture of hydraulic cement.

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

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

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

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

3.27 Cenosphere — Lightweight aggregate in the form of hollow glass spheres.

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

3.29 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.

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

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

3.32 Crushed Rock — Coarse aggregate produced by crushing rock.

3.33 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.

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

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

3.36 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.

3.37 Elongated Aggregate — Coarse aggregate consisting of particles that have one dimension significantly larger than the other two.

3.38 Expanded Clay Aggregate — Expanded aggregate produced from clay.

3.39 Expanded Plastic Particle Aggregate — Expanded aggregate that consists of plastic particles.

3.40 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, 3.36 mm, 4.75 mm, 10 mm, 20 mm, 40 mm and larger increasing in the ratio of 2 to 1.

3.41 Flaky Aggregate — Coarse aggregate consisting of particles with a thickness that is small in relation to the other two dimensions.

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

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

3.44 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.

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

3.46 Gradation — *See* 3.55.

3.47 Grading — *See* 3.55.

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

3.49 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.

3.50 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.

Coarse aggregate resulting from natural disintegration and abrasion of rock or processing of weakly bound conglomerate.

3.51 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.

3.52 Manufactured Fine Aggregate (Manufactured Sand) — Fine aggregate manufactured from other than natural sources, by processing materials, using thermal or other processes such as separation, washing, crushing and scrubbing.

3.53 Mixed Sand — Fine aggregate produced by blending natural sand and crushed stone sand or crushed gravel sand in suitable proportion.

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

3.54.1 *Angular* **—** The particles of aggregates possessing well defined edges formed at the inter-section of roughly planer faces. And those aggregate that consists of particles with sharp edges.

3.54.2 *Cubical* **—** Angular aggregate most of its particles have length, breadth and thickness approximately equal, that is the three substantially equal dimensions.

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

3.54.4 *Elongation Index* **—** Percentage by weight of particles whose greatest dimensions (length) is greater than one and four-fifths times their mean dimension.

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

3.54.6 *Flakiness Index* **—** The percentage by weight of particles in it whose least dimension (thickness) is less than three-fifths of their mean dimension.

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

Coarse aggregate that consists of particles with rounded surfaces. In the case of other that natural aggregates, the coarse aggregate that consist of particles of irregular shape and round edges.

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

3.55 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).

3.56 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.

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

3.58 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.

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

3.60 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 is commonly known as 'manufactured sand'.

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

3.62 Scalper — A screen for removing oversize particles.

3.63 Shingle — Rounded or water worm stone of irregular size occurring in river beds or opened beaches.

3.64 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.

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

3.66 Silica Fume — Very fine pozzolonic materials composed mostly of amorphous silica produced by electric arc furnaces as a byproduct of the production of elemental silicon or ferro silicon alloys.

3.67 Silt — A granular material resulting from the disintegration of rock, with grains largely passing a No. 200 (75 micron) sieve; alternatively, such particles in the range from 2 microns to 50 microns diameter.

3.68 Sinter — A ceramic material or mixture fired to less than complete fusion, resulting in a coherent mass.

3.69 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.

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

3.71 Stone Sand — *See* 3.6.2.

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

3.73 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.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Cement and Concrete Sectional Committee, CED 02

Organization	*Representative(s)*
In Personal Capacity (*Grace Villa, Kadamankulam PO, Thiruvalla - 689583*)	SHRI JOSE KURIAN **(*Chairperson*)**
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Composition of Concrete Sub-Committee, CED 2 : 2

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Cement Manufacturers Association, Noida	SHRI K. JAYASANKAR SHRI UTTAM KUMAR SINGH (*Alternate* I) SHRI SHUBHO CHAKRAVARTY (*Alternate* II)
Central Public Works Department, New Delhi	SHRI DINESH KUMAR UJJAINIA
Central Soil and Materials Research Station, New Delhi	SHRI U. S. VIDYARTHI SHRI M. RAJA (*Alternate*)
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(*Continued from second cover*)

The composition of the Committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be periodically removed to create more space for the future falling blocks.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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