ACI MANUAL OF CONCRETE PRACTICE

PART 1—1980

Part 1 contains current committee reports and standards concerned with:

Materials and General Properties of Concrete

New editions of each part of the *ACI Manual of Concrete Practice* are issued annually and include the latest ACI standards and committee reports.

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The reports and standards herein were the latest approved versions at the time the contents of this edition were established. The content of each report or standard is subject to periodic review and to revision whenever the developments in concrete design and construction warrant a change. Since this is a continuing process, some reports or standards in this volume may have been superseded in the interim since publication. Inquiries concerning revisions or additional material in a subject area are welcome and should be directed to Institute headquarters.

Most standards and committee reports contained in this volume are also available as separate booklets from ACI headquarters. Prices supplied on request.

The American Concrete Institute publishes material on all phases of concrete technology. Much of the material can provide additional or background information on the reports and standards in this volume. A catalog is available.

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The AMERICAN CONCRETE INSTITUTE

is a nonprofit, nonpartisan organization of engineers, architects, scientists, constructors, and individuals associated in their technical interest with the field of concrete and dedicated to public service. The purpose of the Institute is to further engineering and technical education, scientific investigation and research, and development of standards for the design and construction of concrete structures. Members of the Institute are involved in gathering, correlating, and disseminating information for the improvement of the design, construction, manufacture, use, and maintenance of concrete products and structures. The Institute and its members also promote improved technology, technical competence, and good design and construction practices.

Since 1905 the objectives of the Institute have been achieved by a combined membership effort. Individually and through committees, and with the cooperation of many public and private agencies, members have correlated the results of research, from both field and laboratory, and of practices in design, construction, and manufacture.

The work of the Institute is made available to the engineering profession through seminars, workshops, chapter functions, and publications. The Institute publishes three periodicals: the ACI JOURNAL, *Concrete Abstracts,* and *Concrete International: Design & Construction.* The Institute also has an extensive nonperiodical publications program which includes committee reports, standards, symposia, manuals, design handbooks, monographs, education bulletins, bibliographies, and the *ACI Manual of Concrete Practice.*

Some of the most recent of these publications are:

SP-2	ACI Manual of Concrete Inspection
SP-17A(78)	Design Handbook in Accordance with the Strength Design Method of ACI 318-77: Volume 2—Columns
SP-61	Ferrocement—Materials and Applications
B-13	Concrete Core Tests
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The *ACI Manual of Concrete Practice* is a five part compilation of current ACI standards and committee reports.

Part 1—Materials and General Properties of Concrete
Part 2—Construction Practices and Inspection
Pavements
Part 3—Use of Concrete in Buildings—Design, Specifications, and Related Topics
Part 4—Bridges, Substructures, Sanitary, and Other Special Structures
Structural Properties
Part 5—Masonry
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Special Processes

Some of the most important work of the Institute is performed by its technical committees which prepare the committee reports and standards contained in the *Manual.* Technical committees of the Institute are organized into the following five groups with regard to their function: 100—Research and Administration, 200—Materials and Properties of Concrete, 300—Design and Construction, 400—Structural Analysis, and 500—Special Products and Special Processes. Committees are assigned a number which indicates its group or general area of responsibility.

Each standard of the Institute bears a hyphenated number to identify it. The first three digits identify the committee orginating the standard and the last two digits identify the year it was adopted. Thus standard ACI 214-77 was prepared by Committee 214 and was adopted as a standard in the year 1977.

Committee reports are also identified by a hyphenated number with the addition of an "R" to indicate a report rather than a standard. For committee reports the last two digits refer either to the year of original publication or in a few cases the year of adoption of a related standard.

The following consolidated list contains the titles of all committee reports and standards found in the *ACI Manual of Concrete Practice*—1980. Reports and standards are listed numerically and the location in the *Manual* follows the title.

100—Research and Administration

This group contains all research and administrative committees governed by TAC including any committees not logically placed in other subdivisions.

ACI 104-71, Reaffirmed 1976 Preparation of Notation for Concrete, **Part 3**
ACI 116R-78 Cement and Concrete Terminology, **Part 1**

200—Materials and Properties of Concrete

This group contains committees whose major concern is materials in concrete and properties of concrete.

ACI 201.1R-68 Guide for Making a Condition Survey of Concrete in Service, **Part 1**
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ACI 207.1R-70 Mass Concrete for Dams and Other Massive Structures, **Part 1**
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ACI 210R-55 Erosion Resistance of Concrete in Hydraulic Structures, **Part 1**
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300—Design and Construction Practices

This group contains committees whose major concern is design and construction practices.

ACI 301-72, Revised 1975 Specifications for Structural Concrete for Buildings, **Part 3**

ACI 302-69 Recommended Practice for Concrete Floor and Slab Construction, **Part 3**

ACI 303R-74 Guide to Cast-in-Place Architectural Concrete Practice, **Part 3**

ACI 304-73, Reaffirmed 1978 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete, **Part 2**

ACI 304.1R-69 Preplaced Aggregate Concrete for Structural and Mass Concrete, **Part 2**

ACI 304.2R-71 Placing Concrete by Pumping Methods, **Part 2**

ACI 304.3R-75 High Density Concrete: Measuring, Mixing, Transporting, and Placing, **Part 2**

ACI 304.4R-75 Placing Concrete With Belt Conveyors, **Part 2**

ACI 305R-77 Hot Weather Concreting, **Part 2**

ACI 306R-78 Cold Weather Concreting, **Part 2**

ACI 307-79 Specification for the Design and Construction of Reinforced Concrete Chimneys, **Part 4**

ACI 308-71, Reaffirmed 1978 Recommended Practice for Curing Concrete, **Part 2**

ACI 309-72, Reaffirmed 1978 Recommended Practice for Consolidation of Concrete, **Part 2**

ACI 311-75 Recommended Practice for Concrete Inspection, **Part 2**

ACI 311.1R-75 ACI Manual of Concrete Inspection (Synopsis only), **Part 2**

ACI 311.2R-63 Training Courses for Concrete Inspectors, **Part 2**

ACI 311.3R-75 Guide for Certification of Nuclear Concrete Inspection and Testing Personnel, **Part 2**

ACI 313-77 Recommended Practice for Design and Construction of Concrete Bins, Silos, and Bunkers for Storing Granular Materials, **Part 4**

ACI 313R-77 Commentary on Recommended Practice for Design and Construction of Concrete Bins, Silos, and Bunkers for Storing Granular Materials (ACI 313-77), **Part 4**

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ACI 325.4R-72 A Design Procedure for Continuously Reinforced Concrete Pavements for Highways, **Part 2**

ACI 334.1R-74 Concrete Shell Structures—Practice and Commentary, **Part 4**

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ACI 336.2R-66 Suggested Design Procedures for Combined Footings and Mats, **Part 4**

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ACI 340.1R-73 Design Handbook in Accordance with the Strength Design Method of ACI 318-71, Volume 1 (Synopsis only), **Parts 3 and 4**

ACI 340.2R-78 Design Handbook in Accordance with the Strength Design Method of ACI 318-77, Volume 2 Columns (Synopsis only), **Parts 3 and 4**

ACI 340.3R-77 Step-by-Step Design Procedures in Accordance with the Strength Design Method of ACI 318-71 (Synopsis only), **Parts 3 and 4**

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400—Structural Analysis

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ACI 423.1R-69 Tentative Recommendations for Concrete Members Prestressed With Unbonded Tendons, **Part 3**
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This group contains committees dealing with special products used with concrete or special processing of concrete.

ACI 503.1-79 Standard Specification for Bonding Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive, **Part 5**
ACI 503.2-79 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive, **Part 5**
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ACI 523.2R-68 Guide for Low Density Precast Concrete Floor, Roof, and Wall Units, **Part 5**

ACI 523.3R-75 Guide for Cellular Concretes Above 50 pcf, and for Aggregate Concretes Above 50 pcf with Compressive Strengths Less Than 2500 psi, **Part 5**

ACI 531-79 Building Code Requirements for Concrete Masonry Structures, **Part 5**

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ACI 533.3R-70 Fabrication, Handling and Erection of Precast Concrete Wall Panels, **Part 5**

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MATERIALS AND GENERAL PROPERTIES OF CONCRETE

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ACI Committee Reports, Guides, Standard Practices, and Commentaries are intended for guidance in designing, planning, executing, or inspecting construction, and in preparing specifications. Reference to these documents shall not be made in the Project Documents. If items found in these documents are desired to be part of the Project Documents, they should be incorporated directly into the Project Documents.

ACI 116R-78

Cement and Concrete Terminology

Reported by ACI Committee 116

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Foreword

The first edition of the ACI glossary was the result of ten years of work by Committee 116. The second edition, which is based on the first edition, is the product of approximately six years of effort.

For the drafting of the second edition, the committee membership was divided into eight task groups, each of which was responsible for the preparation of an individual section. These sections were subsequently combined to form a base document for study and comment by the full committee. The comments resulting from this and other reviews, both within and without the committee, were considered by an Editorial Subcommittee composed of J. J. Shideler (Chairman), R. D. Gaynor, J. R. Libby, Bryant Mather, and R. C. Mielenz.

Committee 116 recognizes that despite meticulous attention to detail, the listing may not be complete and that some definitions may be at variance with some commonly accepted meanings. Users of the glossary are invited to submit suggestions for changes and additions to ACI Headquarters for consideration in preparing for future editions.

The Committee is aware that some of the definitions included may seem entirely self-evident to an expert in the concrete field. This occurs because no term has been discarded if there was reason to believe it would appear to be technical in nature to a casual reader of the ACI literature.

The invaluable contributions of the past-chairmen of Committee 116, R. C. Mielenz, D. L. Bloem, W. H. Price, and R. E. Davis, Jr., and of Bryant Mather as past-chairman of the Editorial Subcommittee, are gratefully acknowledged.

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A

Abrams' law—A rule stating that with given concrete materials and conditions of test the ratio of the amount of water to the amount of the cement in the mixture determines the strength of the concrete provided the mixture is of a workable consistency. (See also **Water-cement ratio**.)

Abrasion resistance—Ability of a surface to resist being worn away by rubbing and friction.

Absolute specific gravity—Ratio of the mass of a given volume of a solid or liquid, referred to a vacuum, at a stated temperature to the mass, referred to a vacuum, of an equal volume of gas-free distilled water at a stated temperature. (See also **Specific gravity**.)

Absolute volume (of ingredients of concrete or mortar)—The displacement volume of an ingredient of concrete or mortar; in the case of solids, the volume of the particles themselves, including their permeable and impermeable voids but excluding space between particles; in the case of fluids, the cubic content which they occupy.

Absorbed moisture—Moisture that has entered a solid material by absorption and has physical properties not substantially different from ordinary water at the same temperature and pressure. (See also **Absorption**.)

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. (See also **Absorbed moisture.**)

Abutment—In bridges, the end structure (usually of concrete) which supports the beams, girders, and deck of the bridge, or combinations thereof, and sometimes retains the earthen bank, or supports the end of the approach pavement slab; in prestressing, the structure against which the tendons are stressed in producing pretensioned precast members or post-tensioned pavement; in dams, the side of the gorge or bank of the stream against which a dam abuts.

Acceleration—Increase in velocity or in rate of change, especially the quickening of the natural progress of a process, such as hardening, setting, or strength development of concrete. (See also **Accelerator**.)

Accelerator—A substance which, when added to concrete, mortar, or grout, increases the rate of hydration of the hydraulic cement, shortens the time of setting, or increases the rate of hardening of strength development, or both. (See also **Acceleration**.)

Accessories—Those items other than frames, braces, or post shores used to facilitate the construction of scaffold and shoring.

Accidental air—See **Entrapped air**.

Acrylic resin—One of a group of thermoplastic resins formed by polymerizing the esters or amides of acrylic acid; used in concrete construction as a bonding agent or surface sealer.

Addition—A material that is interground or blended in limited amounts into a hydraulic cement during manufacture either as a "processing addition" to aid in manufacturing and handling the cement or as a "functional addition" to modify the use properties of the finished product.

Additive—A term frequently (but improperly) used as a synonym for addition or admixture.

Adhesives—The group of materials used to join or bond similar or dissimilar materials; for example, in concrete work, the epoxy resins.

Adiabatic—A condition in which heat neither enters nor leaves a system.

Adiabatic curing—The maintenance of adiabatic conditions in concrete or mortar during the curing period.

Adjustment screw—A leveling device or jack composed of a threaded screw and an adjusting handle used for the vertical adjustment of shoring and formwork.

Admixture—A material other than water, aggregates, and hydraulic cement, used as an ingredient of concrete or mortar, and added to the concrete immediately before or during its mixing.

Adobe—Unburnt brick dried in the sun.

Adsorbed water—Water held on surfaces of a material by electrochemical forces and having physical properties substantially different from those of absorbed water or chemically combined water at the same temperature and pressure. (See also **Adsorption**.)

Adsorption—Development at the surface of a liquid or solid of a higher concentration of a substance than exists in the bulk of the medium; especially formation of one or more layers of molecules of gases, of dissolved substances, or of liquids at the surface of a solid, such as cement, cement paste, or aggregate, or of air-entraining agents at the air-water interfaces; also the process by which a substance is adsorbed. (See also **Adsorbed water**.)

Advancing slope grouting—A method of grouting by which the front of a mass of grout is caused to move horizontally through preplaced aggregate by use of a suitable grout injection sequence.

Advancing slope method—A method of placing concrete as in tunnel linings in which the face of the fresh concrete is not vertical and moves forward as concrete is placed.

Aerated concrete—See **Cellular concrete**.

A/F ratio—The molar or weight ratio of aluminum oxide (Al_2O_3) to iron oxide (Fe_2O_3), as in portland cement.

Afwillite—A mineral with composition $3CaO \cdot 2SiO_2 \cdot 3H_2O$ occurring naturally in South Africa, Northern Ireland, and California, and artificially in some hydrated portland cement mixtures.

Agglomeration—Gathering into a ball or mass.

Aggregate—Granular material, such as sand, gravel, crushed stone, and iron blast-furnace slag, used with a cementing medium to form a hydraulic-cement, concrete or mortar. (See also **Aggregate, heavyweight** and **Aggregate, lightweight**.)

Aggregate, coarse—See **Coarse aggregate.**

Aggregate, fine—See **Fine aggregate.**

Aggregate, gap-graded—See **Gap-graded aggregate.**

Aggregate, heavyweight—Aggregate of high specific gravity such as barite, magnetite, limonite, ilmenite, iron, or steel used to produce heavy concrete.

Aggregate, lightweight—Aggregate of low specific gravity, such as expanded or sintered clay, shale, slate, diatomaceous shale, perlite, vermiculite, or slag; natural pumice, scoria, volcanic cinders, tuff, and diatomite; sintered fly ash or industrial cinders; used to produce lightweight concrete.

Aggregate, maximum size—See **Maximum size of aggregate**.

Aggregate, nominal maximum size—See **Nominal maximum size of aggregate**.

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Aggregate blending—The process of intermixing two or more aggregates to produce a different set of properties; generally, but not exclusively, to improve grading.

Aggregate-cement ratio—See Cement-aggregate ratio.

Aggregate gradation—See **Grading**.

Aggregate interlock—The projection of aggregate particles or portions of aggregate particles from one side of a joint or crack in concrete into recesses in the other side of such joint or crack so as to effect load transfer in compression and shear, and maintain mutual alignment.

Agitating speed—The rate of rotation of the drum or blades of a truck mixer or other device when used for agitation of mixed concrete.

Agitating truck—A vehicle carrying a drum in which freshly mixed concrete can be conveyed from the point of mixing to that of placing, the drum being rotated continuously so as to agitate the contents; designated "agitating lorry" in United Kingdom.

Agitation—

1. The process of providing gentle motion in mixed concrete just sufficient to prevent segregation or loss of plasticity.

2. The mixing and homogenization of slurries or finely ground powders by air or mechanical means.

See also **Agitator**.

Agitator—A device for maintaining plasticity and preventing segregation of mixed concrete by agitation. (See also **Agitation**.)

Air, entrained—See **Entrained air**.

Air blow pipe—Air jet used in shotcrete gunning to remove rebound or other loose material from the work area.

Air-blown mortar—See **Shotcrete**.

Air content—The volume of air voids in cement paste, mortar, or concrete, exclusive of pore space in aggregate particles, usually expressed as a percentage of total volume of the paste, mortar, or concrete.

Air-cooled blast-furnace slag—See **Blast-furnace slag**.

Air-entraining—The capability of a material or process to develop a system of minute bubbles of air in cement paste, mortar, or concrete during mixing. (See also **Air entrainment**.)

Air entraining agent—An addition for hydraulic cement or an admixture for concrete or mortar which causes entrained air to be incorporated in the concrete or mortar during mixing, usually to increase its workability and frost resistance. (See also **Entrained air**.)

Air-entraining hydraulic cement—Hydraulic cement containing an air-entraining addition in such amount as to cause the product to entrain air in mortar within specified limits.

Air entrainment—The occlusion of air in the form of minute bubbles (generally smaller than 1 mm) during the mixing of concrete or mortar. (See also **Air entraining** and **Entrained air**.)

Air lift—Equipment whereby slurry or dry powder is lifted through pipes by means of compressed air.

Air meter—A device for measuring the air content of concrete and mortar.

Air permeability test—A procedure for measuring the fineness of powdered materials such as portland cement.

Air ring—Perforated manifold in nozzle of wet-mix shotcrete equipment through which high pressure air is introduced into the material flow.

Air separator—An upright cylindrical-conical apparatus, with internal rotating blades, which separates various size fractions of ground materials pneumatically; fine particles are discharged as product; oversize is returned to the mill as tailing.

Air void—A space in cement paste, mortar, or concrete filled with air; an entrapped air void is characteristically 1 mm or more in size and irregular in shape; an entrained air void is typically between 10 and 1000μm in diameter and spherical or nearly so.

Air-water jet—A high-velocity jet of air and water mixed at the nozzle, used in clean-up of surfaces of rock or concrete such as horizontal construction joints.

Alabaster—A massive densely crystalline, softly textured form of practically pure gypsum.

Alignment wire—See **Ground wire**.

Alite—A name used by Tornebohm (1897) to identify tricalcium silicate including small amounts of MgO, Al_2O_3, Fe_2O_3, and other oxides; a principal constituent of portland-cement clinker. (See also **Belite, Celite,** and **Felite**.)

Alkali—Salts of alkali metals, principally sodium and potassium; specifically sodium and potassium occurring in constituents of concrete or mortar, usually expressed in chemical analyses as the oxides Na_2O and K_2O. (See also **Cement, low alkali**.)

Alkali-aggregate reaction—Chemical reaction in mortar or concrete between alkalies (sodium and potassium) from portland cement or other sources and certain constituents of some aggregates; under certain conditions, deleterious expansion of the concrete or mortar may result.

Alkali-carbonate rock reaction—The reaction between the alkalies (sodium and potassium) in portland cement and certain carbonate rocks, particularly calcitic dolomite and dolomitic limestones, present in some aggregates; the products of the reaction may cause abnormal expansion and cracking of concrete in service.

Alkali reactivity (of aggregate)—Susceptibility of aggregate to alkali-aggregate reaction.

Alkali-silica reaction—The reaction between the alkalies (sodium and potassium) in portland cement and certain siliceous rocks or minerals, such as opaline chert and acidic volcanic glass, present in some aggregates; the products of the reaction may cause abnormal expansion and cracking of concrete in service.

Alkyl aryl sulfonate—Synthetic detergent from petroleum fractions.

Allowable load—The ultimate load divided by factor of safety.

Allowable stress—Maximum permissible stress used in design of members of a structure and based on a factor of safety against rupture or yielding of any type.

Alternate lane construction—A method of constructing concrete roads, runways, or other paved areas, in which alternate lanes are placed and allowed to harden before the remaining intermediate lanes are placed.

Alumina—Aluminum oxide (Al_2O_3).

Aluminate cement—See **Calcium-aluminate cement.**

Aluminate concrete—Concrete made with calcium-aluminate cement; used primarily where high-early-strength or refractory or corrosion-resistant concrete is required.

Amount of mixing—The designation of extent of mixer action employed in combining the ingredients for concrete or mortar; in the case of stationary mixers, the

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Amp
mixing time; in the case of truck mixers, the number of revolutions of the drum or blades at mixing speed after the intermingling of the cement with water and aggregates. (See also **Mixing time**.)

Amplitude—The maximum displacement from the mean position in connection with vibration.

Anchor—In prestressed concrete, to lock the stressed tendon in position so that it will retain its stressed condition; in precast concrete construction, to attach the precast units to the building frame; in slabs on grade or walls, to fasten to rock or adjacent structures to prevent movement of the slab or wall with respect to the foundation, adjacent structure or rock. (See also **Form anchor**.)

Anchor bolt—A metal bolt or stud, headed or threaded, either cast in place, grouted in place, or drilled into finished concrete, used to hold various structural members or embedments in the concrete, and to resist shear, tension, and vibration loadings from various sources such as wind, machine vibration, etc.; known also as a **Hold-down bolt** or a **Foundation bolt**.

Anchorage—In post-tensioning, a device used to anchor the tendon to the concrete member; in pretensioning, a device used to anchor the tendon during hardening of the concrete; in precast concrete construction, the devices for attaching precast units to the building frame; in slab or wall construction, the device used to anchor the slab or wall to the foundation, rock, or adjacent structure.

Anchorage bond stress—The bar forces divided by the product of the bar perimeter or perimeters and the embedment length.

Anchorage deformation or **slip**—The loss of elongation or stress in the tendons of prestressed concrete due to the deformation of the anchorage or slippage of the tendons in the anchorage device when the prestressing force is transferred from the jack to the anchorage device.

Anchorage device—See **Anchorage.**

Anchorage loss—See **Anchorage deformation** or **slip.**

Anchorage zone—In post-tensioning, the region adjacent to the anchorage subjected to secondary stresses resulting from the distribution of the prestressing force; in pretensioning, the region in which the transfer bond stresses are developed.

Angle float—A finishing tool having a surface bent to form a right angle; used to finish re-entrant angles.

Angle of repose—The angle between the horizontal and the natural slope of loose material below which the material will not slide.

Angular aggregate—Aggregate, the particles of which possess well-defined edges formed at the intersection of roughly planar faces.

Anhydrite—A mineral, anhydrous calcium sulfate ($CaSO_4$); gypsum from which the water of crystallization has been removed, usually by heating above 325 F (160 C); natural anhydrite is less reactive than that obtained by calcination of gypsum.

Apparent specific gravity—See **Specific gravity**.

Architect-Engineer or **Engineer-Architect**—The architect, engineer, architectural firm, engineering firm, or architectural and engineering firm, issuing project drawings and specifications, or administering the work under contract specifications and drawings, or both.

Architectural concrete—Concrete which will be permanently exposed to view and which therefore requires special care in selection of the concrete materials, forming, placing, and finishing to obtain the desired architectural appearance.

Arc spectrography—Spectographic identification of elements in a sample of material, heated to volatilization in an electric arc or spark.

Area of steel—The cross-sectional area of the reinforcing bars in or for a given concrete cross-section. (See also **Effective area of reinforcement.**)

Arenaceous—Composed primarily of sand; sandy.

Argillaceous—Composed primarily of clay or shale; clayey.

Arrissing tool—A tool similar to a float, but having a form suitable for rounding an edge of freshly placed concrete.

Asbestos-cement products—Products made from rigid material composed essentially of asbestos fiber and portland cement, used in a wide range of forms in the building industry.

Ashlar—Masonry composed of squared stones; one pattern of masonry construction.

Asphalt concrete—See **Concrete, asphalt.**

Atmospheric-pressure steam curing—Steam curing of concrete products or cement at atmospheric pressure, usually at maximum ambient temperature between 100–200 F (40–95 C).

Atterberg limits—Arbitrary water contents (shrinkage limit, plastic limit, liquid limit) determined by standard tests, which define the boundaries between the different states of consistency of plastic soils.

Atterberg test—A method for determining the plasticity of soils.

Autoclave—A pressure vessel in which an environment of steam at high pressure may be produced; used in the curing of concrete products and in the testing of hydraulic cement.

Autoclave curing—Steam curing of concrete products, sand-lime brick, asbestos-cement products, hydrous calcium silicate insulation products, or cement in an autoclave at maximum ambient temperatures generally between 340-420 F (170-215 C).

Autoclave cycle—The time interval between the start of the temperature-rise period and the end of the blowdown period; also, a schedule of the time and temperature-pressure conditions of periods which make up the cycle.

Autoclaved—See **Autoclave curing.**

Autoclaving—See **Autoclave curing.**

Autogenous healing—A natural process of closing and filling of cracks in concrete or mortar when the concrete or mortar is kept damp.

Autogenous volume change—Change in volume produced by continued hydration of cement exclusive of effects of external forces or change of water content or temperature.

Automatic batcher—See **Batcher**.

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

Average bond stress—The force in a bar divided by the product of its perimeter and its embedded length.

Axle load—The portion of the gross weight of a vehicle transmitted to a structure or a roadway through wheels supporting a given axle.

Axle steel—Steel from carbon-steel axles for railroad cars.

Axle steel reinforcement—Plain or deformed reinforcing bars rolled from axle steel.

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B

b/b_0—See **Coarse aggregate factor.**

Backfill concrete—Non-structural concrete used to correct over-excavation, or fill excavated pockets in rock, or to prepare a surface to receive structural concrete.

Back form—See **Top form.**

Back plastering—Plaster applied to one face of a lath system following application and subsequent hardening of plaster applied to the opposite face.

Back stay—See **Brace.**

Bacterial corrosion—The destruction of a material by chemical processes brought about by the activity of certain bacteria which may produce substances such as hydrogen sulfide, ammonia, and sulfuric acid.

Bag (of cement; also **Sack)**—A quantity of portland cement: 94 lb in the United States, and 50 kg in most other countries; for other kinds of cement a quantity indicated on the bag (obsolete).

Balanced load—Load capacity at simultaneous crushing of concrete and yielding of tension steel.

Balanced moment—Moment capacity at simultaneous crushing of concrete and yielding of tension steel.

Balanced reinforcement—An amount and distribution of reinforcement in a flexural member such that in working stress design the allowable tensile stress in the steel and the allowable compressive stress in the concrete are attained simultaneously; or such that in strength design the tensile reinforcement reaches its specified yield strength simultaneously with the concrete in compression reaching its assumed ultimate strain of 0.003.

Ball mill—Horizontal, cylindrical, rotating mill charged with large grinding media.

Ball test—A test to determine the consistency of freshly mixed concrete by measuring the depth of penetration of a cylindrical metal weight with a hemispherical bottom.

Band—Small bars or wire encircling the main reinforcement in a member to form a peripheral tie; group of bars distributed in a slab, or wall, or footing.

Band iron—Thin metal strap used as form tie, hanger, etc.

Bar—A member used to reinforce concrete.

Bar bender—A tradesman who cuts and bends steel reinforcement; or a machine for bending reinforcement.

Bar chair—An individual supporting device used to support or hold reinforcing bars in proper position to prevent displacement before or during concreting.

Bar, deformed—See **Deformed bar.**

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.

Bar spacing—The distance between parallel reinforcing bars, measured center to center of the bars perpendicular to their longitudinal axes.

Bar support—A rigid device used to support or hold reinforcing bars in proper position to prevent displacement before or during concreting.

Barite—A mineral, barium sulfate ($BaSO_4$), used in pure or impure form as concrete aggregate primarily for the construction of high-density radiation shielding concrete; designated "barytes" in United Kingdom.

Barrage—A low dam erected to control the level of a stream.

Barrel (of cement)—A quantity of portland cement; 376 lb (4 bags) in the United States (obsolete); also wood or metal container formerly used for shipping cement.

Barrel-vault roof—A thin concrete roof taking the form of a part of a cylinder.

Base—A subfloor slab or "working mat," either previously placed and hardened or freshly placed, on which floor topping is placed in a later operation; also the underlying stratum on which a concrete slab, such as a pavement, is placed. (See also **Subbase.**)

Base bead—See **Base screed.**

Base coat—Any plaster coat or coats applied prior to application of the finished coat.

Base course—A layer of specified selected material of planned thickness constructed on the subgrade or subbase of a pavement to serve one or more functions such as distributing loads, providing drainage, or minimizing frost action; also the lowest course of masonry in a wall or pier.

Base plate—A plate of metal or other approved material formerly placed under pavement joints and the adjacent slab ends to prevent the infiltration of soil and moisture from the sides or bottom of the joint opening; also a device used to distribute vertical loads as for building columns or machinery.

Base screed—A preformed metal screed with perforated or expanded flanges to provide a ground for plaster and to separate areas of dissimilar materials.

Basket—See **Load-transfer assembly.**

Bassanite—Calcium sulfate hemihydrate, $2CaSO_4 \cdot H_2O$. (See also **Hemihydrate** and **Plaster of Paris.**)

Bat—A broken, burned brick or shape.

Batch—Quantity of concrete or mortar mixed at one time.

Batch box—Container of known volume used to measure constituents of a batch of concrete or mortar in proper proportions.

Batch mixer—A machine which mixes batches of concrete or mortar in contrast to a continuous mixer.

Batch plant—An operating installation of equipment including batchers and mixers as required for batching or for batching and mixing concrete materials; also called mixing plant when mixing equipment is included.

Batch weights—The weights of the various materials (cement, water, the several sizes of aggregate, and admixtures if used) of which a batch of concrete is composed.

Batched water—The mixing water added by a batcher to a concrete or mortar mixture before or during the initial stages of mixing.

Batcher—A device for measuring ingredients for a batch of concrete.

1. **Manual batcher**—A batcher equipped with gates or valves which are operated manually, with or without supplementary power from pneumatic, hydraulic, or electrical machinery, the accuracy of the weighing operation being dependent on the operator's observation of the scale.

2. **Semiautomatic batcher**—A batcher equipped with gates or valves which are separately opened manually to allow the material to be weighed but which are closed automatically when the designated weight of each material has been reached.

3. **Automatic batcher**—A batcher equipped with gates or valves which, when actuated by a single starter switch, will open automatically at the start of the weighing operation of each material and close automatically when the designated weight of each material has been

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Bat

reached, interlocked in such a manner that: (a) the charging mechanism cannot be opened until the scale has returned to zero; (b) the charging mechanism cannot be opened if the discharge mechanism is open; (c) the discharge mechanism cannot be opened if the charging mechanism is open; (d) the discharge mechanism cannot be opened until the designated weight has been reached within the allowable tolerance; and (e) if different kinds of aggregates or different kinds of cements are weighed cumulatively in a single batcher, interlocked sequential controls are provided.

Batching—Weighing or volumetrically measuring and introducing into the mixer the ingredients for a batch of concrete or mortar.

Batten (also **Batten strip**)—A narrow strip of wood placed over the vertical joint of sheathing or paneling, or used to hold several boards together. (See also **Cleat**.)

Batter—Inclination from the vertical or horizontal.

Batter boards—Pairs of horizontal boards nailed to wood stakes adjoining an excavation, used as a guide to elevations and to outline the building.

Batter pile—A pile which is installed at an angle to the vertical; a raking pile.

Bauxite—A rock composed principally of hydrous aluminum oxides; the principal ore of aluminum, and a raw material for manufacture of calcium aluminate cement.

Bay—The space between two adjacent piers or mullions or between two adjacent lines of columns; a small, well-defined area of concrete laid at one time in the course of placing large areas such as floors, pavements, or runways.

Beam—A structural member subjected primarily to flexure; also the gradated horizontal bar of a weighing scale on which the balancing poises ride. (See also **Girder, Girt, Joist, Ledger, Purlin, Spandrel beam,** and **Stringer**.)

Beam-and-slab floor—A reinforced concrete floor system in which the floor slab is supported by beams of reinforced concrete.

Beam bottom—Soffit or bottom form for a beam.

Beam clamp—Any of various types of tying or fastening units used to hold the sides of beam forms.

Beam-column—A structural member which is subjected to forces producing significant amounts of both bending and compression simultaneously.

Beam form—A retainer or mold so erected as to give the necessary shape, support, and finish to a concrete beam.

Beam hanger—A wire, strap, or other hardware device that supports formwork from structural members.

Beam pocket—Opening left in a vertical member in which a beam is to rest; also an opening in the column or girder form where forms for an intersecting beam will be framed.

Beam saddle—See **Beam hanger**.

Beam side—Vertical side panels or parts of a beam form.

Beam test—A method of measuring the flexural strength (modulus of rupture) of concrete by testing a standard unreinforced beam.

Bearing capacity—The maximum unit pressure which a soil or other material will withstand without failure or without settlement to an amount detrimental to the integrity or the function of the structure.

Bearing stratum—The soil or rock stratum on which a footing or mat bears or which carries the load transferred to it by a pile, pier, caisson, or similar deep foundation unit.

Belite—A name used by Tornebohm (1897) to identify one form of the constituent of portland cement clinker now known when pure as dicalcium silicate ($2CaO \cdot SiO_2$). (See also **Alite, Celite** and **Felite**.)

Bench—See **Pretensioning bed**.

Bending moment—The bending effect at any section of a structural element; it is equal to the algebraic sum of all moments to the right or left of the section.

Bending moment diagram—A graphical representation of the variation of bending moment along the length of the member for a given stationary system of loads.

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.

Beneficiation—Improvement of the chemical or physical properties of a raw material or intermediate product by the removal of undesirable components or impurities.

Bent—Two-dimensional frame which is self-supporting within these dimensions, having at least two legs and usually placed at right angles to the length of the structure which it supports.

Bent bar—A reinforcing bar bent to a prescribed shape such as a truss bar, straight bar with hook, stirrup, or column tie.

Bentonite—A clay composed principally of minerals of the montmorillonoid group, characterized by high adsorption and very large volume change with wetting or drying.

Berliner—A type of terrazzo topping using small and large pieces of marble paving, usually with a standard terrazzo matrix between pieces.

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 acid Bessemer steel and conforming to specified limits on chemical composition.

Binders—Cementing materials, either hydrated cements or products of cement or lime and reactive siliceous materials; the kinds of cement and curing conditions govern the general kind of binder formed; also materials such as asphalt, resins, and other materials forming the matrix of concretes, mortars, and sanded grouts.

Biological shielding—Shielding provided to attenuate or absorb nuclear radiation, such as neutron, proton, alpha, beta, and gamma particles; the shielding is provided mainly by the density of the concrete, except that in the case of neutrons the attenuation is achieved by compounds of some of the lighter elements (e.g., hydrogen and boron). (See also **Shielding concrete**.)

Blaine apparatus—Air-permeability apparatus for measuring the surface area of a finely ground cement, raw material, or other product.

Blaine fineness—The fineness of powdered materials such as cement and pozzolans, expressed as surface area usually in square centimeters per gram, determined by the Blaine apparatus. (See also **Specific surface**.)

Blaine test—A method for determining the fineness of cement or other fine material on the basis of the permeability to air of a sample prepared under specified conditions.

Blast-furnace slag—The nonmetallic product consisting essentially of silicates and aluminosilicates of calcium and other bases, that is developed in a molten condition

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simultaneously with iron in a blast furnace.

1. **Air-cooled blast-furnace slag** is 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.

2. **Expanded blast-furnace slag** is the lightweight, cellular material obtained by controlled processing of molten blast-furnace slag with water, or water and other agents, such as steam or compressed air, or both.

3. **Granulated blast-furnace slag** is the glassy, granular material formed when molten blast-furnace slag is rapidly chilled, as by immersion in water.

Bleed—To undergo bleeding. (See **Bleeding.**)

Bleeding—The autogenous flow of mixing water within, or its emergence from newly placed concrete or mortar; caused by the settlement of the solid materials within the mass; also called water gain.

Bleeding capacity—The ratio of volume of water released by bleeding to the volume of paste or mortar.

Bleeding rate—The rate at which water is released from a paste or mortar by bleeding.

Blending cement—See **Cement, blended**.

Blinding—The application of a layer of weak concrete or other suitable material to reduce surface voids, or to provide a clean dry working surface; also the filling or plugging of the openings in a screen or sieve by the material being separated.

Blistering—The irregular raising of a thin layer at the surface of placed mortar or concrete during or soon after completion of the finishing operation, or in the case of pipe after spinning; also bulging of the finish plaster coat as it separates and draws away from the base coat.

Bloated—Swollen, as in certain lightweight aggregates as a result of processing.

Block—A concrete masonry unit, usually containing hollow cores; also a solid piece of wood or other material to fill spaces between formwork members.

Block beam—A flexural member composed of individual blocks which are joined together by prestressing.

Blockout—A space within a concrete structure under construction in which fresh concrete is not to be placed, called **Core** in United Kingdom.

Blowdown period—Time taken to reduce pressure in an autoclave from maximum to atmospheric.

Blowhole—See **Bug holes**.

Board butt joint—Shotcrete construction joint formed by sloping gunned surface to a 1-in. board laid flat.

Bolster, slab—Continuous wire bar support used to support bars in the bottom of slabs; top wire corrugated at one inch centers to hold bars in position.

Board butt joint—Shortcrete construction joint formed by sloping gunned surface to a 1-in. board laid flat.

Bolt sleeve—A tube surrounding a bolt in a concrete wall to prevent concrete from sticking to the bolt and acting as a spreader for the formwork.

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

Bond area—The area of interface between two elements across which adhesion develops or may develop, as between concrete and reinforcing steel.

Bond breaker—A material used to prevent adhesion of newly placed concrete and the substrate.

Bond length—See **Development length**.

Bond plaster—A specially formulated gypsum plaster designed as first coat application over monolithic concrete.

Bond prevention—Procedures whereby specific tendons in pretensioned construction are prevented from becoming bonded to the concrete for a predetermined distance from the ends of flexural members; measures taken to prevent adhesion of concrete or mortar to surfaces against which it is placed.

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.

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.

Bonded member—A prestressed concrete member in which the tendons are bonded to the concrete either directly or through grouting.

Bonded post-tensioning—Post-tensioned construction in which the annular spaces around the tendons are grouted after stressing, thereby bonding the tendon to the concrete section.

Bonded tendon—A prestressing tendon which is bonded to the concrete either directly or through grouting.

Bonder (Header)—A masonry unit which ties two or more wythes (leaves) of a wall together by overlapping.

Bonding agent—A substance applied to a suitable substrate to create a bond between it and a succeeding layer as between a subsurface and a terrazzo topping or a succeeding plaster application.

Bonding layer—A layer of mortar, usually ⅛ to ½ in. (3 to 13 mm) thick, which is spread on a moist and prepared, hardened concrete surface prior to placing fresh concrete.

Bored pile—A concrete pile, with or without a casing, cast-in-place in a hole previously bored in soil or rock. (See also **Cast-in-place pile**.)

Boron frits—Clear, colorless, synthetic glass produced by fusion and quenching, containing boron. (See also **Boron-loaded concrete**.)

Boron-loaded concrete—High-density concrete including a boron-containing admixture or aggregate, such as mineral colemanite, boron frits, or boron metal alloys, to act as a neutron attenuator. (See also **Biological shielding** and **Shielding concrete**.)

Box out—To form an opening or pocket in concrete by a box-like form.

Brace—Any structural member used to support another; always designed for compression and sometimes for tension under special load conditions.

Bracing—Structural elements which due to their ability to transmit direct stress, are provided to either prevent buckling of individual members subject to compression, to add rigidity to a structure as a whole, or to resist

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lateral loads. A member used to support, strengthen, or position another piece or portion of a framework.

Bracket—An overhanging member projecting from a wall or other body to support weight acting outside the wall, or similar piece to strengthen an angle.

Breccia—Rock composed of angular fragments of older rock cemented together.

Bredigite—A mineral, alpha prime dicalcium silicate ($2CaO \cdot SiO_2$), occurring naturally at Scawt Hill, Northern Ireland; and at Isle of Muck, Scotland; also in slags and portland cement.

Breeze—Usually clinker; also fine divided material from coke production.

Brick seat—Ledge on wall or footing to support a course of masonry.

Bridge deck—The slab or other structure forming the travel surface of a bridge.

Briquette (also **Briquet**)—A molded specimen of mortar with enlarged extremities and reduced center having a cross section of definite area, used for measurement of tensile strength.

Broadcast—To toss granular material, such as sand, over a horizontal surface so that a thin, uniform layer is obtained.

Broom finish—The surface texture obtained by stroking a broom over freshly placed concrete. (See also **Brushed surface**.)

Brown coat—The second coat in three-coat plaster application.

Brown out—To complete application of basecoat plaster.

Brown oxide—A brown mineral pigment having an iron oxide content between 28 and 95 percent. (See also **Limonite**.)

Brownmillerite—A ternary compound originally regarded as $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ (C_4AF) occurring in portland and calcium aluminate cement; now used to refer to a series of solid solutions between $2CaO \cdot Fe_2O_3$ (C_2F) and $2CaO \cdot Al_2O_3$ (C_2A).

Brucite—A mineral having the composition magnesium hydroxide, $Mg(OH)_2$, and a specific crystal structure.

Brushed surface—A sandy texture obtained by brushing the surface of freshly placed or slightly hardened concrete with a stiff brush for architectural effect or, in pavements, to increase skid resistance. (See also **Broom finish**.)

Buck—Framing around an opening in a wall; a door buck encloses the opening in which a door is placed.

Buckling—Failure by lateral or torsional instability of a structural member, occurring with stresses below the yield or ultimate values.

Bug holes—Small regular or irregular cavities, usually not exceeding 15 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.

Buggy—A two-wheeled or motor-driven cart usually rubber-tired, for transporting small quantities of concrete from hoppers or mixers to forms; sometimes called a concrete cart.

Building official—The official charged with administration and enforcement of the applicable building code, or his duly authorized representative.

Build-up—Gunning of shotcrete in successive layers to form a thicker mass; also the accumulation of residual hardened concrete in a mixer.

Bulk cement—Cement which is transported and delivered in bulk (usually in specially constructed vehicles) instead of in bags.

Bulk density—The weight of a material (including solid particles and any contained water) per unit volume including voids. (See also **Specific gravity**.)

Bulk loading—Loading of unbagged cement in containers, specially designed trucks, railroad cars, or ships.

Bulk specific gravity—See **Specific gravity**.

Bulkhead—A partition in formwork blocking fresh concrete from a section of the form or closing a section of the form, such as at a construction joint; a partition in a storage tank or bin, as for cement or aggregate.

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.

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

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

Bull float—A tool comprising a large, flat, rectangular piece of wood, aluminum, or magnesium usually 8 in. (20 cm) wide and 42 to 60 in. (100 to 150 cm) long, and a handle 4 to 16 ft (1 to 5 m) in length used to smooth unformed surfaces of freshly placed concrete.

Bundled bars—A group of not more than four parallel reinforcing bars in contact with each other, usually tied together.

Burlap—A coarse fabric of jute, hemp, or less commonly, flax, for use as a water-retaining covering in curing concrete surfaces; also called **Hessian**.

Bush-hammer—A hammer having a serrated face, as rows of pyramidal points used to roughen or dress a surface; to finish a concrete surface by application of a bush-hammer.

Bush-hammer finish—A finish on concrete obtained by means of a bush-hammer.

Butt joint—A plain square joint between two members.

Buttering—Process of spreading mortars on a brick or other masonry unit with a trowel; also the process by which the interior of a concrete mixer, transportation unit, or other item coming in contact with fresh concrete is provided with a mortar coating so that the fresh concrete coming in contact with it will not be depleted of mortar.

Buttress—A projecting structure to support a wall or building.

Butyl stearate—A colorless oleaginous, practically odorless material ($C_{17}H_{35}COOC_4H_9$) used as a dampproofer for concrete.

C

Cable—See **Tendon**.

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

Caisson pile—A cast-in-place pile made by driving a tube, excavating it, and filling the cavity with concrete.

Calcareous—Containing calcium carbonate or, less generally, containing the element calcium.

Calcine—To alter composition of physical state by heating below the temperature of fusion.

Calcite—A mineral having the composition calcium carbonate ($CaCO_3$) and a specific crystal structure; the principal constituent of limestone, chalk, and marble; used as a major constituent in the manufacture of portland cement.

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Calcium—A silver-white metallic element of the alkaline-earth group occurring only in combination with other elements.

Calcium-aluminate cement—The product obtained by pulverizing clinker consisting essentially of hydraulic calcium aluminates resulting from fusing or sintering a suitably proportioned mixture of aluminous and calcareous materials, called **High-alumina cement** in United Kingdom.

Calcium chloride—A crystalline solid, $CaCl_2$; in various technical grades, used as a drying agent, as an accelerator of concrete, a deicing chemical, and for other purposes.

Calcium stearate—Product of the reaction of lime and stearic acid used as an integral water repellant in concrete.

Calcium-silicate brick—A concrete product made principally from sand and lime which is hardened by autoclave curing.

Calcium-silicate hydrate—Any of the various reaction products of calcium silicate and water, often produced by autoclave curing.

Caliche—Gravel, sand, and desert debris cemented by calcium carbonate or other salts.

California bearing ratio—The ratio of the force per unit area required to penetrate a soil mass with a 3 sq in. (19.4 sq cm) circular piston at the rate of 0.05 in. (1.27 mm) per min to the force required for corresponding penetration of a standard crushed-rock base material; the ratio is usually determined at 0.1 in. (2.5 mm) penetration.

Calorimeter—An instrument for measuring heat exchange during a chemical reaction such as the quantities of heat liberated by the combustion of a fuel or hydration of a cement.

Camber—A deflection that is intentionally built into a structural element or form to improve appearance or to nullify the deflection of the element under the effects of loads, shrinkage, and creep.

Cant strip—See **Chamfer strip**.

Cap—A smooth, plane surface of suitable material bonded to the bearing surfaces of test specimens to insure uniform distribution of load during strength testing.

Cap cables—Short cables (tendons) introduced to prestress the zone of negative bending only.

Capacity—A measure of the rated volume of a particular concrete mixer or agitator, usually limited by specifications to a maximum percentage of total gross volume; also the output of concrete, aggregate, or other product per unit of time (as plant capacity or screen capacity); also load carrying limit of a structure.

Capacity reduction factor—See **Phi (ϕ) factor**.

Capillarity—The movement of a liquid in the interstices of soil or other porous material due to surface tension. (See also **Capillary flow**.)

Capillary flow—Flow of moisture through a capillary pore system, such as in concrete.

Capillary space—Void space in concrete resembling microscopic channels small enough to draw liquid water through them by the molecular attraction of the water adsorbed on their inner surfaces (capillarity).

Carbon black—A finely divided amorphous carbon used to color concrete; produced by burning natural gas in supply of air insufficient for complete combustion; characterized by a high oil absorption and a low specific gravity.

Carbonation—Reaction between carbon dioxide and a hydroxide or oxide to form a carbonate, especially in cement paste, mortar, or concrete; the reaction with calcium compounds to produce calcium carbonate.

Carriageway—In the United Kingdom, a term used in the same meaning as the word "road" in the United States.

Cast-in-place—Mortar or concrete which is deposited in the place where it is required to harden as part of the structure, as opposed to precast concrete.

Cast-in-place pile—A concrete pile concreted either with or without a casing in its permanent location, as distinguished from a precast pile.

Cast-in-situ—See **Cast-in-place**.

Cast stone—Concrete or mortar cast into blocks or small slabs in special molds so as to resemble natural building stone.

Castable refractory—A packaged, dry mixture of hydraulic cement, generally calcium-aluminate cement, and specially selected and proportioned refractory aggregates which, when mixed with water, will produce refractory concrete or mortar.

Catalyst—A substance that initiates a chemical reaction and enables it to proceed under milder conditions than otherwise required and which does not, itself, alter or enter into the reaction.

Catface—Blemish or rough depression in the finish plaster coat caused by variations in the base coat thickness.

Cathead—A notched wedge placed between two formwork members meeting at an oblique angle; a spindle on a hoist; the large, round retention nut used on she bolts.

Catwalk—A narrow elevated walkway.

Cavitation damage—Pitting of concrete caused by implosion, i.e., the collapse of vapor bubbles in flowing water which form in areas of low pressure and collapse as they enter areas of higher pressure.

Celite—A name used by Tornebohm (1897) to identify the calcium aluminoferrite constituent of portland cement. (See also **Alite, Belite, Felite**, and **Brownmillerite.**)

Cellular concrete—A lightweight product consisting of portland cement, cement-silica, cement-pozzolan, lime-pozzolan, or lime-silica pastes, or pastes containing blends of these ingredients and having a homogeneous void or cell structure, attained with gas-forming chemicals or foaming agents (for cellular concretes containing binder ingredients other than, or in addition to, portland cement, autoclave curing is usually employed).

Cellular construction—A method of constructing concrete elements in which part of the interior concrete is replaced by voids.

Cement, aluminous—See **Calcium-aluminate cement**.

Cement, bituminous—A black solid, semisolid, or liquid substance at natural air temperatures and appreciably soluble only in carbon disulfide or some volatile liquid hydrocarbon, being composed of mixed indeterminate hydrocarbons mined from natural deposits, produced as a residue in the distillation of petroleum, or obtained by the destructive distillation of coal or wood.

Cement, blended—A hydraulic cement consisting essentially of an intimate and uniform blend of granulated blast-furnace slag and hydrated lime; or an intimate and uniform blend of portland cement and granulated blast-furnace slag, portland cement and pozzolan, or portland blast-furnace slag cement and pozzolan, produced by intergrinding portland cement clinker with the other ma-

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terials or by blending portland cement with the other materials, or a combination of intergrinding and blending.

Cement, expansive—See **Expansive cement**.

Cement, high-early-strength—Cement characterized by producing earlier strength in mortar or concrete than regular cement, referred to in United States as "Type III."

Cement, hydraulic—See **Hydraulic cement**.

Cement, low-alkali—A portland cement that contains a relatively small amount of sodium or potassium or both; in the United States a cement containing not more than 0.6 percent Na_2O equivalent, i.e., percent Na_2O + (0.658 x percent K_2O).

Cement, low-heat—A cement in which there is only limited generation of heat during setting, achieved by modifying the chemical composition of normal portland cement, referred to in United States as "Type IV."

Cement, masonry—A hydraulic cement for use in mortars for masonry construction, containing one or more of the following materials: portland cement, portland blast-furnace slag cement, portland-pozzolan cement, natural cement, slag cement or hydraulic lime; and in addition usually containing one or more materials such as hydrated lime, limestone, chalk, calcareous shell, talc, slag, or clay, as prepared for this purpose.

Cement, natural—A hydraulic cement produced by calcining a naturally occurring argillaceous limestone at a temperature below the sintering point and then grinding to a fine powder.

Cement, oil-well—Hydraulic cement suitable for use under high pressure and temperature in sealing water and gas pockets and setting casing during the drilling and repair of oil wells; often contains retarders to meet the requirements of use.

Cement, plastic—A special product manufactured for plaster and stucco application.

Cement, portland—A hydraulic cement produced by pulverizing clinker consisting essentially of hydraulic calcium silicates, and usually containing one or more of the forms of calcium sulfate as an interground addition.

Cement, portland blast-furnace slag—A hydraulic cement consisting essentially of an intimately interground mixture of portland cement clinker and granulated blast-furnace slag or an intimate and uniform blend of portland cement and fine granulated blast-furnace slag in which the amount of the slag constituent is within specified limits.

Cement, portland-pozzolan—A hydraulic cement consisting essentially of an intimate and uniform blend of portland cement or portland blast-furnace slag cement and fine pozzolan produced by intergrinding portland-cement clinker and pozzolan, by blending portland cement or portland blast-furnace slag cement and finely divided pozzolan, or a combination of intergrinding and blending, in which the pozzolan constituent is within specified limits.

Cement, self-stressing—See **Expansive cement**.

Cement, shrinkage-compensating—See **Expansive cement.**

Cement, slag—A hydraulic cement consisting essentially of an intimate and uniform blend of granulated blast-furnace slag and hydrated lime in which the slag constituent is more than a specified minimum percentage.

Cement, sulfate-resistant—Portland cement, low in tricalcium aluminate, to reduce susceptibility of concrete to attack by dissolved sulfates in water or soils, designated "Type V" in United States.

Cement, sulfoaluminate—See **Expansive cement**.

Cement, supersulfated—A hydraulic cement made by intimately intergrinding a mixture of granulated blast-furnace slag, calcium sulfate, and a small amount of lime, cement, or cement clinker; so named because the equivalent content of sulfate exceeds that for portland blast-furnace slag cement.

Cement, white—Portland cement which hydrates to a white paste; made from raw materials of low iron content the clinker for which is fired by a reducing flame.

Cement-aggregate ratio—The ratio of cement to total aggregate either by weight or volume.

Cement bacillus—See **Ettringite**.

Cement content—Quantity of cement contained in a unit volume of concrete or mortar, preferably expressed as weight.

Cement factor—See **Cement content**.

Cement gel—The colloidal material that makes up the major portion of the porous mass of which mature hydrated cement paste is composed.

Cement gun—A machine for pneumatic placement of mortar or small aggregate concrete; in the "Dry Gun" water from a separate hose meets the dry material at the nozzle of the gun; with the "Wet Gun" the delivery hose conveys the premixed mortar or concrete. (See also **Shotcrete**.)

Cement kiln—See **Kiln, cement**.

Cement paint—A paint consisting generally of white portland cement and water, pigments, hydrated lime, water repellents, or hygroscopic salts.

Cement plaste, neat—See **Neat cement paste**.

Cement plaster—See **Stucco** and **Plaster**.

Cement rock—Natural impure limestone which contains the ingredients for production of portland cement in approximately the required proportions.

Cementation process—The process of injecting cement grout under pressure into certain types of ground (e.g., gravel, fractured rock) to solidify it.

Cementitious—Having cementing properties.

Center-matched—Tongue-and-groove lumber with the tongue and groove at the center of the piece rather than offset as in standard matched. (See also **Standard matched**.)

Centering—Specialized falsework used in the construction of arches, shells, and space structures, or any continuous structure where the entire falsework is lowered (struck or decentered) as a unit to avoid the introduction of injurious stress in any part of the structure. (See also **Falsework**.)

Central-mixed concrete—Concrete which is completely mixed in a stationary mixer from which it is transported to the delivery point.

Central mixer—A stationary concrete mixer from which the freshly mixed concrete is transported to the work.

Centrifugally cast concrete—See **Spun concrete**.

Ceramic bond—The development of fired strength as a result of thermo-chemical reactions between materials exposed to temperatures approaching the fusion point of the mixture such as that which may occur, under these conditions, between calcium-aluminate cement and a refractory aggregate.

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Chair—See **Bar support**.

Chalk—A soft limestone composed chiefly of the calcareous remains of marine organisms.

Chalking—Disintegration of coatings such as a cement paint, manifested by the presence of a loose powder evolved from the paint at, or just beneath, the surface.

Charging—Introducing, feeding, or loading materials into a concrete or mortar mixer, furnace, or other container or receptacle where they will be further treated or processed.

Checking—Development of shallow cracks at closely spaced but irregular intervals on the surface of mortar or concrete.

Chemical bond—Bond between materials that is the result of cohesion and adhesion developed by chemical reaction.

Chemically prestressed concrete—Concrete made with expansive cement and reinforcing under conditions such that the expansion of the cement induces tensile stress in the reinforcing so as to produce prestressed concrete.

Chemically prestressing cement—A type of expansive cement containing a higher percentage of expansive component than shrinkage compensating cement which, when used in concretes with adequate internal or external restraint, will expand sufficiently, due to chemical reactions within the matrix, to develop the stresses necessary for prestressing the concrete.

Chert—A very fine grained siliceous rock characterized by hardness and conchoidal fracture in dense varieties, the fracture becoming splintery and the hardness decreasing in porous varieties, and in a variety of colors; it is composed of silica in the form of chalcedony, cryptocrystalline or microcrystalline quartz, or opal, or combinations of any of these.

Chipping—Treatment of a hardened concrete surface by chiseling.

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

Chordus moldus—See **Modulus of elasticity**.

Chute—A sloping trough or tube for conducting concrete, cement, aggregate, or other free flowing materials from a higher to a lower point.

Clamp—See **Tie Coupler**.

Class (of concrete)—An arbitrary characterization of concrete of various qualities or usages, usually by compressive strength.

Clay—Natural mineral material having plastic properties and composed of very fine particles; the clay mineral fraction of a soil is usually considered to be the portion consisting of particles finer than 2 μm; clay minerals are essentially hydrous aluminum silicates or occasionally hydrous magnesium silicates.

Clay content—Percentage of clay by dry weight of a heterogeneous material, such as a soil or a natural concrete aggregate.

Cleanout—An opening in the forms for removal of refuse, to be closed before the concrete is placed; a port in tanks, bins, or other receptacles for inspection and cleaning.

Cleanup—Treatment of horizontal construction joints to remove all surface material and contamination down to a condition of cleanness corresponding to that of a freshly broken surface of concrete.

Cleat—Small board used to connect formwork members or used as a brace. (See also **Batten**.)

Climbing form—A form which is raised vertically for succeeding lifts of concrete in a given structure.

Clinker—A partially fused product of a kiln, which is ground to make cement; also other vitrified or burnt material.

Clip—Wire or sheet-metal device used to attach various types of lath to supports or to secure adjacent lath sheets.

Closed-circuit grouting—Injection of grout into a hole intersecting fissures or voids which are to be filled at such volume and pressure that grout input to the hole is greater than the grout take of the surrounding formation, excess grout being returned to the pumping plant for recirculation.

Coarse aggregate—Aggregate predominantly retained on the U.S. Standard No. 4 (4.75 mm) sieve; or that portion of an aggregate retained on the No. 4 (4.75 mm) sieve. (See also **Aggregate**.)

Coarse aggregate factor—The ratio, expressed as a decimal, of the amount (weight or solid volume) of coarse aggregate in a unit volume of well-proportioned concrete to the amount of dry-rodded coarse aggregate compacted into the same volume (b/b_0).

Coarse-grained soil—Soil in which the larger grain sizes, such as sand and gravel predominate.

Coat—A film or layer as of paint or plaster applied in a single operation.

Coating—Material applied to a surface by brushing, dipping, mopping, spraying, trowelling, etc., to preserve, protect, decorate, seal, or smooth the substrate; also refers to foreign or deleterious substances found adhering to aggregate particles.

Cobble—In geology, a rock fragment between 2½ and 10 in. (64 and 256 mm) in diameter; as applied to coarse aggregate for concrete, the material in the nominal size range 3 to 6 in. (75 to 150 mm).

Cobblestone—A rock fragment, usually rounded or semirounded, with an average dimension between 3 and 12 in. (75 and 300 mm).

Coefficient of subgrade friction—The coefficient of friction between a grade slab and its subgrade; used to estimate shrinkage reinforcing steel requirements by calculating stresses induced in the concrete by its shrinkage and the subgrade restraint.

Coefficient of subgrade reaction—See **Modulus of subgrade reaction**.

Coefficient of thermal expansion—Change in linear dimension per unit length or change in volume per unit volume per degree of temperature change.

Coefficient of variation (V)—The standard deviation expressed as a percentage of the average. (See also **Standard deviation**.)

Cold face—The surface of a refractory section not exposed to the source of heat.

Cold joint—A joint or discontinuity resulting from a delay in placement of sufficient time to preclude a union of the material in two successive lifts.

Cold joint lines—Visible lines on the surfaces of formed concrete indicating the presence of joints where one layer of concrete had hardened before subsequent concrete was placed. (See also **Cold joint**.)

Cold strength—The compressive or flexural strength of refractory concrete determined prior to drying or firing.

Cold-water paint—A paint in which the binder or vehicle portion is composed of latex, casein, glue, or some similar material dissolved or dispersed in water.

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Colemanite—A mineral, hydrated calcium borate ($Ca_2B_6O_{11} \cdot 5H_2O$). (See also **Boron-loaded concrete**.)

Colloid—A substance that is in a state of division preventing passage through a semipermeable membrane, consisting of particles ranging from 10^{-5} to 10^{-7} cm in diameter.

Colloidal concrete—Concrete of which the aggregate is bound by colloidal grout.

Colloidal grout—A grout which has artificially induced cohesiveness or ability to retain the dispersed solid particles in suspension.

Colloidal particle—An electrically charged particle, generally smaller than 200 μm, dispersed in a second continuous medium.

Colorimetric value—An indication of the amount of organic impurities present in fine aggregate.

Column—A member used primarily to support axial compression loads and with a height of at least three times its least lateral dimension.

Column, long—A column whose load capacity is limited by buckling rather than strength. (See also **Column, slender**.)

Column, short—A column whose load capacity is limited by strength rather than buckling; a column which is customarily so stocky and sufficiently restrained that at least 95 percent of the cross-sectional strength can be developed.

Column, slender—A column whose load capacity is reduced by the increased eccentricity caused by secondary deflection moments.

Column capital—An enlargement of the end of a column designed and built to act as an integral unit with the column and flat slab and increase the shearing resistance.

Column clamp—Any of various types of tying or fastening units to hold column form sides together.

Column side—One of the vertical panel components of a column form.

Column strip—The portion of a flat slab over the columns and consisting of the two adjacent quarter panels on each side of the column center line.

Combined aggregate grading—Particle size distribution of a mixture of fine and coarse aggregate.

Combined footing—A structural unit or assembly of units supporting more than one column.

Come-along—

1. A hoe-like tool with a blade about 4 in. (10 cm) high and 20 in. (50 cm) wide and curved from top to bottom, used for spreading concrete.
2. A colloquial name for a device (load binder) used to tighten chains holding loads in place on a truck bed.

Compacting factor—The ratio obtained by dividing the observed weight of concrete which fills a container of standard size and shape when allowed to fall into it under standard conditions of test, by the weight of fully compacted concrete which fills the same container.

Compaction—The process whereby the volume of freshly placed mortar or concrete is reduced to the minimum practical space usually by vibration, centrifugation, tamping, or some combination of these; to mold it within forms or molds and around embedded parts and reinforcement, and to eliminate voids other than entrained air. (See also **Consolidation**.)

Composite column—A concrete compression member reinforced longitudinally with structural steel shapes, pipe or tubing with or without longitudinal reinforcing bars.

Composite concrete flexural members—Concrete flexural members consisting of concrete elements constructed in separate placements but so interconnected that the elements respond to loads as a unit.

Composite construction—A type of construction using members produced by combining different materials (e.g., concrete and structural steel), or members produced by combining cast-in-place and precast concrete such that the combined components act together as a single member.

Composite pile—A pile made up of different materials, usually concrete and wood, or steel fastened together end to end, to form a single pile.

Composite sample—Sample obtained by blending two or more individual samples of a material.

Compound, curing—See **Curing compound, Membrane curing**.

Compound, joint sealing—An impervious material used to fill joints in pavements or structures.

Compound, sealing—An impervious material applied as a coating or to fill joints or cracks in concrete or mortar. (See also **Joint sealant**.)

Compound, "waterproofing"— Material used to impart water repellency to a structure or a constructional unit.

Compression flange—The widened portion of an I, T, or similar cross section beam which is shortened or compressed by bending under normal loads, such as the horizontal portion of the cross section of a simple span T-beam.

Compression member—Any member in which the primary stress is longitudinal compression.

Compression reinforcement—Reinforcement designed to carry compressive stresses. (See also **Stress.**)

Compression test—Test made on a test specimen of mortar or concrete to determine the compressive strength; in the United States, unless otherwise specified, compression tests of mortars are made on 2-in. (50-mm) cubes and compression tests of concrete are made on cylinders 6 in. (152 mm) in diameter and 12 in. (305 mm) high.

Compressive strength—The measured maximum resistance of a concrete or mortar specimen to axial loading; expressed as force per unit cross-sectional area; or the specified resistance used in design calculations, in the U.S. customary units of measure expressed in pounds per square inch (psi) and designated f_c'.

Compressive strength, average f_c'—The term used to describe the average compressive strength of a given class or strength level of concrete; in ACI 214, defined as average compressive strength required to statistically meet a designated specific strength, f_c'.

Concentric tendons—Tendons following a line coincident with the gravity axis of the prestressed concrete member.

Concordant tendons—Tendons in statically indeterminate structures which are coincident with the pressure line produced by the tendons; such tendons do not produce secondary moments.

Concrete—A composite material which consists essentially of a binding medium within which are embedded particles or fragments of aggregate; in portland cement concrete, the binder is a mixture of portland cement and water.

Concrete, aerated—See **Concrete, foamed**.

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Concrete, asphalt—A mixture of asphalt and aggregate.
Concrete, colloidal—See **Colloidal concrete**.
Concrete, cyclopean—See **Cyclopean concrete**.
Concrete, dense—Concrete containing a minimum of voids.
Concrete, dry-packed—See **Dry-packed concrete**.
Concrete, exposed—See **Exposed concrete**.
Concrete, fair face—See **Fair face concrete**.
Concrete, fat—See **Fat concrete**.
Concrete, fibrous—Concrete containing, dispersed, randomly oriented fibers.
Concrete, field—Concrete delivered or mixed, placed, and cured on the job site.
Concrete, foamed—Concrete made very light and cellular by the addition of a prepared foam or by generation of gas within the unhardened mixture.
Concrete, gap-graded—See **Gap-graded concrete**.
Concrete, granolithic—See **Granolithic concrete**.
Concrete, green—Concrete which has set but not appreciably hardened.
Concrete, heavy—See **High-density concrete**.
Concrete, high-density—See **High-density concrete**.
Concrete, in-situ (also **cast-in-place**)—Concrete which is deposited in the place where it is required to harden as part of the structure, as opposed to precast concrete.
Concrete, lean—See **Lean concrete**.
Concrete, lightweight—See **Lightweight concrete**.
Concrete, low-density—See **Low-density concrete**.
Concrete, mass—See **Mass concrete**.
Concrete, monolithic—See **Monolithic concrete**.
Concrete, no-fines—See **No-slump concrete**.
Concrete, normal-weight—Concrete having a unit weight of approximately 150 lb per cu ft (2400 kg per cu m) made with aggregates of normal weight.
Concrete pile—See **Cast-in-place pile** and **Precast pile**.
Concrete, precast—See **Precast concrete**.
Concrete, prepacked—See **Concrete, preplaced-aggregate.**
Concrete, preplaced-aggregate—Concrete produced by placing coarse aggregate in a form and later injecting a portland cement-sand grout, usually with admixtures, to fill the voids.
Concrete, prestressed—See **Prestressed concrete**.
Concrete, pumped—See **Pumped concrete**.
Concrete, ready-mixed—See **Ready-mixed concrete.**
Concrete, refractory—See **Refractory concrete**.
Concrete, reinforced—See **Reinforced concrete**.
Concrete, spun—See **Spun concrete**.
Concrete, structural—Concrete used to carry structural load or to form an integral part of a structure; concrete of a quality specified for structural use; concrete used solely for protective cover, fill, or insulation is not considered structural concrete.
Concrete, structural lightweight—Structural concrete made with lightweight aggregate; the unit weight usually is in the range of 90 to 115 lb per cu ft (1440 to 1850 kg per cu m).
Concrete, terrazzo—Marble-aggregate concrete that is cast-in-place or precast and ground smooth for decorative surfacing purposes on floors and walls.
Concrete, transit-mixed—See **Transit-mixed concrete**.
Concrete, translucent—A combination of glass and concrete used together in precast or prestressed panels.
Concrete, vacuum—See **Vacuum concrete**.
Concrete, vibrated—See **Vibrated concrete**.
Concrete, visual—See **Exposed concrete**.

Concrete breaker—A compressed-air tool specially designed and constructed to break up concrete.
Concrete cart—See **Buggy**.
Concrete containment structure—A composite concrete and steel assembly that is designed as an integral part of a pressure retaining barrier which in an emergency prevents the release of radioactive or hazardous effluents from nuclear power plant equipment enclosed therein.
Concrete finishing machine—A machine mounted on flanged wheels which rides on the forms or on specially set tracks, used to finish surfaces such as those of pavements; or a portable power driven machine for floating and finishing of floors and other slabs.
Concrete paver—A concrete mixer, usually mounted on crawler tracks, which mixes and places concrete pavement on the subgrade.
Concrete pile—A precast reinforced or prestressed concrete pile driven into the ground by a pile driver or otherwise placed. (See also **Cast-in-place pile**.)
Concrete pump—An apparatus which forces concrete to the placing position through a pipeline or hose.
Concrete reactor vessel—A composite concrete and steel assembly that functions as a component of the principal pressure-containing barrier for the nuclear fuel's primary heat extraction fluid (primary coolant).
Concrete spreader—A machine, usually carried on side forms or on rails parallel thereto, designed to spread concrete from heaps already dumped in front of it, or to receive and spread concrete in a uniform layer.
Concrete strength—See **Compressive strength, Fatigue strength, Flexural strength, Shear strength, Splitting tensile strength, Tensile strength, Ultimate strength,** and **Yield strength**.
Concrete vibrating machine—A machine which compacts a layer of freshly mixed concrete by vibration.
Conductivity, thermal—See **Thermal conductivity**.
Cone, slump—See **Slump cone** and **Slump**.
Cone bolt—A form of tie rod for wall forms with cones at each end inside the forms so that a bolt can act as a spreader as well as a tie.
Confined concrete—Concrete containing closely spaced special transverse reinforcement which is provided to restrain the concrete in directions perpendicular to the applied stresses.
Confined region—Region with transverse reinforcement within beam-column joints.
Consistency—The relative mobility or ability of freshly mixed concrete or mortar to flow; the usual measurements are slump for concrete, flow for mortar or grout, and penetration resistance for neat cement paste.
Consistency factor—A measure of grout fluidity roughly analogous to viscosity, which describes the ease with which grout may be pumped into pores or fissures; usually a laboratory measurement in which consistency is reported in degrees of rotation of a torque viscosimeter in a specimen of grout.
Consistometer—An apparatus for measuring the consistency of cement pastes, mortars, grouts, or concretes.
Consolidation—The process of inducing a closer arrangement of the solid particles in freshly mixed concrete or mortar during placement by the reduction of voids, usually by vibration, centrifugation, tamping, or some combination of these actions; also applicable to similar manipulation of other cementitious mixtures, soils, aggregates, or the like. (See also **Compaction**.)

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Construction joint—The surface where two successive placements of concrete meet, across which it is desirable to develop and maintain bond between the two concrete placements, and through which any reinforcement which may be present is not interrupted. (See also **Contraction joint**.)

Construction loads—The loads to which a permanent or temporary structure is subjected during construction.

Contact ceiling—A ceiling which is secured in direct contact with the construction above without use of furring.

Contact pressure—Pressure acting at and perpendicular to the contact area between footing and soil, produced by the weight of the footing and all forces acting on it.

Contact splice—A means of connecting reinforcing bars in which the bars are lapped and in direct contact. (See also **Lap splice**.)

Containment grouting—See **Perimeter grouting**.

Continuous beam—See **Continuous slab or beam**.

Continuous footing—A combined footing of prismatic or truncated shape, supporting two or more columns in a row.

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

Continuous mixer—A mixer into which the ingredients of the mixture are fed without stopping, and from which the mixed product is discharged in a continuous stream.

Continuous slab or beam—A slab or beam which extends as a unit over three or more supports in a given direction.

Continuously reinforced pavement—A pavement with continuous longitudinal steel reinforcement and no intermediate transverse expansion or contraction joints.

Contraction (or Expansion), of concrete—The sum of volume changes occurring as the result of all processes affecting the bulk volume of a mass of concrete. (See also **Shrinkage**.)

Contraction joint—Formed, sawed, or tooled groove in a concrete structure to create a weakened plane and regulate the location of cracking resulting from the dimensional change of different parts of the structure. (See also **Isolation joint**.)

Contraction-joint grouting—Injection of grout into contraction joints.

Control factor—The ratio of the minimum compressive strength to the average compressive strength.

Control joint—See **Contraction joint**.

Control-joint grouting—See **Contraction-joint grouting**.

Conventional design—Design procedure using moments or stresses determined by widely accepted methods.

Conveying hose—See **Delivery hose**.

Conveyor—A device for moving materials; usually a continuous belt, an articulated system of buckets, a confined screw, or a pipe through which material is moved by air or water.

Coping—The material or units used to form a cap or finish on top of a wall, pier, pilaster, or chimney.

Coquina—A type of limestone formed of sea shells in loose or weakly cemented condition, found along present or former shorelines; used as a calcareous raw material in cement manufacture and other industrial operations.

Corbel—A projection from the face of a beam, girder, column, or wall used as a beam seat or a decoration.

Core—

1. The soil material enclosed within a tubular pile after driving (it may be replaced with concrete).
2. The mandrel used for driving casings for cast-in-place piles.
3. A structural shape used to internally reinforce a drilled-in-caisson.
4. A cylindrical sample of hardened concrete or rock obtained by means of a core drill.
5. The molded open space in a concrete masonry unit. See also **Blockout**.

Core test—Compression test on a concrete sample cut from hardened concrete by means of a core drill.

Cored beam—A beam whose cross section is partially hollow, or a beam from which cored samples of concrete have been taken.

Coring—The act of obtaining cores from concrete structures or rock foundations.

Corner reinforcement—Metal reinforcement for plaster at re-entrant corners to provide continuity between two intersecting planes; or concrete reinforcement used at wall intersections or near corners of square or rectangular openings in walls, slabs, or beams.

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

Cotton mats—Cotton-filled quilts fabricated for use as a water-retaining covering in curing concrete surfaces.

Coupler—

1. A device for connecting reinforcing bars or prestressing tendons end to end.
2. A device for locking together the component parts of a tubular metal scaffold (also known as a **Clamp**).

Coupling pin—An insert device used to connect lifts or tiers or formwork scaffolding vertically.

Course—In concrete construction, a horizontal layer of concrete, usually one of several making up a lift; in masonry construction, a horizontal layer of block or brick. (See also **Lift**.)

Cover—In reinforced concrete, the least distance between the surface of the reinforcement and the outer surface of the concrete.

Cover block—See **Spacer**.

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

Cracked section—A section designed or analyzed on the assumption that concrete has no resistance to tensile stress.

Cracking load—The load which causes tensile stress in a member to exceed the tensile strength of the concrete.

Craze cracks—Fine, random cracks or fissures caused by shrinkage which may appear in a surface of plaster, cement paste, mortar, or concrete.

Crazing—The development of craze cracks; the pattern of craze cracks existing in a surface. (See also **Checking.**)

Creep—Time-dependent deformation due to sustained load.

Crimped wire—Wire deformed into a curve which approximates a sine curve as a means of increasing the capacity of the wire to bond to concrete; also welded wire fabric crimped to provide an integral chair. (See also **Deformed reinforcement**.)

Cross bracing—A system of members which connect frames or panels of scaffolding laterally to make a tower or continuous structure.

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Cross joint—The joint at the end of individual formboards between sub-purlins.

Cross section—The section of a body perpendicular to a given axis of the body; a drawing showing such a section.

Cross-tee—A light-gage metal member resembling an upside-down "tee" used to support the abutting ends of form-boards in insulating concrete roof constructions

Crush plate—An expendable strip of wood attached to the edge of a form or intersection of fitted forms, to protect the form from damage during prying, pulling, or other stripping operations. (See also **Wrecking strip**.)

Crushed gravel—The product resulting from the artificial crushing of gravel with a specified minimum percentage of fragments having one or more faces resulting from fracture. (See also **Coarse aggregate**.)

Crushed stone—The product resulting from the artificial crushing of rocks, boulders, or large cobblestones, substantially all faces of which possess well-defined edges and have resulted from the crushing operation. (See also **Coarse aggregate**.)

Crusher-run aggregate—Aggregate that has been broken in a mechanical crusher and has not been subjected to any subsequent screening process.

C/S ratio—The molar or weight ratio, whichever is specified, of calcium oxide to silicon dioxide; usually of binder materials cured in an autoclave.

Cube strength—The load per unit area at which a standard cube fails when tested in a specified manner.

Cubical piece (of aggregate)—One in which length, breadth and thickness are approximately equal.

Cumulative batching—Measuring more than one ingredient of a batch in the same container by bringing the batcher scale into balance at successive total weights as each ingredient is accumulated in the container.

Curb form—A retainer or mold used in conjunction with a curb tool to give the necessary shape and finish to a concrete curb.

Curb tool—A tool used to give the desired finish and shape to the exposed surfaces of a concrete curb.

Curing—Maintenance of humidity and temperature of freshly placed concrete during some definite period following placing, casting, or finishing to assure satisfactory hydration of the cementitious materials and proper hardening of the concrete.

Curing, electrical—A system in which a favorable temperature is maintained in freshly-placed concrete by supplying heat generated by electrical resistance.

Curing, steam—See **Steam curing**.

Curing agent—Catalyst, hardener. (See also **Catalyst, Hardener**.)

Curing blanket—A built-up covering of sacks, matting, hessian, straw, waterproof paper, or other suitable material placed over freshly finished concrete. (See also **Burlap**.)

Curing compound—A liquid that can be applied as a coating to the surface of newly placed concrete to retard the loss of water or, in the case of pigmented compounds, also to reflect heat so as to provide an opportunity for the concrete to develop its properties in a favorable temperature and moisture environment. (See also **Curing**.)

Curing cycle—See **Autoclave cycle** and **Steam-curing cycle**.

Curing delay—See **Presteaming period**.

Curing kiln—See **Steam curing room**.

Curing membrane—See **Membrane curing** and **Curing compound**.

Curling—The distortion of an originally essentially linear or planar member into a curved shape such as the warping of a slab due to creep or to differences in temperature or moisture content in the zones adjacent to its opposite faces.

Curtain—A vertically-placed mat of vertical and horizontal reinforcing steel in a member such as a wall; known as a double curtain (of reinforcement) when a mat is at each face.

Curtain grouting—Injection of grout into a subsurface formation in such a way as to create a zone of grouted material transverse to the direction of anticipated water flow.

Curvature friction—Friction resulting from bends or curves in the specified prestressing cable profile.

Cutting screed—Sharp edged tool used to trim shotcrete to finished outline. (See also **Rod**.)

Cyclopean concrete—Mass concrete in which large stones, each of 100 lb (50 kg) or more, are placed and embedded in the concrete as it is deposited. (See also **Rubble concrete**.)

Cylinder strength—See **Compressive strength**.

D

Dampproofing—Treatment of concrete or mortar to retard the passage or absorption of water, or water vapor, either by application of a suitable coating to exposed surfaces, or by use of a suitable admixture or treated cement, or by use of pre-formed films such as polyethylene sheets under slabs on grade. (See also **Vapor barrier**.)

Darby—A hand-manipulated straightedge, usually 3 to 8 ft (1 to 2.5 m) long, used in the early stage leveling operations of concrete or plaster, preceding supplemental floating and finishing.

Dash-bond coat—A thick slurry of portland cement, sand, and water flicked on surfaces with a paddle or brush to provide a base for subsequent portland cement plaster coats; sometimes used as a final finish on plaster.

D-cracking—The progressive formation on a concrete surface of a series of fine cracks at rather close intervals, often of random patterns, but in slabs on grade paralleling edges, joints, and cracks and usually curving across slab corners. (Also termed **D-cracks** and **D-line cracks**.)

Dead end—In the stressing of a tendon from one end only, the end opposite that to which stress is applied.

Dead-end anchorage—The anchorage at that end of a tendon which is opposite the jacking end.

Dead load—A constant load that in structures is due to the mass of the members, the supported structure, and permanent attachments or accessories.

Deadman—An anchor for a guy line, usually a beam, block, or other heavy item buried in the ground, to which a line is attached.

Decenter—To lower or remove centering or shoring.

Deck—The form on which concrete for a slab is placed, also the floor or roof slab itself. (See also **Bridge deck**.)

Decking—Sheathing material for a deck or slab form.

Deflected tendons—Tendons which have a trajectory that is curved or bent with respect to the gravity axis of the concrete member.

Deflection—A variation in position or shape of a structure or structural element due to effects of loads or volume

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Def

change, usually measured as a linear deviation from an established plane rather than an angular variation.

Deformation—A change in dimension or shape due to stress. (See also **Time dependent deformation**.)

Deformed bar—A reinforcing bar with a manufactured pattern of surface ridges which provide a locking anchorage with surrounding concrete.

Deformed plate—A flat piece of metal, thicker than ¼ in. (6 mm), having horizontal deformations or corrugations; used in construction to form a vertical joint and provide a mechanical interlock between adjacent sections.

Deformed reinforcement—Metal bars, wire, or fabric with a manufactured pattern of surface ridges which provide a locking anchorage with surrounding concrete.

Deformed tie bar—See **Tie bar.**

Dehydration—Removal of chemically bound, adsorbed, or absorbed water from a material.

Deicer—A chemical, such as sodium or calcium chloride, used to melt ice or snow on slabs and pavements, such melting being due to depression of the freezing point.

Delamination—A separation along a plane parallel to a surface as in the separation of a coating from a substrate or the layers of a coating from each other, or in the case of a concrete slab, a horizontal splitting, cracking, or separation of a slab in a plane roughly parallel to, and generally near,the upper surface; found most frequently in bridge decks and caused by the corrosion of reinforcing steel or freezing and thawing; similar to spalling, scaling or peeling except that delamination affects large areas and can often only be detected by tapping.

Delay—See **Prestreaming period**.

Delivery hose—Hose through which shotcrete, grout, or pumped concrete or mortar passes; also known as material hose or conveying hose.

Demolding—Removal of molds from concrete test specimens or precast products. (See also **Strip**.)

Dense concrete—See **Concrete, dense**.

Dense-graded aggregate—Aggregates graded to produce low void content and maximum weight when compacted.

Density—Weight per unit volume. (See also **Specific gravity**.)

Density (dry)—The weight per unit volume of a dry substance at a stated temperature. (See also **Specific gravity**.)

Density control—Control of density of concrete in field construction to insure that specified values as determined by standard tests are obtained.

Design load—Load, multiplied by appropriate load factor, used to proportion members.

Design strength—The load-bearing capacity of a member computed on the basis of strain compatibility between the concrete and the reinforcement, the resulting design stresses being taken as the strength of concrete and the yield stress of steel respectively to compute the ultimate strength of a section.

Deterioration—Disintegration or chemical decomposition of a material during test or service exposure. (See also **Disintegration**.)

Detritus—Loose material produced by the disintegration of rocks through geological agencies or processes simulating those of nature.

Development bond stress—See **Anchorage bond stress.**

Development length—The length of embedded reinforcement required to develop the design strength of the reinforcement at a critical section; formerly called bond length.

Devil's float—A wooden float with two nails protruding from the toe, used to roughen the surface of a brown plaster coat. (See also **Texturing**.)

Diagonal crack—An inclined crack caused by shear stress, usually at about 45 degrees to the neutral axis of a concrete member; or a crack in a slab, not parallel to lateral or longitudinal dimension.

Diagonal cracking—Development of diagonal cracks. (See also **Diagonal tension**.)

Diagonal tension—The principal tensile stress resulting from the combination of normal and shear stresses acting upon a structural element.

Diametral compression test—See **Splitting tensile test**.

Diamond mesh—A metallic fabric having rhomboidal openings in a geometric pattern. (See also **Expanded metal lath**.)

Diatomaceous earth—A friable earthy material composed of nearly pure hydrous amorphous silica (opal) and consisting essentially of the frustules of the microscopic plants called diatoms.

Dicalcium silicate—A compound having the composition $2CaO \cdot SiO_2$, abbreviated C_2S, that occurs in portland-cement clinker. (See also **Belite**.)

Differential thermal analysis (DTA)—Indication of thermal reaction by differential thermocouple recording of temperature changes in a sample under investigation compared with those of a thermally passive control sample, that is heated uniformly and simultaneously.

Diffusivity, thermal—See **Thermal diffusivity**.

Dilation—An expansion of concrete during cooling or freezing generally calculated as the maximum deviation from the normal thermal contraction predicted from the length change-temperature curve or length change-time curve established at temperatures before initial freezing.

Diluent—A substance, liquid or solid, mixed with the active constituents of a formulation to increase the bulk or lower the concentration.

Direct dumping—Discharge of concrete directly into place from crane bucket or mixer.

Discoloration—Departure of color from that which is normal or desired.

Disintegration—Deterioration into small fragments or particles due to any cause.

Dispersant—A material which deflocculates or disperses finely ground materials by satisfying the surface energy requirements of the particles; used as a slurry thinner or grinding aid.

Dispersing agent—An agent capable of increasing the fludity of pastes, mortars, or concretes by reduction of inter-particle attraction.

Divider strips—In terrazzo work, nonferrous metal or plastic strips of different thicknesses, and embedded depths usually ⅜ to 1¼ in. (10 to 40 mm), used to form panels in the topping.

D-line cracks—See **D-cracking**.

Dolomite—A mineral having a specific crystal structure and consisting of calcium carbonate and magnesium carbonate in equivalent chemical amounts which are 54.27 and 45.73 percent by weight, respectively; a rock containing dolomite as the principal constituent.

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Dome—Square prefabricated pan form used in two-way (waffle) concrete joist floor construction.

Double headed nail—A nail with two heads at, or near, one end to permit easy removal; widely used in concrete formwork.

Double T-beam—A precast concrete member composed of two beams and a top slab projecting on both sides; also a flat slab panel with projecting stems.

Double-up—A method of plastering characterized by application in successive operations with no setting or drying time between coats.

Doughnut (Donut)—A large washer of any shape to increase bearing area of bolts and ties; also a round concrete spacer with hole in the center to hold bars the desired distance from the forms.

Dowel—A steel pin, commonly a plain round steel bar, which extends into two adjoining portions of a concrete construction, as at a joint in a pavement slab, so as to connect the portions and transfer shear loads. Also, as used in the construction of column and wall sections, a deformed steel reinforcing bar placed so as to transmit tension or compression as well as shear loads.

Dowel deflection—Deflection caused by the transverse load imposed on a dowel.

Dowel lubricant—Lubricating material applied to bars in expansion joints to reduce bond with the concrete and promote unrestrained longitudinal movement.

Dowel shear—The force applied in the plane of the cross section of the dowel.

Drainage—The interception and removal of water from on or under an area or roadway; the process of removing surplus ground or surface water artificially; a general term for gravity flow of liquids in conduits.

Drainage fill—Base course of granular material placed between floor slab and sub-grade to impede capillary rise of moisture. Also, lightweight concrete placed on floors or roofs to promote drainage.

Draped tendons—See **Deflected tendons**.

Dried strength—The compressive or flexural strength of refractory concrete determined within 3 hrs after first drying in an oven at 220 to 230 F (105 to 110 C) for a specified time.

Drier—Chemical which promotes oxidation or drying of a paint or adhesive.

Drip—A transverse groove in the underside of a projecting piece of wood, stone, or concrete to prevent water from flowing back to a wall.

Dropchute—A device used to confine or to direct the flow of a falling stream of fresh concrete.

1. **Dropchute, articulated**—A device consisting of a succession of tapered metal cylinders so designed that the lower end of each cylinder fits into the upper end of the one below.

2. **Dropchute, flexible**—A device consisting of a heavy, rubberized canvas, or plastic, collapsible tube.

Drop-in beam—A simple beam, usually supported by cantilever arms, with joints so arranged that it is installed by lowering into position.

Drop panel—The thickened structural portion of a flat slab in the area surrounding column, column capital, or bracket, in order to reduce the intensity of stresses.

Drop panel form—A retainer or mold so erected as to give the necessary shape, support, and finish to a drop panel.

Dry-batch weight—The weight of the materials, excluding water, used to make a batch of concrete.

Dry mix—A concrete, mortar, or plaster mixture, commonly sold in bags, containing all components except water; also a concrete of near zero slump or less.

Dry-mix shotcrete—Pneumatically conveyed shotcrete in which most of the mixing water is added at the nozzle. (See also **Pneumatic feed**.)

Dry mixing—Blending of the solid materials for mortar or concrete prior to adding the mixing water.

Dry pack—Concrete or mortar mixtures deposited and consolidated by dry packing.

Dry packed concrete—Concrete placed by dry packing.

Dry packing—Placing of zero slump, or near zero slump, concrete, mortar, or grout by ramming into a confined space.

Dry process—In the manufacture of cement, the process in which the raw materials are ground, conveyed, blended, and stored in a dry condition. (See also **Wet process**.)

Dry-rodded volume—The bulk volume occupied by a dry aggregate compacted by rodding under the standardized conditions used in measuring unit weight of aggregate.

Dry-rodded weight—Weight per unit volume of dry aggregate compacted by rodding under standardized conditions; used in measuring unit weight of aggregate.

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.

Dry-shake—A dry mixture of cement and fine aggregate, which is distributed evenly on an unformed surface after water has largely disappeared following the strike-off, and then worked in by floating.

Dry-tamp process—See **Dry packing**.

Dry topping—See **Dry-shake**.

Dry-volume measurement—Measurement of the ingredients of grout, mortar, or concrete by their bulk volume.

Drying shrinkage—Contraction caused by moisture loss. (See also **Shrinkage**.)

Duct—A hole formed in a concrete member to accommodate a tendon for post-tensioning; a pipe or runway for electric, telephone, or other utilities.

Ductility—That property of a material by virtue of which it may undergo large permanent deformation without rupture.

Dummy joint—See **Groove joint**.

Dunagan analysis—A method of separating the ingredients of freshly mixed concrete or mortar to determine the proportions of the mixture.

Durability—The ability of concrete to resist weathering action, chemical attack, abrasion, and other conditions of service.

Dusting—The development of a powdered material at the surface of hardened concrete.

Dynamic analysis—Analysis of stresses in framing as functions of displacement under transient loading.

Dynamic load—A load which is variable, i.e., not static, such as a moving live load, earthquake, or wind.

Dynamic loading—Loading from units (particularly machinery) which, by virtue of their movement or vibration, impose stresses in excess of those imposed by their dead load.

Dynamic modulus of elasticity—The modulus of elasticity computed from the size, weight, shape, and fundamental frequency of vibration of a concrete test specimen, or from pulse velocity.

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Early strength—Strength of concrete or mortar usually as developed at various times during the first 72 hrs after placement.

Earth pigments—The class of pigments which are produced by physical processing of materials mined directly from the earth; also frequently termed natural or mineral pigments or colors.

Eccentric tendon—A prestressing tendon which follows a trajectory not coincident with the gravity axis of the concrete member.

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

Edge beam—A stiffening beam at the edge of a slab.

Edge form—Formwork used to limit the horizontal spread of fresh concrete on flat surfaces such as pavements or floors.

Edger—A finishing tool used on the edges of fresh concrete to provide a rounded corner.

Effective area of concrete—Area of a section assumed to be active in resisting the applied stresses; the area of a section which lies between the centroid of the tension reinforcement and the compression face of the flexural member.

Effective area of reinforcement—The area obtained by multiplying the right cross-sectional area of the metal reinforcement by the cosine of the angle between its direction and the direction for which its effectiveness is considered.

Effective area of reinforcement in diagonal bands—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.

Effective depth—Depth of a beam or slab section measured from the compression face to the centroid of the tensile reinforcement.

Effective flange width—Width of slab adjoining a beam stem where the slab is assumed to function as the flange element of a T-beam section.

Effective prestress—The stress remaining in concrete due to prestressing after all losses have occurred, excluding the effect of superimposed loads and the weight of the member; the stress remaining in the tendons after all losses have occurred excluding effects of dead load and superimposed load.

Effective span—The lesser of the two following distances: (a) the distance between centers of supports; (b) the clear distance between supports plus the effective depth of the beam or slab.

Effective stress—In prestressed concrete, the stress remaining in the tendons after all losses of the prestressing load have occurred.

Effective width of slab—That part of the width of a slab taken into account when designing T- or L-beams.

Efflorescence—A deposit of salts, usually white, formed on a surface, the substance having emerged in solution from within concrete or masonry and deposited by evaporation.

Elastic design—A method of analysis in which the design of a member is based on a linear stress-strain relationship and corresponding limiting elastic properties of the material.

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

Elastic loss—In prestressed concrete, the reduction in prestressing load resulting from the elastic shortening of the member.

Elastic modulus—See **Modulus of elasticity**.

Elastic shortening—In prestressed concrete, the shortening of a member which occurs immediately on the application of forces induced by prestressing.

Elasticity—That property of a material by virtue of which it tends to recover its original size and shape after deformation.

Electrolysis—Production of chemical changes by the passage of current through an electrolyte.

Electrolyte—A conducting medium in which the flow of current is accompanied by movement of matter; usually an aqueous solution.

Elephant trunk—An articulated tube or chute used in concrete placement. (See also **Dropchute** and **Tremie**.)

Elongated piece (of aggregate)—Particle of aggregate for which the ratio of the length to the width of its circumscribing rectangular prism is greater than a specified value. (See also **Flat piece**.)

Embedment length—The length of embedded reinforcement provided beyond a critical section.

Embedment length equivalent—The length of embedded reinforcement which can develop the same stress as that which can be developed by a hook or mechanical anchorage.

Emery—A rock consisting essentially of an intercrystalline mixture of corundum and magnetite or hematite; a manufactured aggregate composed of emery used to produce a wear and slip resistant concrete floor surface. (See also **Dry shake**.)

Encastré—The end fixing of a built-in beam.

Enclosure wall—A nonload-bearing wall intended only to enclose space.

Encrustation—See **Incrustation**.

End anchorage—

1. Length of reinforcement, or a mechanical anchor, or a hook, or combination thereof, beyond the point of nominal zero stress in the reinforcement of cast-in-place concrete;
2. Mechanical device to transmit prestressing force to the concrete in a post-tensioned member.

See also **Anchorage.**

End block—An enlarged end section of a member designed to reduce anchorage stresses to allowable values.

Endothermic reaction—A chemical reaction which occurs with the absorption of heat.

Entrained air—Microscopic air bubbles intentionally incorporated in mortar or concrete during mixing, usually by use of a surface-active agent; typically between 10 and 1000 μm in diameter and spherical or nearly so. (See also **Air entrainment**.)

Entrapped air—Air voids in concrete which are not purposely entrained and which are significantly larger and less useful than those of entrained air, 1 mm or larger in size.

Epoxy concrete—A mixture of epoxy resin, catalyst, fine aggregate, and coarse aggregate. (See also **Epoxy mortar, Epoxy resins,** and **Polymer concrete**.)

Epoxy mortar—A mixture of epoxy resin, catalyst, and fine aggregate. (See also **Epoxy resins**.)

Epoxy resins—A class of organic chemical bonding systems used in the preparation of special coatings or adhe-

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sives for concrete or as binders in epoxy resin mortars and concretes.

Equivalent rectangular stress distribution—An assumption of uniform stress on compression side of neutral axis in strength method of design to determine flexural capacity.

Erosion—Progressive disintegration of a solid by the abrasive or cavitation action of gases, fluids, or solids in motion. (See also **Abrasion resistance** and **Cavitation damage.**)

Ettringite—A mineral, high sulfate calcium sulfoaluminate ($3\ CaO \cdot Al_2O_3 .\ 3\ CaSO_4 \cdot 30\text{–}32\ H_2O$) also written as $Ca_6\ [Al(OH)_6]_2 \cdot 24\ H_2O\ [(SO_4)_3 \cdot 1\frac{1}{2}\ H_2O]$; occurring in nature or formed by sulfate attack on mortar and concrete; the product of the principal expansion-producing reaction in expansive cements; designated as "cement bacillus" in older literature.

Evaporable water—Water in set cement paste present in capillaries or held by surface forces; measured as that removable by drying under specified conditions. (See also **Nonevaporable water.**)

Evaporation retardant—A long-chain organic material such as cetyl alcohol which when spread on a water film on the surface of concrete retards the evaporation of bleeding water.

Exfoliation—Disintegration occurring by peeling off in successive layers; swelling up and opening into leaves or plates like a partly opened book.

Exothermic reaction—A chemical reaction which occurs with the evolution of heat.

Expanded blast-furnace slag—The lightweight cellular material obtained by controlled processing of molten blast-furnace slag with water, or water and other agents, such as steam or compressed air or both. (See also **Blast-furnace slag.**)

Expanded metal lath—A metal network, often used as reinforcement in concrete or mortar construction, formed by suitably stamping or cutting sheet metal and stretching it to form open meshes, usually of diamond shape. (See also **Diamond mesh.**)

Expanded shale (clay or **slate)**—Lightweight vesicular aggregate obtained by firing suitable raw materials in a kiln or on a sintering grate under controlled conditions.

Expanding cement—See **Expansive cement.**

Expansion—See **Contraction.**

Expansion joint—A separation between adjoining parts of a concrete structure which is provided to allow small relative movements such as those caused by thermal changes to occur independently.

Expansion sleeve—A tubular metal covering for a dowel bar to allow its free longitudinal movement at a joint.

Expansive cement (general)—A cement which when mixed with water forms a paste that, after setting, tends to increase in volume to a significantly greater degree than portland cement paste; used to compensate for volume decrease due to shrinkage or to induce tensile stress in reinforcement (post-tensioning).

Expansive Cement, Type K—A mixture of portland cement, anhydrous tetracalcium trialuminate sulfate ($C_4A_3\bar{S}$), calcium sulfate ($CaSO_4$), and lime (CaO); the $C_4A_3\bar{S}$ is a constituent of a separately burned clinker that is interground with portland cement or alternately, it may be formed simultaneously with the portland cement clinker compounds during the burning process.

Expansive cement, Type M—Interground or blended mixtures of portland cement, calcium-aluminate cement, and calcium sulfate suitably proportioned.

Expansive cement, Type S—A portland cement containing a large computed tricalcium aluminate (C_3A) content and an amount of calcium sulfate above the usual amount found in portland cement.

Expansive-cement concrete (mortar or **grout)**—A concrete (mortar or grout) made with expansive cement.

Expansive component—The portion of an expansive cement which is responsible for the expansion, generally one of several anhydrous calcium aluminate or sulfoaluminate compounds and a source of sulfate, with or without free lime, (CaO). The expansive component may be produced separately and later ground or blended with a normal portland cement clinker, in other instances, produced by firing in a kiln with the constituents of portland cement.

Exposed-aggregate finish—A decorative finish for concrete work achieved by removing, generally before the concrete has fully hardened, the outer skin of mortar and exposing the coarse aggregate.

Exposed concrete—Concrete surfaces formed so as to yield an acceptable texture and finish for permanent exposure to view. (See also **Architectural concrete.**)

Extender—A finely divided inert mineral added to provide economical bulk in paints, synthetic resins and adhesives, or other products.

Extensibility—The maximum tensile strain that hardened cement paste, mortar, or concrete can sustain before cracking occurs.

Extension device—Any device, other than an adjustment screw, used to obtain vertical adjustment of shoring towers.

Exterior panel—In a flat slab, a panel having at least one edge which is not in common with another panel.

External vibrator—See **Vibration.**

Extreme compression fiber—Farthest fiber from the neutral axis on the compression side of a member subjected to bending.

Extreme tension fiber—Farthest fiber from the neutral axis on the tension side of a member subjected to bending.

Exudation—A liquid or viscous gel-like material discharged through a pore, crack, or opening in the surface of concrete.

F

Factor of safety—The ratio of the ultimate strength (or yield strength) of a material to the working stress assumed in the design (stress factor of safety); may also be expressed as the ratio of load, moment, or shear of structural member at the ultimate to that at the working level (load factor of safety).

Fair face concrete—A concrete surface which, on completion of the forming process, requires no further (concrete) treatment other than curing. (See also **Architectural concrete.**)

False header—See **Header.**

False set—The rapid development of rigidity in a freshly mixed portland cement paste, mortar, or concrete without the evolution of much heat, which rigidity can be dispelled and plasticity regained by further mixing without addition of water; premature stiffening, hesitation

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Fal

set, early stiffening, and rubber set are terms referring to the same phenomenon, but false set is the preferred designation.

Falsework—The temporary structure erected to support work in the process of construction; composed of shoring or vertical posting, formwork for beams and slabs, and lateral bracing. (See also **Centering**.)

Fascia—A flat member or band at the surface of a building or the edge beam of a bridge; exposed eave of a building; often inappropriately called facia.

Fat concrete—Concrete containing a relatively large amount of plastic and cohesive mortar.

Fatigue—The weakening of a material caused by repeated or alternating loads.

Fatigue failure—The phenomenon of rupture of a material, when subjected to repeated loadings, at a stress substantially less than the ultimate static strength.

Fatigue strength—The greatest stress which can be sustained for a given number of stress cycles without failure.

Faulting—Differential vertical displacement of a slab or other member adjacent to a joint or crack.

Feather edge—A wood or metal tool having a beveled edge; used to straighten re-entrant angles in finish plaster coat; also edge of a concrete or mortar placement such as a patch or topping that is beveled at an acute angle.

Feed wheel—Material distributor or regulator in certain types of shotcrete equipment.

Felite—A name used by Tornebohm (1897) to identify one form of dicalcium silicate ($2CaO \cdot SiO_2$), one of the crystalline components of portland cement clinker. (See also **Alite, Belite,** and **Celite**.)

Ferrocement—A composite hydraulic structural material comprising thin sections consisting of cement mortar reinforced by a number of very closely spaced layers of steel wire mesh.

Fiber-reinforced concrete—See **Concrete, fibrous**.

Field bending—Bending of reinforcing bars on the job rather than in a fabricating shop.

Field concrete—See **Concrete, field**.

Field-cured cylinders—Test cylinders cured as nearly as practicable in the same manner as the concrete in the structure to indicate when supporting forms may be removed, additional construction loads may be imposed, or the structure may be placed in service.

Filler—

1. Finely divided inert material such as pulverized limestone, silica, or colloidal substances sometimes added to portland cement paint or other materials to reduce shrinkage, improve workability, or act as an extender.
2. Material used to fill an opening in a form.

Fillet—A concave junction formed where two surfaces meet. (See also **Chamfer strip.**)

Fin—A narrow linear projection on a formed concrete surface, resulting from mortar flowing out between spaces in the formwork.

Final prestress—See **Final stress**.

Final set—A degree of stiffening of a mixture of cement and water greater than initial set, generally stated as an empirical value indicating the time in hours and minutes required for a cement paste to stiffen sufficiently to resist to an established degree, the penetration of a weighted test needle; also applicable to concrete and mortar mixtures with use of suitable test procedures. (See also **Initial set**.)

Final setting time—The time required for a freshly mixed cement paste, mortar, or concrete to achieve final set. (See also **Initial setting time**.)

Final stress—In prestressed concrete, the stress which exists after substantially all losses have occurred.

Fine aggregate—Aggregate passing the ⅜-in. (9.5-mm) sieve and almost entirely passing the No. 4 (4.75-mm) sieve and predominantly retained on the No. 200 (75-μm) sieve; or that portion of an aggregate passing the No. 4 (4.75-mm) sieve and predominantly retained on the No. 200 (75-μm) sieve. (See also **Aggregate** and **Sand**.)

Fine grained soil—Soil in which the smaller grain sizes predominate, such as fine sand, silt, and clay.

Fineness—A measure of particle size.

Fineness modulus—A factor obtained by adding the total percentages by weight of an aggregate sample retained on each of a specified series of sieves, and dividing the sum by 100; in the United States the standard sieve sizes are No. 100 (150 μm), No. 50 (300 μm), No. 30 (600 μm), No. 16 (1.18 mm), No. 8 (2.36 mm) and No. 4 (4.75 mm), and ⅜ in. (9.5 mm), ¾ in. (19 mm), 1½ in. (38.1 mm), 3 in. (75 mm), and 6 in. (150 mm).

Finish—The texture of a surface after compacting and finishing operations have been performed.

Finish coat—Final thin coat of shotcrete preparatory to hand finishing; also exposed coat of plaster and stucco.

Finish grinding—The final grinding of clinker into cement, with calcium sulfate in the form of gypsum or anhydrite generally being added; the final grinding operation required for a finished concrete surface, e.g., bump cutting of pavement, fin removal from structural concrete, terrazzo floor grinding.

Finishing—Leveling, smoothing, compacting, and otherwise treating surfaces of fresh or recently placed concrete or mortar to produce desired appearance and service. (See also **Float** and **Trowel**.)

Finishing machine—A power-operated machine used to give the desired surface texture to a concrete slab.

Fire clay—An earthy or stony mineral aggregate which has as the essential constituent hydrous silicates of aluminum with or without free silica, plastic when sufficiently pulverized and wetted, rigid when subsequently dried, and of suitable refractoriness for use in commercial refractory products.

Fire resistance—The property of a material or assembly to withstand fire or give protection from it; as applied to elements of buildings, it is characterized by the ability to confine a fire or to continue to perform a given structural function, or both.

Fired strength—The compressive or flexural strength of refractory concrete determined upon cooling after first firing to a specified temperature for a specified time.

Fired unit weight—The unit weight of refractory concrete, upon cooling, after having been exposed to a specified firing temperature for a specified time.

Fishtail—A wedge-shaped piece of wood used as part of the support form between tapered pans in concrete joist construction.

Flame photometer—An instrument used to determine elements (especially sodium and potassium in portland cement) by the color intensity of their unique flame spectra resulting from introducing a solution of a compound of the element into a flame. (Also known as **Flame spectrophotometer**.)

Flash coat—A light coat of shotcrete used to cover minor blemishes on a concrete surface.

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Flash set—The rapid development of rigidity in a freshly mixed portland cement paste, mortar, or concrete, usually with the evolution of considerable heat, which rigidity cannot be dispelled nor can the plasticity be regained by further mixing without addition of water; also referred to as quick set or grab set.

Flashing—A thin impermeable sheet, narrow in comparison with its length, installed as a "waterproof" cover over exposed joints, at roof valleys, hips, roof parapets, or intersections of roof and chimney.

Flat jack—A hydraulic jack consisting of light gage metal bent and welded to a flat shape which expands under internal pressure.

Flat piece (of aggregate)—One in which the ratio of the width to thickness of its circumscribing rectangular prism is greater than a specified value. (See also **Elongated piece (of aggregate**.)

Flat plate—A flat slab without column capitals or drop panels. (See also **Flat slab**.)

Flat slab—A concrete slab reinforced in two or more directions, generally without beams or girders to transfer the loads to supporting members. (See also **Flat plate**.)

Flexible pavement—A pavement structure which maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability; cementing agents, where used, are generally bituminous materials as contrasted to portland cement in the case of rigid pavement. (See also **Rigid pavement**.)

Flexural bond—In prestressed concrete, the stress between the concrete and the tendon which results from the application of external load.

Flexural rigidity—A measure of stiffness of a member, indicated by the product of modulus of elasticity and moment of inertia divided by the length of the member.

Flexural strength—A property of a material or structural member that indicates its ability to resist failure in bending. (See also **Modulus of rupture**.)

Flint—A variety of chert. (See also **Chert**.)

Float—A tool (not a darby), usually of wood, aluminum, or magnesium, used in finishing operations to impart a relatively even but still open texture to an unformed fresh concrete surface.

Float finish—A rather rough concrete surface texture obtained by finishing with a float.

Floating—The operation of finishing a fresh concrete or mortar surface by use of a float, preceding troweling when that is the final finish.

Flow—

1. Time dependent irrecoverable deformation. (See **Rheology**.)

2. A measure of the consistency of freshly mixed concrete, mortar, or cement paste in terms of the increase in diameter of a molded truncated cone specimen after jigging a specified number of times.

Flow cone—A device for measurement of grout consistency in which a predetermined volume of grout is permitted to escape through a precisely sized orifice, the time of efflux (flow factor) being used as the indication of consistency; also the mold used to prepare a specimen for the flow test.

Flow factor—See **Flow cone**.

Flow promoter—Substance added to coating to enhance brushability, flow, and leveling.

For

Flow table—A jigging device used in making flow tests for consistency of cement paste, mortar, or concrete. (See also **Flow (2)**.)

Flow trough—A sloping trough used to convey concrete by gravity flow from a transit mix truck, or a receiving hopper to the point of placement. (See also **Chute**.)

Fluidifier—An admixture employed in grout to decrease the flow factor without changing water content.

Fluosilicate—Magnesium or zinc silico-fluoride used to prepare aqueous solutions sometimes applied to concrete as surface-hardening agents.

Flush water—See **Wash water**.

Fly ash—The finely divided residue resulting from the combustion of ground or powdered coal and which is transported from the firebox through the boiler by flue gases; known in UK as **Pulverized fuel ash (pfa)**.

Foamed blast-furnace slag—See **Expanded blast-furnace slag**.

Foamed concrete—See **Concrete, foamed**.

Fog curing—

1. Storage of concrete in a moist room in which the desired high humidity is achieved by the atomization of fresh water. (See also **Moist room**.)

2. Application of atomized fresh water to concrete, stucco, mortar, or plaster.

Folded plate—

1. A framing assembly composed of sloping slabs in a hipped or gabled arrangement.

2. Prismatic shell with open polygonal section.

Footing—That portion of the foundation of a structure which spreads and transmits load directly to the piles, or to the soil or supporting grillage.

Form—A temporary structure or mold for the support of concrete while it is setting and gaining sufficient strength to be self supporting. (See also **Formwork**.)

Form anchor—Device used to secure formwork to previously placed concrete of adequate strength; the device is normally embedded in the concrete during placement.

Form coating—A liquid applied to usually interior formwork surfaces for a specific purpose, usually to promote easy release from the concrete, to preserve the form material or to retard set of the near-surface matrix for preparation of exposed-aggregate finishes.

Form hanger—Device used to support formwork from a structural framework; the dead load of forms, weight of concrete, and construction and impact loads must be supported.

Form insulation—Insulating material applied to outside of forms between studs and over the top in sufficient thickness and air tightness to conserve heat of hydration to maintain concrete at required temperatures in cold weather.

Form lining—Selected materials used to line the concreting face of formwork in order to impart a smooth or patterned finish to the concrete surface, to absorb moisture from the concrete, or to apply a set-retarding chemical to the formed surface.

Form oil—Oil applied to interior surface of formwork to promote easy release from the concrete when forms are removed.

Form pressure—Lateral pressure acting on vertical or inclined formed surfaces, resulting from the fluid-like behavior of the unhardened concrete confined by the forms.

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Hea

Heavy-media separation—A method in which a liquid or suspension of given specific gravity is used to separate particles into a portion lighter than (those that float) and a portion heavier than (those that sink) the medium.

Heavyweight aggregate—See **Aggregate, heavyweight.**

Heavyweight concrete—See **High density concrete.**

Hematite—A mineral, iron oxide (Fe_2O_3), used as aggregate in high density concrete and in finely divided form as a red pigment in colored concrete.

Hemihydrate—A hydrate containing one-half molecule of water to one molecule of compound, the most commonly known hemihydrate is partially dehydrated gypsum (also known as **Plaster of Paris**), $CaSO_4 \cdot \frac{1}{2}H_2O$. (See also **Bassanite.**)

Hesitation set—See **False set.**

Hessian—See **Burlap.**

High alumina cement—See **Calcium-aluminate cement.**

High-bond bar—See **Deformed bar.**

High-density concrete—Concrete of exceptionally high density, usually obtained by use of heavyweight aggregates, used especially for radiation shielding.

High-discharge mixer—See **Inclined-axis mixer.**

High-early-strength cement—See **Cement, high-early-strength.**

High-early-strength concrete—Concrete which, through the use of high-early-strength cement or admixtures, is capable of attaining specified strength at an earlier age than normal concrete.

High-lift grouting—A technique in concrete masonry wall construction in which the grouting operation is delayed until the wall has been laid up to a full story height.

High pressure steam curing—See **Autoclave curing.**

High strength reinforcement—See **Reinforcement, high strength.**

High-strength steel—Steel with a high yield point, in the case of reinforcing bars 60,000 psi (414MPa) and greater. (See also **Reinforcement, high strength.**)

High temperature steam curing—See **Atmospheric-pressure steam curing,** and **Autoclave curing.**

Hinge joint—Any joint which permits hinge action with no appreciable separation of the adjacent members.

Hod—A portable trough for carrying mortar, brickes, etc., fixed crosswise on top of a pole and carried on the shoulder.

Holding-down bolt—See **Anchor bolt.**

Holding period—See **Presteaming period.**

Honeycomb—Voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.

Hook—A bend in the end of a reinforcing bar.

Hooked bar—A reinforcing bar with the end bent into a hook to provide anchorage.

Hooke's Law—The law, which holds practically for strains within the elastic limit, that the strain is proportional to the stress producing it. (See also **Proportional limit** and **Modulus of elasticity.**)

Hoop—A one-piece closed tie or continuously wound tie not less than #3 in size, the ends of which have a standard 135-deg bend with a ten-bar-diameter extension, that encloses the longitudinal reinforcement.

Horizontal-axis mixer—A concrete mixer of the revolving drum type in which the drum rotates about a horizontal axis.

Horizontal brace—See **Ledger.**

Horizontal shoring—See **Shoring, horizontal.**

Hot cement—Newly manufactured cement which has not had an opportunity to cool after burning and grinding of the component materials.

Hot face—The surface of a refractory section exposed to the source of heat.

Hot load test—A test for determining the resistance to deformation or shear of a refractory material when subjected to a specified compressive load at a specified temperature for a specified time.

Hoyer effect—In prestressed concrete, frictional forces which result from the tendency of the tendons to regain the diameter which they had before they were stressed.

Hydrate—A chemical combination of water with another compound or an element.

Hydrated lime—Calcium hydroxide, a dry powder obtained by treating quicklime with water.

Hydration—Formation of a compound by the combining of water with some other substance; in concrete, the chemical reaction between hydraulic cement and water.

Hydraulic cement—A cement that sets and hardens by chemical interaction with water and that is capable of doing so under water.

Hydraulic hydrated lime—The hydrated dry cementitious product obtained by calcining a limestone containing silica and alumina to a temperature short of incipient fusion so as to form sufficient free calcium oxide to permit hydration and at the same time leaving unhydrated sufficient calcium silicates to give the dry powder its hydraulic properties.

I

Ignition loss—See **Loss on ignition.**

Ilmenite—A mineral, iron titanate ($FeTiO_3$), which in pure or impure form is commonly used as aggregate in high density concrete.

Impending slough—The consistency obtained with shotcrete containing the maximum amount of water that can be used without flow or sag after placement.

Inclined-axis mixer—A truck with revolving drum which rotates about an axis inclined to the bed of the truck chassis.

Incrustation—A crust or coating, generally hard, formed on the surface of concrete or masonry construction or on aggregate particles.

Indented wire—Wire having machine-made surface indentations intended to improve bond; depending on type of wire, may be used for either concrete reinforcement or pretensioning tendons.

Industrialized building—The integration of planning, design, programming, manufacturing, site operations, scheduling, financing and management into a disciplined method of mechanized production of buildings, sometimes called **Systems building.**

Inelastic behavior—See **Plastic deformation.**

Infrared spectroscopy—The use of a spectrophotometer for determination of infrared absorption spectra (2.5 to 18 μm wave lengths) of materials; used for detection, determination, and identification especially of organic materials.

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Initial drying shrinkage—The difference between the length of a specimen (molded and cured under stated conditions) and its length when first dried to constant length, expressed as a percentage of the moist length.

Initial prestress—The prestressing stress (or force) applied to the concrete at the time of stressing.

Initial set—A degree of stiffening of a mixture of cement and water less than final set, generally stated as an empirical value indicating the time in hours and minutes required for cement paste to stiffen sufficiently to resist to an established degree, the penetration of a weighted test needle; also applicable to concrete or mortar with use of suitable test procedures. (See also **Final set.**)

Initial setting time—The time required for a freshly mixed cement paste, mortar or concrete to achieve initial set. (See also **Final setting time.**)

Initial stresses—The stresses occurring in prestressed concrete members before any losses occur.

Initial tangent modulus—See **Modulus of elasticity.**

In-situ concrete—See **Concrete, in-situ.**

Insoluble residue—The portion of a cement or aggregate that is not soluble in dilute hydrochloric acid of stated concentration.

Insulating concrete—Concrete having low thermal conductivity; used as thermal insulation.

Internal vibration—See **Vibration.**

I-section—Beam cross section consisting of top and bottom flanges connected by a vertical web.

Isolation joint—A separation between adjoining parts of a concrete structure, usually a vertical plane, at a designed location such as to interfere least with performance of the structure, yet such as to allow relative movement and avoid formation of cracks elsewhere in the concrete and through which all or part of the bonded reinforcement is interrupted. (See also **Contraction joint.**)

Isotropy—The behavior of a medium having the same properties in all directions.

J

Jack—A mechanical device used to apply force to prestressing tendons, adjust elevation of forms or form supports, and raise objects small distances.

Jack shore—Telescoping, or otherwise adjustable, single-post metal shore.

Jacking device—The device used to stress the tendons for prestressed concrete; also, a device for raising a vertical slipform.

Jacking force—In prestressed concrete, the temporary force exerted by the device which introduces tension into the tendons.

Jacking stress—The maximum stress occurring in a prestressed tendon during stressing.

Jaw crusher—A machine having two inclined jaws, one or both being actuated by a reciprocating motion so that the charge is repeatedly "nipped" between the jaws.

Jitterbug—A grate tamper for pushing coarse aggregate slightly below the surface of a slab to facilitate finishing.

Joint, construction—See **Construction joint.**

Joint, contraction—See **Contraction joint.**

Joint, expansion—See **Expansion joint.**

Joint filler—Compressible material used to fill a joint to prevent the infiltration of debris and to provide support for sealants.

Joint sealant—Compressible material used to exclude water and solid foreign materials from joints.

Jointer (concrete)—A metal tool about 6 in. (150 mm) long and from 2 to 4½ in. (50 to 100 mm) wide and having shallow, medium, or deep bits (cutting edges) ranging from $^3/_{16}$ in. to ¾ in. (5 to 20 mm) or deeper used to cut a joint partly through fresh concrete.

Joist—A comparatively narrow beam, used in closely spaced arrangements to support floor or roof slabs which require no reinforcement except that required for temperature and shrinkage stresses; also a horizontal structural member such as that which supports deck form sheathing. (See also **Beam.**)

Jumbo—Traveling support for forms, commonly used in tunnel work.

K

Kaolin—A rock, generally white, consisting primarily of clay minerals of the kaolinite group, composed principally of hydrous aluminum silicate, of low iron content, used as raw material in the manufacture of white cement.

Kaolinite—A common clay mineral having the general formula Al_2 (Si_2O_5) (OH_4), the primary constituent of kaolin.

Keene's cement—A cement composed of finely ground, anhydrous, calcined gypsum, the set of which is accelerated by the addition of other materials.

Kelly ball—An apparatus used for indicating the consistency of fresh concrete, consisting of a cylinder 6 in. (150 mm) in diameter with a hemispherically shaped bottom and handle weighing 30 lb (14 kg) and a stirrup to guide the handle and serve as a reference for measuring depth of penetration. (See also **Ball test.**)

Kelly ball test—See **Ball test** and **Kelly ball.**

Kerb form; Kerb tool—See **Curb form** and **Curb tool.**

Kerf—To cut or notch, as a beam, transversely along the underside to curve it; also a cut or notch in a member such as a rustication strip to avoid damage from swelling of the wood and to permit easier removal.

Kern area—The area within a geometric shape in which a compressive force may be applied without tensile stresses resulting in any of the extreme fibers of the section.

Kern distance—The ratio of the section modulus of the cross section about the axis perpendicular to the kern distance, divided by the area of the cross section.

Key—See **Keyway.**

Keyed, Keying—Fastened or fixed in position in a notch or other recess.

Keyway—A recess or groove in one lift or placement of concrete which is filled with concrete of the next lift, giving shear strength to the joint.

Kick strip—See **Kicker.**

Kicker—A wood block or board attached to a formwork member in a building frame or formwork to make the structure more stable; in formwork it acts as a haunch. (See also **Stub wall.**)

Kiln—A furnace or oven for drying, charring, hardening, baking, calcining, sintering, or burning various materials. (See also **Steam-curing room.**)

Kiln, Cement—A kiln in which the ground and proportioned raw mix is dried, calcined and burned into clinker at a temperature of 2600 to 3000 F (1420 to 1650 C); can be of the rotary, shaft, fluid-bed, or traveling grate type; fuel may be coal, oil, or gas.

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Kip

Kip—1000 lb force, equals 4448.222 newtons.

Knee brace—Brace between horizontal and vertical members in a building frame or formwork to make the structure more stable; in formwork it acts as a haunch.

L

Lacing—Horizontal bracing between shoring members.

Lagging—Heavy sheathing used as in underground work to withstand earth pressure. (See also **Sheathing.**)

Laitance—A layer of weak and nondurable material containing cement and fines from aggregates, brought by bleeding water to the top of overwet concrete, the amount of which is generally increased by overworking or overmanipulating concrete at the surface by improper finishing or by job traffic.

Lap—The length by which one bar or sheet of fabric reinforcement overlaps another.

Lap splice—A connection of reinforcing steel made by lapping the ends of the bars.

Lapping (reinforcing steel)—The overlapping of reinforcing steel bars, welded wire fabric, or expanded metal so that there may be continuity of stress in the reinforcing when the concrete member is subjected to flexural or tensile loading.

Larnite—A mineral; beta dicalcium silicate (Ca_2SiO_4); occurs naturally at Scawt Hill, Northern Ireland, and artificially in slags and as a major constituent of portland cement.

Lateral reinforcement—See **Reinforcement, lateral.**

Latex—A water emulsion of a synthetic rubber or plastic obtained by polymerization and used especially in coatings and adhesives.

Layer—See **Course.**

L-beam—A beam whose section has the form of an inverted L, usually occurring in the edge of a floor, of which a part forms the top flange of the beam.

L-column—The portion of a precast concrete frame, composed of the column, the haunch, and part of the girder.

Leaf—See **Wythe.**

Lean concrete—Concrete of low cement content.

Ledger—An L-shaped horizontal member that supports other permanent or temporary structural members. (See also **Beam.**)

Lever arm—In a structural member, the distance from the center of the tensile reinforcement to the center of action of the compression.

L-head—The top of a shore formed with a braced horizontal member projecting from one side forming an inverted L-shaped assembly.

Lift—The concrete placed between two consecutive horizontal construction joints, usually consisting of several layers or courses.

Lift joint—Surface at which two successive lifts meet.

Lift slab—A method of concrete construction in which floor and roof slabs are cast on or at ground level and hoisted into position by jacking; also a slab which is a component of such construction.

Lifts (or Tiers)—The number of frames of scaffolding erected one above each other in a vertical direction.

Lightweight aggregate—See **Aggregate, lightweight.**

Lightweight concrete—Concrete of substantially lower unit weight than that made using gravel or crushed stone aggregates.

Lime—Specifically, calcium oxide (CaO); also, loosely, a general term for the various chemical and physical forms of quicklime, hydrated lime, and hydraulic hydrated lime.

Limit design—A method of proportioning reinforced concrete members based on calculations of their strength. (See also **Strength design method.**)

Limonite—An iron ore composed of a mixture of hydrated ferric oxides; occasionally used in high density concrete because of its high density and water content which contribute to its effectiveness in radiation shielding. (See also **Brown oxide.**)

Linear prestressing—Prestressing as applied to linear members, such as beams, columns, etc.

Linear transformation—The method of altering the trajectory of the prestressing tendon in any statically indeterminate prestressed structure by changing the location of the tendon at one or more interior supports without altering its position at the end supports and without changing the basic shape of the trajectory between any supports; linear transformation does not change the location of trajectory of the pressure line.

Linear traverse method—Determination of the volumetric composition of a solid by integrating the distance traversed across areas of each component along a line or along regularly spaced lines in one or more planes intersecting a sample of the solid; frequently employed to determine characteristics of the air-void system in hardened concrete by microscopical examination along a series of traverse lines on finely ground sections of the concrete; sometimes called the **Rosiwal method.**

Lining—Any sheet, plate, or layer of material attached directly to the inside face of formwork to improve or alter the surface texture and quality of the finished concrete. (See also **Form lining.**)

Lintel—A horizontal supporting member above an opening such as a window or a door.

Liquid limit—Water content, expressed as a percentage of the dry weight of the soil at which the soil passes from the plastic to the liquid state under standard test conditions. (See also **Atterberg limits.**)

Liquid-volume measurement—Measurement of grout on the basis of the total volume of solid and liquid constituents.

Live load—Any load that is not permanently applied to a structure.

Load, service—See **Service dead load** and **Service live load.**

Load binder—A device used to tighten chains holding loads in place on a truck bed.

Load-factor—A factor by which a service load is multiplied to determine a design load. (See also **Phi (ϕ) factor.**)

Load-bearing wall—A wall designed and built to carry superimposed vertical and shear loads as opposed to nonload-bearing walls.

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.

Loading hopper—A hopper in which concrete or other free flowing material is placed for loading by gravity into buggies or other conveyances for transport to the forms or to other place of processing, use, or storage.

Locking device—A device used to secure a cross brace or scaffolding to the frame or panel.

Long column—See **Column, long.**

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Longitudinal bar—See **Longitudinal reinforcement.**

Longitudinal joint—A joint parallel to the long dimension of a structure or pavement.

Longitudinal reinforcement—Reinforcement essentially parallel to the long axis of a concrete member or pavement.

Los Angeles Abrasion Test—Test for abrasion resistance of concrete aggregates.

Loss of prestress—The reduction in the prestressing force which results from the combined effects of strains in the concrete and steel, including slip at anchorage, relaxation of steel stress, frictional loss due to curvature in the tendons and the effects of elastic shortening, creep and shrinkage of the concrete.

Loss on ignition—The percentage loss in weight of a sample ignited to constant weight at a specified temperature, usually 900-1000 C.

Low-alkali cement—See **Cement, low-alkali.**

Low-density concrete—Concrete having an oven-dry unit weight of less than 50 pcf (800 kg/m^3).

Low-heat cement—See **Cement, low-heat.**

Low-lift grouting—The common and simple method of unifying concrete masonry, in which the wall sections are built to a height of not more than 4 ft. (1.2 m) before the cells of the masonry units are filled with grout.

Low-pressure steam curing—See **Atmospheric-pressure steam curing.**

L-shore—A shore with an L-head. (See also **L-head.**)

M

Macroscopic—See **Megascopic.**

Magnetite—A mineral, ferrous ferric oxide ($FeFe_2O_4$); the principal constituent of magnetic black iron ore; specific gravity about 5.2 and Mohs hardness about 6; used as an aggregate in high density concrete.

Main bar—See **Main reinforcement.**

Main reinforcement—Steel reinforcement designed to resist stresses resulting from design loads and moments, as opposed to reinforcement intended to resist secondary stresses.

Manual batcher—See **Batcher.**

Manufactured sand—See **Sand.**

Map cracking—See **Crazing.**

Marl—Calcareous clay, usually containing from 35 to 65 percent calcium carbonate ($CaCO_3$), found in the bottoms of shallow lakes, swamps, or extinct fresh-water basins.

Masonry—Construction composed of shaped or molded units, usually small enough to be handled by one man and composed of stone, ceramic brick or tile, concrete, glass, adobe, or the like; sometimes used to designate cast-in-place concrete.

Masonry cement—See **Cement, masonry.**

Masonry filler unit—Masonry unit used to fill in between joists or beams to provide a platform for a cast-in-place concrete slab.

Masonry mortar—Mortar used in masonry structures. (See also **Cement, masonry** and **Mortar.**)

Masonry unit—A construction unit in masonry. (See also **Block.**)

Mass concrete—Any volume of concrete with dimensions large enough to require that measures be taken to cope with generation of heat from hydration of the cement and attendant volume change to minimize cracking.

Mass curing—Adiabatic curing in sealed containers.

Mat—See **Bar mat.**

Mat foundation—A continuous footing supporting an array of columns in several rows in each direction, having a slab-like shape with or without depressions or openings, covering an area at least 75 percent of the total area within the outer limits of the assembly. (See also **Raft foundation.**)

Material hose—See **Delivery hose.**

Matrix—In the case of mortar, the cement paste in which the fine aggregate particles are embedded; in the case of concrete, the mortar in which the coarse aggregate particles are embedded.

Maximum size of aggregate—In specifications for or descriptions of aggregate, the smallest sieve opening through which the entire amount of aggregate is *required* to pass. (See also **Nominal maximum size of aggregate.**)

Maximum-temperature period—A time interval throughout which the maximum temperature is held constant in an autoclave or steam-curing room.

Mechanical analysis—The process of determining particle-size distribution of an aggregate. (See also **Sieve analysis.**)

Mechanical anchorage—Any mechanical device capable of developing the strength of the reinforcement without damage to the concrete.

Mechanical bond—In general concrete construction, the physical interlock between cement paste and aggregate, or between concrete and reinforcement (specifically, the sliding resistance of an embedded bar and not the adhesive resistance). In plastering, the physical keying of a plaster coat to: (a) another, (b) to the plaster base by means of plaster keys to the lath, or (c) through interlock with adjacent plaster casts created by means of scratching or cross raking.

Megascopic—Visible to the unaided eye.

Melilite—A group of minerals ranging from the calcium magnesium silicate (ackermanite) to the calcium aluminate silicate (gehlenite) that occur as crystals in blast-furnace slag. (See also **Merwinite.**)

Melt—The molten portion of the raw material mass during the burning of cement clinker, firing of lightweight aggregates, or expanding of blast-furnace slags.

Membrane curing—A process that involves either liquid sealing compound (e.g., bituminous and paraffinic emulsions, coal tar cut-backs, pigmented and nonpigmented resin suspensions, or suspensions of wax and drying oil) or nonliquid protective coating (e.g., sheet plastics or "waterproof" paper), both of which types function as films to restrict evaporation of mixing water from the fresh concrete surface.

Membrane theory—A theory of design for thin shells, based on the premise that a shell cannot resist bending because it deflects; the only stresses that exist, therefore, in any section are shear stress and direct compression or tension.

Merwinite—One of the principal crystalline phases found in blast-furnace slags; chemical formula is $3CaO \cdot MgO \cdot 2SiO_2$, crystal system is monoclinic, and specific gravity is 3.15. (See also Melilite.)

Mesh—See **Welded-wire fabric.**

Mesh reinforcement—See **Welded-wire fabric reinforcement.**

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Mic

Micron—Name formerly used for micrometre (μm); a unit of length, one-thousandth of a millimeter or one-millionth of a meter.

Microscopic—Discernible only with the aid of a microscope.

Microcracks—Microscopic cracks within concrete.

Middle strip—In flat slab framing, the slab portion which occupies the middle half of the span between columns. (See also **Column strip.**)

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

Mineral aggregate—Aggregate consisting essentially of inorganic nonmetallic materials.

Mix—The act or process of mixing; also mixture of materials, such as mortar or concrete.

Mix design—See **Proportioning.**

Mixer—A machine used for blending the constituents of concrete, grout, mortar, cement paste, or other mixture.

Mixer, batch—See **Batch mixer.**

Mixer, colloidal—A mixer designed to produce colloidal grout.

Mixer, horizontal shaft—A mixer having a stationary cylindrical mixing compartment, with the axis of the cylinder horizontal, and one or more rotating horizontal shafts to which mixing blades or paddles are attached.

Mixer, nontilting—A horizontally rotating drum mixer that charges, mixes, and discharges without tilting.

Mixer, open-top—A truck-mounted mixer consisting of a trough or a segment of a cylindrical mixing compartment within which paddles or blades rotate about the horizontal axis of the trough. (See also **Mixer, horizontal shaft.**)

Mixer, pan—See **Mixer, vertical shaft.**

Mixer, tilting—A rotating drum mixer that discharges by tilting the drum about a fixed or movable horizontal axis at right angles to the drum axis. The drum axis may be horizontal or inclined while charging and mixing.

Mixer, vertical shaft—A cylindrical or annular mixing compartment having an essentially level floor and containing one or more vertical rotating shafts to which blades or paddles are attached; the mixing compartment may be stationary or rotate about a vertical axis.

Mixer efficiency—The adequacy of a mixer in rendering a homogeneous product within a stated period; homogeneity is determinable by testing for relative differences in physical properties of samples extracted from different portions of a freshly mixed batch.

Mixing cycle—The time taken for a complete cycle in a batch mixer, i.e., the time elapsing between successive repetitions of the same operation (e.g., successive discharges of the mixer).

Mixing plant—See **Batch plant.**

Mixing speed—Rotation rate of a mixer drum or of the paddles in an open-top, pan, or trough mixer, when mixing a batch; expressed in revolutions per minute (rpm), or in peripheral feet per minute of a point on the circumference at maximum diameter.

Mixing time—The period during which the constituents of a batch of concrete are mixed by a mixer; for a stationary mixer, time is given in minutes from the completion of mixer charging until the beginning of discharge; for a truck mixer, time is given in total minutes at a specified mixing speed or expressed in terms of total revolutions at a specified mixing speed. (See also **Amount of mixing.**)

Mixing water—The water in freshly mixed sand-cement grout, mortar, or concrete, exclusive of any previously absorbed by the aggregate (e.g., water considered in the computation of the net water-cement ratio). (See also **Batched water** and **Surface moisture.**)

Mixture—The assembled, blended, commingled ingredients of mortar, concrete, or the like; or the proportions for their assembly.

Modular ratio—The ratio of modulus of elasticity of steel E_S to that of concrete E_c, usually denoted by the symbol n.

Modulus of deformation—A concept of modulus of elasticity expressed as a function of two time variables; strain in loaded concrete as a function of the age at which the load is initially applied and of the length of time the load is sustained.

Modulus of elasticity—The ratio of normal stress to corresponding strain for tensile or compressive stresses below the proportional limit of the material; referred to as "elastic modulus of elasticity;" "Young's modulus," and "Young's modulus of elasticity;" denoted by the symbol E. (See also **Modulus of rigidity.**)

Note: Few materials conform to Hooke's law throughout the entire range of stress-strain relations; deviations there from are caused by inelastic behavior. If the deviations are significant, the slope of the tangent to the stress-strain curve at the origin, the slope of the tangent to the stress-strain curve at any given stress, the slope of the secant drawn from the origin to any specified point on the stress-strain curve, or the slope of the chord connecting any two specified points on the stress-strain curve, may be considered as the modulus; in such cases the modulus is designated, respectively, as the "initial tangent modulus," the "tangent modulus," the "secant modulus," or the "chord modulus," and the stress stated. The modulus is expressed as force per unit of area (e.g., psi or Pa).

Modulus of rigidity—The ratio of unit shearing stress to the corresponding unit shearing strain; referred to as "shear modulus" and "modulus of elasticity in shear;" denoted by the symbol G. (See also **Modulus of elasticity.**)

Modulus of rupture—A measure of the ultimate load-carrying capacity of a beam and sometimes referred to as "rupture modulus" or "rupture strength." It is calculated for apparent tensile stress in the extreme fiber of a transverse test specimen under the load which produces rupture. (See also **Flexural strength.**)

Note: The actual stress in the extreme fiber is less than the apparent stress since the flexure formula employed in the calculation is valid only for stresses within the proportional limit of the material; nevertheless, the nominal rupture strength so obtained is considered the rupture modulus.

Modulus of subgrade reaction—Ratio of load per unit area of horizontal surface (of a mass of soil) to corresponding settlement of the surface; it is determined as the slope of the secant, drawn between the point corresponding to zero settlement and a specified point on the load-settlement curve obtained from a plate load test on a soil using a 30 in. or greater diameter loading plate.

Moist room—A room in which the atmosphere is maintained at a selected temperature (usually 23.0 ± 1.7 C or 73.4 ± 3.0 F) and a relative humidity of at least 98

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percent, for the purpose of curing and storing cementitious test speciment; the facilities must be sufficient to maintain free moisture continuously on the exterior of test specimens.

Moisture movement—

1. The movement of moisture through a porous medium.

2. The effects of such movement on efflorescence and volume change in hardened cement paste, mortar, concrete, or rock.

See also **Shrinkage** and **Swelling.**

Mold—

1. A device containing a cavity into which neat cement, mortar, or concrete test specimens are cast.

2. A form used in the fabrication of precast mortar or concrete units (e.g., masonry units).

Mold oil—A mineral oil that is applied to the interior surface of a clean mold, before casting concrete or mortar therein, to facilitate removal of the mold after the concrete or mortar has hardened. (See also **Form oil, Bond breaker,** and **Release agent.**)

Moment—The colloquial expression for the more descriptive term bending moment. (See also **Bending moment.**)

Moment distribution—A method of structural analysis for continuous beams and rigid frames whereby successive converging corrections are made to an assumed set of moments until the desired precision is obtained; also known as the Hardy Cross method.

Monolith—A body of plain or reinforced concrete cast or erected as a single integral mass or structure.

Monolithic concrete—Concrete cast with no joints other than construction joints.

Monolithic surface treatment—See **Dry shake.**

Monolithic terrazzo—The application of a ⅝ in. (15 mm) terrazzo topping directly to a specially prepared concrete substrata, eliminating an underbed.

Monolithic topping—On flatwork: a higher quality, more serviceable topping course placed promptly after the base course has lost all slump and bleeding water.

Monomer—An organic liquid, of relatively low molecular weight, that creates a solid polymer by reacting with itself or other compounds of low molecular weight or both.

Monomolecular—Composed of single molecules; specifically, films that are one molecule thick. Denotes a thickness equal to one molecule (e.g., certain chemical compounds develop a "monomolecular film" over bleeding water at the surface of freshly placed concrete or mortar as a means of reducing the rate of evaporation). (See also **Evaporation retardant.**)

Montmorillonite—See **Montmorillonoid.**

Montmorillonoid—A group of clay minerals, including montmorillonite characterized by a sheet-like internal molecular structure; consisting of extremely finely-divided hydrous aluminum or magnesium silicates that swell on wetting, shrink on drying, and are subject to ion exchange.

Mortar—A mixture of cement paste and fine aggregate; in fresh concrete, the material occupying the interstices among particles of coarse aggregate; in masonry construction, mortar may contain masonry cement, or may contain hydraulic cement with lime (and possibly other admixtures) to afford greater plasticity and workability than are attainable with standard hydraulic cement mortar. (See also **Cement, masonry** and **Masonry**

Nom

Mosaic—Inlaid exposed surface designs of aggregates or other material.

Moving forms—Large prefabricated units of formwork incorporating supports, and designed to be moved horizontally on rollers or similar devices, with a minimum amount of dismantling between successive uses.

Mud sill—A timber or timber assembly bedded into the earth grade as a means of supporting framed construction.

Mud slab—A 2-in. to 6-in. (50-mm to 150-mm) layer of concrete below a structural concrete floor or footing over soft, wet soil; also called mud mat.

Multielement prestressing—Prestressing accomplished by stressing an assembly of several individual structural elements as a means of producing one integrated structural member.

Multistage stressing—Prestressing performed in stages as the construction progresses.

N

Nailable concrete—Concrete, usually made with a suitable lightweight aggregate, with or without the addition of sawdust, into which nails can be driven.

Nailer—A strip of wood or other fitting attached to or set in concrete, or attached to steel to facilitate making nailed connections.

Natural cement—See **Cement, natural.**

Natural sand—Sand resulting from natural disintegration and abrasion of rock. (See also **Sand** and **Fine aggregate.**)

Neat cement—Hydraulic cement in the unhydrated state.

Neat cement grout—A fluid mixture of hydraulic cement and water, with or without admixture; also the hardened equivalent of such mixture.

Neat cement paste—A mixture of hydraulic cement and water, both before and after setting and hardening.

Neat line—A line defining the proposed or specified limits of an excavation or structure.

Negative moment—A condition of flexure in which top fibers of a horizontally placed member, or external fibers of a vertically placed exterior member, are subjected to tensile stresses.

Negative reinforcement—Steel reinforcement for negative moment.

Net mixing water—See **Mixing water.**

Neutral axis—A line in the plane of a structural member subject to bending where the longitudinal stress is zero.

Nicol prism—A system of two optically clear crystals of calcite ("Iceland spar") used in producing plane-polarized light.

No-fines concrete—A concrete mixture containing little or no fine aggregate.

No-slump concrete—Concrete with a slump of ¼ in. (6 mm) or less. (See also **Zero-slump concrete.**)

Nominal maximum size of aggregate—In specifications for or descriptions of aggregate, the smallest sieve opening through which the entire amount of aggregate is *permitted* to pass. (See also **Maximum size of aggregate.**)

Note: Specifications on aggregates usually state the sieve opening through which all the aggregate may, but not need, pass so that a stated maximum proportion of the aggregate may be retained on that sieve. A sieve opening so designated is the nominal size of the aggre-

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Non

Nominal mix—The proportions of the constituents of a proposed concrete mixture.

Nonagitating unit—A truck-mounted container, for transporting central-mixed concrete, not equipped to provide agitation (slow mixing) during delivery.

Non-air-entrained concrete—Concrete in which neither an air-entraining admixture nor air-entraining cement has been used.

Nonconcordant tendons—In statically indeterminate structures, tendons that are not coincident with the pressure line caused by the tendons. (See also **Cap cables.**)

Nonevaporable water—The water that is chemically combined during cement hydration; not removable by specified drying. (See also **Evaporable water.**)

Nonprestressed reinforcement—Reinforcing steel, not subjected to either pretensioning or post-tensioning.

Nonsimultaneous prestressing—The post-tensioning of tendons individually rather than simultaneously.

Normal consistency—

1. The degree of wetness exhibited by a freshly mixed concrete, mortar, or neat cement grout when the workability of the mixture is considered acceptable for the purpose at hand.

2. The physical condition of neat cement paste as determined with the Vicat apparatus in accordance with a standard method of test (e.g., ASTM C187).

Normal-weight concrete—See **Concrete, normal-weight.**

Nozzle—A metal or rubber tip attached to the discharge end of a heavy thick-wall rubber hose from which a continuous stream of shotcrete is ejected.

Nozzle liner—A replaceable rubber lining, fitted into the nozzle tip, to prevent abrasion of the interior surface of the nozzle.

Nozzle velocity—The rate at which shotcrete is ejected from the nozzle, usually stated in feet per second or meters per second.

Nozzleman—The operator who manipulates the nozzle and controls placement of the shotcrete; in the case of dry-mix shotcrete, the operator also controls the water content of the shotcrete.

O

Obsidian—A natural volcanic glass of relatively low water content. (See also **Perlite.**)

Offset—An abrupt change in alignment or dimension, either horizontally or vertically; a horizontal ledge occurring along a change in wall thickness of the wall above.

Offset bend—An intentional distortion from the normal straightness of a steel reinforcing bar in order to move the center line of a segment of the bar to a position parallel to the original position of the center line; a mechanical operation commonly applied to vertical bars that reinforce concrete columns.

Oil well cement—See **Cement, oil well.**

One-way system—The arrangement of steel reinforcement within a slab that presumably bends in only one direction.

Opal—A mineral composed of amorphous hydrous silica ($SiO_2 \cdot H_2O$).

Opaline chert—Chert composed entirely or mainly of opal.

Open-circuit grouting—A grouting system with no provision for recirculation of grout to the pump.

Open-top mixer—A truck-mounted mixer consisting of a trough or a segment of a cylindrical mixing compartment within which paddles or blades rotate about the horizontal axis of the trough. (See also **Mixer, horizontal shaft.**)

Orthotropic—A contraction of the terms "orthogonal anistropic" as in the phrase "orthogonal anistropic plate;" a hypothetical plate consisting of beams and a slab acting together with different flexural rigidities in the longitudinal and transverse directions, as in a composite beam bridge.

Ottawa sand—Silica sand produced by processing of material obtained by hydraulic mining of massive orthoquartzite situated in deposits near Ottawa, Illinois, composed almost entirely of naturally rounded grains of nearly pure quartz; used in mortars for testing of hydraulic cement. (See also **Standard sand** and **Graded standard sand.**)

Ovals—Marble chips which have been tumbled until a smooth oval shape has resulted.

Ovendry—The condition resulting from having been dried to essentially constant weight, in an oven, at a temperature which has been fixed, usually between 221 and 239 F (105 and 115 C).

Oven dry—To dry in an oven at a temperature usually between 221 and 239 F (105 and 115 C) until the weight of the test specimen becomes essentially constant.

Overdesign—To require adherence to structural design requirements higher than service demands, as a means of compensating for statistical variation or for anticipated deficiencies or both.

Overlay—A layer of concrete or mortar, seldom thinner than 1 in. (25 mm), placed on and usually bonded onto the worn or cracked surface of a concrete slab to either restore or improve the function of the previous surface.

Oversanded—Containing more sand than would be necessary to produce adequate workability and a satisfactory condition for finishing.

Overstretching—Stressing of tendons to a value higher than designed for the initial stress to: (a) overcome frictional losses, (b) temporarily overstress the steel to reduce steel creep that occurs after anchorage, and (c) counteract loss of prestressing force that is caused by subsequent prestressing of other tendons.

Overvibration—Excessive use of vibrators during placement of freshly mixed concrete, causing segregation and excessive bleeding.

P

Pack set—See **Sticky cement.**

Packaged concrete, mortar, grout—Mixtures of dry ingredients in packages, requiring only the addition of water to produce concrete, mortar, or grout.

Packer—A device inserted into a hole in which grout is to be injected which acts to prevent return of the grout around the injection pipe; usually an expandable device actuated mechanically, hydraulically, or pneumatically.

Packer-head process—A method of casting concrete pipe in a vertical position in which concrete of low water content is compacted with a revolving compaction tool.

Paddle mixer—See **Open-top mixer.**

Palladiana—See **Berliner.**

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Pan—
1. A prefabricated form unit used in concrete joist floor construction.
2. A container that receives particles passing the finest sieve during mechanical analysis of granular materials.

Pan mixer—See **Mixer, pan.**

Panel—
1. A section of form sheathing, constructed from boards, plywood, metal sheets, etc., that can be erected and stripped as a unit.
2. A concrete member, usually precast, rectangular in shape, and relatively thin with respect to other dimensions.

Panel, drop—See **Drop panel.**

Panel strip—A strip extending across the length or width of a flat slab for structural design and construction or architectural purposes.

Paper form—A heavy paper mold used for casting concrete columns and other structural shapes.

Parallel-wire unit—A post-tensioning tendon composed of a number of wires or strands which are approximately parallel.

Parapet—That part of a wall that extends above the roof level; a low wall along the top of a dam.

Parge—To coat with plaster, particularly foundation walls and rough masonry.

Partial prestressing—Prestressing to a stress level such that, under design loads, tensile stresses exist in the precompressed tensile zone of the prestressed member.

Partial release—Release into a prestressed concrete member of a portion of the total prestress initially held wholly in the prestressed reinforcement.

Particle shape—The shape of a particle. (See also **Cubical piece, Elongated piece,** and **Flat piece.**)

Particle-size distribution—See **Grading.**

Parting agent—See **Release agent.**

Pass—Layer of shotcrete placed in one movement over the field of operation.

Paste content (of concrete)—Proportional volume of cement paste in concrete, mortar, or the like, expressed as volume percent of the entire mixture. (See also **Neat cement paste.**)

Paste volume (of concrete)—See **Paste content.**

Pat—A specimen of neat cement paste about 3 in. (76 mm) in diameter and ½ in. (13 mm) in thickness at the center and tapering to a thin edge on a flat glass plate for indicating setting time.

Pattern cracking—Fine openings on concrete surfaces in the form of a pattern; resulting from a decrease in volume of the material near the surface, or increase in volume of the material below the surface, or both.

Pavement (concrete)—A layer of concrete over such areas as roads, sidewalks, canals, playgrounds, and those used for storage or parking. (See also **Rigid pavement.**)

Paving train—An assemblage of equipment designed to place and finish a concrete pavement.

Pea gravel—Screened gravel, most of the particles of which will pass a ⅜ in. (9.5 mm) sieve and be retained on a No. 4 (4.75 mm) sieve.

Pedestal—An upright compression member whose height does not exceed three times its average least lateral dimension, such as a short pier or plinth used as the base for a column.

Pedestal pile—A cast-in-place concrete pile constructed so that concrete is forced out into a widened bulb or pedestal shape at the foot of the pipe which forms the pile.

Peeling—A process in which thin flakes of mortar are broken away from a concrete surface, such as by deterioration or by adherence of surface mortar to forms as forms are removed.

Pencil rod—Plain metal rod of about ¼ in. (6 mm) diameter.

Penetration probe—A device for obtaining a measure of the resistance of concrete to penetration; customarily determined by the distance that a steel pin is driven into the concrete from a special gun by a precisely measured explosive charge.

Penetration resistance—The resistance, usually expressed in pounds per square inch (psi) or megapascals (MPa), of mortar or cement paste to penetration by a plunger or needle under standard conditions.

Percent fines—Amount, expressed as a percentage, of material in aggregate finer than a given sieve, usually the No. 200 (75 μm) sieve; also the amount of fine aggregate in a concrete mixture expressed as a percent by absolute volume of the total amount of aggregate.

Percentage of reinforcement—The ratio of cross-sectional area of reinforcing steel to the effective cross-sectional area of a member, expressed as a percentage.

Periclase—A crystalline mineral, magnesia, MgO, the equivalent of which may be present in portland cement clinker, portland cement, and other materials such as open hearth slags, and certain basic refractories.

Perimeter grouting—Injection of grout, usually at relatively low pressure, around the periphery of an area which is subsequently to be grouted at greater pressure; intended to confine subsequent grout injection within the perimeter.

Period at maximum temperature—See **Maximum-temperature period.**

Perlite—A volcanic glass having a perlitic structure, usually having a higher water content than obsidian; when expanded by heating, used as an insulating material and as a lightweight aggregate in concretes, mortars, and plasters.

Perlitic structure—A structure produced in a homogeneous material by contraction during cooling, and consisting of a system of irregular convolute and spheroidal cracks; generally confined to natural glass.

Permanent form—Any form that remains in place after the concrete has developed its design strength; it may or may not become an integral part of the structure.

Permanent set—Inelastic elongation or shortening.

Permeability to water, coefficient of—The rate of discharge of water under laminar flow conditions through a unit cross-sectional area of a porous medium under a unit hydraulic gradient and standard temperature conditions usually 20 C.

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.

Petrology—The science of rocks, treating of their origin, structure, composition, etc., from all aspects and in all relations. (See also **Petrography.**)

Phenolic resin—A class of synthetic, oil-soluble resins (plastics) produced as condensation products of phenol, substituted phenols and formaldehyde, or some similar aldehyde that may be used in paints for concrete.

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Phi

Phi (ϕ) factor—Capacity reduction factor (in structural design); a number less than 1.0 (usually 0.65–0.90) by which the strength of a structural member or element (in terms of load, moment, shear, or stress) is required to be multiplied in order to determine design strength or capacity; the magnitude of the factor is stipulated in applicable codes and construction specifications for respective types of members and cross sections.

Phlleo factor—A distance, used as an index of the extent to which hardened cement paste is protected from the effects of freezing, so selected that only a small portion of the cement paste (usually 10 percent) lies farther than that distance from the perimeter of the nearest air void. (See also **Protected paste volume.**)

Photometer—See **Flame photometer.**

Pier—Isolated foundation member of plain or reinforced concrete.

Pigment—A coloring matter, usually in the form of an insoluble fine powder.

Pilaster—Column built within a wall, usually projecting beyond the wall.

Pilaster face—The form for the front surface of a pilaster parallel to the wall.

Pilaster side—The form for the side surface of a pilaster perpendicular to the wall.

Pile—A slender timber, concrete, or steel structural element, driven, jetted, or otherwise embedded on end in the ground for the purpose of supporting a load or of compacting the soil. (See also **Composite pile.**)

Pile bent—Two or more piles driven in a row transverse to the long dimension of the structure and fastened together by capping and (sometimes) bracing.

Pile cap—

1. A structural member placed on, and usually fastened to, the top of a pile or a group of piles and used to transmit loads into the pile or group of piles and in the case of a group to connect them into a bent; also known as a rider cap or girder; also a masonry, timber, or concrete footing resting on a group of piles.

2. A metal cap or helmet temporarily fitted over the head of a precast pile to protect it during driving; some form of shock-absorbing material is often incorporated.

Pipe column—Column made of steel pipe; often filled with concrete.

Pipe pile—A steel cylinder, usually between 10 and 24 in. (250 and 600 mm) in diameter, generally driven with open ends to firm bearing and then excavated and filled with concrete; this pile may consist of several sections from 5 to 40 ft (1.5 to 8 m) long joined by special fittings such as cast-steel sleeves and is sometimes used with its lower end closed by a conical steel shoe.

Pitting—Development of relatively small cavities in a surface, due to phenomena such as corrosion or cavitation, or, in concrete, localized disintegration. (See also **Popout.**)

Placeability—See **Workability.**

Placement—The process of placing and consolidating concrete; a quantity of concrete placed and finished during a continuous operation; also inappropriately referred to as **Pouring.**

Placing—The deposition, distribution, and consolidation of freshly mixed concrete in the place where it is to harden; also inappropriately referred to as **Pouring.**

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

Plain concrete—Concrete without reinforcement; reinforced concrete that does not conform to the definition of reinforced concrete; also used loosely to designate concrete containing no admixture and prepared without special treatment.

Plane of weakness—The plane along which a body under stress will tend to fracture; may exist by design, by accident, or because of the nature of the structure and its loading.

Plaster—A cementitious material or combination of cementitious material and aggregate that, when mixed with a suitable amount of water, forms a plastic mass or paste which when applied to a surface, adheres to it and subsequently hardens, preserving in a rigid state the form or texture imposed during the period of plasticity; also the placed and hardened mixture. (See also **Stucco.**)

Plaster mold—A mold or form made from gypsum plaster, usually to permit concrete to be formed or cast in intricate shapes or in conspicuous relief. (See also **Mold** and **Form.**)

Plaster of Paris—$CaSO_4 \cdot \frac{1}{2}H_2O$, gypsum, from which three-quarters of the chemically bound water has been driven off by heating; when wetted it recombines with water and hardens quickly. (See also **Hemihydrate.**)

Plastic—Possessing plasticity, or possessing adequate plasticity. (See also **Plasticity.**)

Plastic centroid—Centroid of the resistance to load computed for the assumptions that the concrete is stressed uniformly to 0.85 its design strength and the steel is stressed uniformly to its specified yield point.

Plastic consistency—Condition of freshly mixed cement paste, mortar, or concrete such that deformation will be sustained continuously in any direction without rupture; in common usage, concrete with slump of 3 to 4 in. (80 to 100 mm).

Plastic cracking—Cracking that occurs in the surface of fresh concrete soon after it is placed and while it is still plastic.

Plastic deformation—Deformation that does not disappear when the force causing the deformation is removed.

Plastic design—See **Ultimate-strength design.**

Plastic flow—See **Creep.**

Plastic-hinge—Region where ultimate moment capacity in a member may be developed and maintained with corresponding significant inelastic rotation as main tensile steel elongates beyond yield strain.

Plastic limit—The water content at which a soil will just begin to crumble when rolled into a thread approximately ⅛ in. (3 mm) in diameter. (See also **Atterberg limits.**)

Plastic loss—See **Creep.**

Plastic mortar—A mortar of plastic consistency.

Plastic or bond fire clay—A fire clay of sufficient natural plasticity to bond nonplastic material; a fire clay used as a plasticizing agent in mortar.

Plastic shrinkage cracks—See **Plastic cracking.**

Plasticity—A complex property of a material involving a combination of qualities of mobility and magnitude of yield value; that property of freshly mixed cement paste concrete, or mortar which determines its resistance deformation or ease of molding.

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Plasticity index—The range in water content through which a soil remains plastic; numerical difference between the liquid limit and the plastic limit. (See also **Atterberg limits.**)

Plasticizer—A material that increases plasticity of a cement paste, mortar, or concrete mixture.

Plasticizing—Producing plasticity or becoming plastic.

Plate—

1. In formwork for concrete: A flat, horizontal member at the top or bottom or both of studs or posts; a mudsill if on the ground.

2. In structural design: A member, the depth of which is substantially smaller than its length and width.

See also **Flat plate** and **Load-transfer assembly.**

Plum—A large random-shaped stone dropped into freshly placed mass concrete to economize on the volume of the concrete. (See also **Cyclopean concrete.**)

Plumb—Vertical or to make vertical.

Pneumatic feed—Shotcrete delivery equipment in which material is conveyed by a pressurized air stream.

Pneumatically applied mortar—See **Shotcrete.**

Point count—Method for determination of the volumetric composition of a solid by observation of the frequency with which areas of each component coincide with a regular system of points in one or more planes intersecting a sample of the solid.

Point count (modified)—The point count method supplemented by a determination of the frequency with which areas of each component of a solid are intersected by regularly spaced lines in one or more planes intersecting a sample of the solid.

Point load—A load whose area of contact with the resisting body is negligible in comparison with the area of the resisting body.

Point of contraflexure—See **Point of inflection.**

Point of inflection—The point on the length of a structural member subjected to flexure where the curvature changes from concave to convex or conversely and at which the bending moment is zero; also called "point of contraflexure"; location of an abrupt bend in a plotted locus of points in a graph.

Poisson's ratio—The ratio of transverse (lateral) strain to the corresponding axial (longitudinal) strain resulting from uniformly distributed axial stress below the proportional limit of the material; the value will average about 0.2 for concrete and 0.25 for most metals.

Polarizing microscope—A microscope equipped with elements permitting observations and determinations to be made using polarized light. (See also **Nicol prism.**)

Pole shore—See **Post shore.**

Polish or final grind—The final operation in which fine abrasives are used to hone a surface to its desired smoothness and appearance.

Polyester—One of a large group of synthetic resins, mainly produced by reaction of dibasic acids with dihydroxy alcohols; commonly prepared for application by mixing with a vinyl-group monomer and free-radical catalysts at ambient temperatures and used as binders for resin mortars and concretes, fiber laminates (mainly glass), adhesives, and the like. (See also **Polymer concrete.**)

Polyethylene—A thermoplastic high-molecular-weight organic compound used in formulating protective coatings or, in sheet form, as a protective cover for concrete surfaces during the curing period, or to provide a temporary enclosure for construction operations.

Polymer—The product of polymerization; more commonly a rubber or resin consisting of large molecules formed by polymerization.

Polymer concrete—Concrete in which an organic polymer serves as the binder (see **Concrete**); also known as resin concrete; sometimes erroneously employed to designate hydraulic cement mortars or concretes in which part or all of the mixing water is replaced by an aqueous dispersion of a thermoplastic copolymer.

Polymer-cement concrete—A mixture of water, hydraulic cement, aggregate, and a monomer or polymer; polymerized in place when a monomer is used.

Polymerization—The reaction in which two or more molecules of the same substance combine to form a compound containing the same elements, and in the same proportions, but of high molecular weight, from which the original substance can be generated, in some cases only with extreme difficulty.

Polystyrene resin—Synthetic resins varying in color from water-white to yellow formed by the polymerization of styrene on heating with or without catalysts that may be used in paints for concrete, or for making sculptured molds, or as insulation.

Polysulfide coating—A protective coating system prepared by polymerizing a chlorinated alkyl polyether with an inorganic polysulfide; exhibits outstanding resistance to ozone, sunlight, oxidation, and weathering.

Polyurethane—Reaction product of an isocyanate with any of a wide variety of other compounds containing an active hydrogen group; used to formulate tough, abrasion-resistant coatings.

Polyvinyl acetate—Colorless, permanently thermoplastic resin; usually supplied as an emulsion or water-dispersible powder characterized by flexibility, stability towards light, transparency to ultraviolet rays, high dielectric strength, toughness, and hardness; the higher the degree of polymerization, the higher the softening temperature; may be used in paints for concrete.

Polyvinyl chloride—A synthetic resin prepared by the polymerization of vinyl chloride, used in the manufacture of nonmetallic waterstops for concrete.

Pop-corn concrete—No-fines concrete containing insufficient cement paste to fill voids among the coarse aggregate so that the particles are bound only at points of contact. (See **No-fines concrete.**)

Popout—The breaking away of small portions of a concrete surface due to internal pressure which leaves a shallow, typically conical, depression.

Porosity—The ratio, usually expressed as a percentage, of the volume of voids in a material to the total volume of the material, including the voids.

Portland blast-furnace slag cement—See **Cement, portland blast-furnace slag.**

Portland cement—See **Cement, portland.**

Portland cement concrete—See **Concrete.**

Portland-pozzolan cement—See **Cement, portland-pozzolan.**

Portlandite—A mineral; calcium hydroxide ($Ca(OH)_2$); occurs naturally in Ireland; equivalent to a common product of hydration of portland cement.

Porous fill—See **Drainage fill.**

Positive displacement—Wet-mix shotcrete delivery equipment in which the material is pushed through the material hose in a solid mass by a piston or auger.

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Pos

Positive moment.—A condition of flexure in which, for a horizontally simply supported member, the deflected shape is normally considered to be concave downward and the top fibers subjected to compression stresses; for other members and other conditions consider positive and negative as relative terms. (See also **Negative moment.**)

Note: For structural design and analysis, moments may be designated as positive or negative with satisfactory results as long as the sign convention adopted is used consistently.

Positive reinforcement—Reinforcement for positive moment.

Post—Vertical formwork member used as a brace; also shore, prop, jack.

Post shore or **Pole shore**—Individual vertical member used to support loads.

1. **Adjustable timber single-post shore**—Individual timber used with a fabricated clamp to obtain adjustment and not normally manufactured as a complete unit.

2. **Fabricated single-post shore**—Type I: Single all-metal post, with a fine-adjustment screw or device in combination with pin-and-hole adjustment or clamp; Type II: Single or double wooden post members adjustable by a metal clamp or screw and usually manufactured as a complete unit.

3. **Timber single-post shore**—Timber used as a structural member for shoring support.

Post-tensioning—A method of prestressing reinforced concrete in which tendons are tensioned after the concrete has hardened.

Pot life—Time interval after preparation during which a liquid or plastic mixture is usable.

Pouring (of concrete)—See **Placement** and **Placing.**

Power float—See **Rotary float.**

Powers spacing factor—See **Spacing factor.**

Pozzolan—A siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

Pozzolanic—Of or pertaining to a pozzolan.

Pozzolanic reaction—See **Pozzolan.**

Precast—A concrete member that is cast and cured in other than its final position; the process of placing and finishing precast concrete.

Precast concrete—Concrete cast elsewhere than its final position.

Precast pile—A reinforced concrete pile manufactured in a casting plant or at the site but not in its final position.

Precompressed zone—The area of a flexural member which is compressed by the prestressing tendons.

Precured period—See **Presteaming period.**

Prefiring—Raising the temperature of refractory concrete under controlled conditions prior to placing it in service.

Preformed foam—Foam produced in a foam generator prior to introduction of the foam into a mixer with other ingredients to produce cellular concrete.

Premature stiffening—See **False set** and **Flash set.**

Prepacked concrete—See **Concrete, preplaced-aggregate.**

Preplaced-aggregate concrete—See **Concrete, preplaced-aggregate** and **Colloidal concrete.**

Pre-post-tensioning—A method of fabricating prestressed concrete in which some of the tendons are pretensioned and a portion of the tendons are post-tensioned.

Preset period—See **Presteaming period.**

Preshrunk—

1. Concrete which has been mixed for a short period in a stationary mixer before being transferred to a transit mixer.

2. Grout, mortar, or concrete that has been mixed 1 to 3 hr before placing to reduce shrinkage during hardening.

Pressed edge—Edge of a footing along which the greatest soil pressure occurs under conditions of overturning.

Pressure line—Locus of force points within a structure resulting from combined prestressing force and externally applied load.

Presteaming period—In the manufacture of concrete products, the time between molding of a concrete product and start of the temperature-rise period.

Prestress—To place a hardened concrete member or an assembly of units in a state of compression prior to application of service loads; the stress developed by prestressing, such as by pretensioning or post-tensioning. (See also **Prestressed concrete, Prestressing steel, Pretensioning,** and **Post-tensioning.**)

Prestressed concrete—Concrete in which internal stresses of such magnitude and distribution are introduced that the tensile stresses resulting from the service loads are counteracted to a desired degree; in reinforced concrete the prestress is commonly introduced by tensioning the tendons.

Prestressing steel—High strength steel used to prestress concrete, commonly seven-wire strands, single wires, bars, rods, or groups of wires or strands. (See also **Prestress, Prestressed concrete, Pretensioning,** and **Post-tensioning.**)

Pretensioning—A method of prestressing reinforced concrete in which the tendons are tensioned before the concrete has hardened.

Pretensioning bed (or **Bench**)—The casting bed on which pretensioned members are manufactured and which resists the pretensioning force prior to release.

Primary crusher—A heavy crusher suitable for the first stage in a process of size reduction of rock, slag, or the like.

Primary nuclear vessel—Interior container in a nuclear reactor designed for sustained loads and for working conditions.

Principal planes—See **Principal stress.**

Principal stress—Maximum and minimum stresses at any point acting at right angles to the mutually perpendicular planes of zero shearing stress, which are designated as the **Principal planes.**

Probabilistic design—Method of design of structures using the principles of statistics (probability) as a basis for evaluation of structural safety.

Promoter—See **Catalyst.**

Proof stress—Stress applied to materials sufficient to produce a specified permanent strain; a specific stress to which some types of tendons are subjected in the manufacturing process as a means of reducing the deformation of anchorage, reducing the creep of steel, or insuring that the tendon is sufficiently strong.

Prop—See **Post** and **Shore.**

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Proportional limit—The greatest stress which a material is capable of developing without any deviation from proportionality of stress to strain (Hooke's Law).

Proportioning—Selection of proportions of ingredients for mortar or concrete to make the most economical use of available materials to produce mortar or concrete of the required properties.

Protected corner—Corner of a slab with adequate provision for load transfer, such that at least 20 percent of the load from one slab corner to the corner of an adjacent slab is transferred by mechanical means or aggregate interlock.

Protected paste volume—The portion of hardened cement paste that is protected from the effects of freezing by proximity to an entrained air void. (See also **Philleo factor.**)

Proving ring—A device for calibrating load indicators of testing machines, consisting of a calibrated elastic ring and a mechanism or device for indicating the magnitude of deformation under load.

Psi—Abbreviation for "pounds per square inch."

Pulverized fuel ash (pfa)—See **Fly ash.**

Pumice—A highly porous and vesicular lava usually of relatively high silica content composed largely of glass drawn into approximately parallel or loosely entwined fibers, which themselves contain sealed vesicles.

Pumicite—Naturally occurring finely divided pumice.

Pumped concrete—Concrete which is transported through hose or pipe by means of a pump.

Pumping (of pavements)—The ejection of water, or water and solid materials such as clay or silt along transverse or longitudinal joints and cracks, and along pavement edges caused by downward slab movement activated by the passage of loads over the pavement after the accumulation of free water on or in the base course, subgrade, or subbase.

Punching shear—

1. Shear stress calculated by dividing the load on a column by the product of its perimeter and the thickness of the base or cap or by the product of the perimeter taken at one half the slab thickness away from the column and the thickness of the base or cap.

2. Failure of a base when a heavily loaded column punches a hole through it.

Punning—An obsolete term designating a light form of ramming. (See also **Ramming** and **Tamping.**)

Purlin—In roofs, a horizontal member supporting the common rafters.

Pycnometer—A vessel for determination of specific gravity of liquids or solids.

Pyrometric cone—A small, slender, three-sided oblique pyramid made of ceramic or refractory material for use in determining the time-temperature effect of heating and in obtaining the pyrometric cone equivalent (PCE) of refractory material.

Pyrometric cone equivalent (PCE)—The number of that cone whose tip would touch the supporting plaque simultaneously with that of a cone of the refractory material being investigated when tested in accordance with a specified procedure such as ASTM C 24.

Q

Quality assurance—A system of procedures for selecting the levels of quality required for a project or portion thereof to perform the functions intended, and assuring that these levels are obtained.

Quality control—A system of procedures and standards by which a constructor, product manufacturer, materials processor, or the like, monitors the properties of the finished work.

Quartering—A method of obtaining a representative sample by dividing a circular pile of a larger sample into four equal parts and discarding opposite quarters successively until the desired size of sample is obtained.

Quicklime—Calcium oxide (CaO). (See also **Lime.**)

Quick set—See **Flash set** and **False set.**

R

Raft foundation—A continuous slab of concrete, usually reinforced, laid over soft ground or where heavy loads must be supported to form a foundation. (See also **Mat foundation.**)

Rail steel reinforcement—Reinforcing bars hot-rolled from standard T-section rails.

Rake classifier—Machine for separating coarse and fine particles of granular material temporarily suspended in water; the coarse particles settle to the bottom of a vessel and are scraped up an incline by a set of blades, the fine particles, remaining in suspension to be carried over the edge of the classifier.

Raker—A sloping brace for a shore head.

Raked joint—A joint in a masonry wall which has the mortar raked out to a specified depth while it is only slightly hardened.

Raking pile—See **Batter pile.**

Ramming—A form of heavy tamping of concrete, grout, or the like by means of a blunt tool forcibly applied. (See also **Dry pack, Punning,** and **Tamping.**)

Ranger—See **Wale.**

Raw mix—Blend of raw materials, ground to desired fineness, correctly proportioned, and blended ready for burning; such as that used in the manufacture of cement clinker.

Reactive aggregate—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.

Reactive silica material—Several types of materials which react at high temperatures with portland cement or lime during autoclaving; includes pulverized silica, natural pozzolan, and fly ash.

Ready-mixed concrete—Concrete manufactured for delivery to a purchaser in a plastic and unhardened state. (See **Central-mixed concrete, Shrink-mixed concrete,** and **Transit-mixed concrete.**)

Rebar—Abbreviation for "reinforcing bar." (See **Reinforcement.**)

Rebound—Aggregate and cement or wet shotcrete which bounces away from a surface against which shotcrete is being projected.

Rebound hammer—An apparatus that provides a rapid indication of the mechanical properties of concrete based on the distance of rebound of a spring-driven missile.

Refractories—Materials, usually nonmetallic, used to withstand high temperatures.

Ref
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Ref

Refractoriness—In refractories, the property of being resistant to softening or deformation at high temperatures.

Refractory—Resistant to high temperatures.

Refractory aggregate—Materials having refractory properties which when bound together into a conglomerate mass by a matrix form a refractory body.

Refractory concrete—Concrete having refractory properties, and suitable for use at high temperatures (generally about 315 to 1315 C), in which the binding agent is a hydraulic cement.

Refractory insulating concrete—Refractory concrete having low thermal conductivity.

Reglet—A groove in a wall to receive flashing.

Reinforced concrete—Concrete containing adequate reinforcement (prestressed or not prestressed) and designed on the assumption that the two materials act together in resisting forces. (See also **Plain concrete.**)

Reinforced masonry—Unit masonry in which reinforcement is embedded in such a manner that the two materials act together in resisting forces.

Reinforcement—Bars, wires, strands, and other slender members which are embedded in concrete in such a manner that the reinforcement and the concrete act together in resisting forces.

Reinforcement, cold-drawn wire—Steel wire made from rods that have been hot rolled from billets, cold-drawn through a die; for concrete reinforcement of small diameter such as in gages not less than 0.080 in. (2 mm) nor greater than 0.625 in. (16 mm).

Reinforcement, cold-worked steel—Steel bars or wires which have been rolled, twisted, or drawn at normal ambient temperatures.

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.

Reinforcement, dowel-bar—See **Dowel.**

Reinforcement, expanded metal fabric—See **Expanded metal lath.**

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.

Reinforcement, helical—Steel reinforcement of hot rolled bar or cold drawn wire fabricated into a helix (more commonly known as spiral reinforcement).

Reinforcement, high strength—Concrete reinforcing bars having a minimum yield of 60,000 psi (414 MPa).

Reinforcement, hoop—A one-piece closed tie or continuously wound tie not less than #3 in size, the ends of which have a standard 135-deg bend with a ten-bar-diameter extension, that encloses the longitudinal reinforcement.

Reinforcement, lateral—Usually applied to ties, hoops, and spirals in columns or column-like members.

Reinforcement, mesh—See **Welded-wire fabric** and **Welded-wire fabric reinforcement.**

Reinforcement, principal—Elements or configurations of reinforcement that provide the main resistance of reinforced concrete to loads borne by structures. (See also **Reinforcement, secondary.**)

Reinforcement, secondary—Reinforcement other than main reinforcement.

Reinforcement, spiral—See **Spiral reinforcement.**

Reinforcement, transverse—Reinforcement at right angles to the longitudinal reinforcement; may be main or secondary reinforcement.

Reinforcement, twin-twisted bar—Two bars of the same nominal diameter twisted together.

Reinforcement, two-way—Reinforcement arranged in bands of bars at right angles to each other.

Reinforcement, welded—Reinforcement joined together by welding.

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

Reinforcement ratio—Ratio of the effective area of the reinforcement to the effective area of the concrete at any section of a structural member. (See also **Percentage of reinforcement.**)

Relative humidity—The ratio of the quantity of water vapor actually present to amount present in a saturated atmosphere at a given temperature; expressed as a percentage.

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.

Release agent—Material used to prevent bonding of concrete to a surface. (See also **Bond breaker.**)

Remoldability—The readiness with which freshly mixed concrete responds to a remolding effort such as jigging or vibration causing it to reshape its mass around reinforcement and to conform to the shape of the form. (See also **Flow.**)

Remolding test—A test to measure remoldability.

Rendering—The application, by means of a trowel or float, of a coat of mortar.

Repeatability—Variability among replicate test results obtained on the same material within a single laboratory by one operator; a quantity that will be exceeded in only about 5 percent of the repetitions by the difference, taken in absolute value, of two randomly selected test results obtained in the same laboratory on a given material; in use of the term all variable factors should be specified.

Reposting—See **Reshoring.**

Reproducibility—Variability among replicate test results obtained on the same material in different laboratories; a quantity that will be exceeded in only about 5 percent of the repetitions by the difference, taken in absolute value, of two single test results made on the same material in two different, randomly selected laboratories; in use of the term all variable factors should be specified.

Resetting (of forms)—Setting of forms separately for each successive lift of a wall to avoid offsets at construction joints.

Reshoring—The construction operation in which the original shoring or posting is removed and replaced in such a manner as to avoid deflection of the shored element or damage to partially cured concrete.

Resilience—The work done per unit volume of a material in producing strain.

Resin—A natural or synthetic, solid or semisolid organic material of indefinite and often high molecular weight having a tendency to flow under stress, usually has a softening or melting range and usually fractures conchoidally.

Resin mortar (or **Concrete**)—See **Polymer concrete.**

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Restraint (of concrete)—Restriction of free movement of fresh or hardened concrete following completion of placing in formwork or molds or within an otherwise confined space; restraint can be internal or external and may act in one or more directions.

Retardation—Reduction in the rate of hardening or setting, i.e., an increase in the time required to reach initial and final set or to develop early strength of fresh concrete, mortar, or grout. (See also **Retarder.**)

Retarder—An admixture which delays the setting of cement paste, and hence of mixtures such as mortar or concrete containing cement.

Retempering—Addition of water and remixing of concrete or mortar which has lost enough workability to become unplaceable or unusable. (See also **Tempering.**)

Reveal—The side of an opening in a wall for a window or door; depth of exposure of aggregate in an exposed aggregate finish. (See also **Exposed-aggregate finish.**)

Revibration—One or more applications of vibration to concrete after completion of placing and initial compaction but preceding initial setting of the concrete.

Revolving-blade (or paddle) mixer—See **Open-top mixer.**

Rheology—The science dealing with flow of materials, including studies of deformation of hardened concrete, the handling and placing of freshly mixed concrete, and the behavior of slurries, pastes, and the like.

Rib—One of a number of parallel structural members backing sheathing; the portion of a T-beam which projects below the slab; in deformed reinforcing bars, the deformations or the longitudinal parting ridge.

Ribbed panel—A panel composed of a thin slab reinforced by a system of ribs in one or two directions, usually orthogonal.

Ribbed slab—See **Ribbed panel.**

Ribbon—A narrow strip of wood or other material used in formwork.

Ribbon loading—Method of batching concrete in which the solid ingredients, and sometimes also the water, enter the mixer simultaneously.

Rich concrete—Concrete of high cement content. (See also **Lean concrete.**)

Rich mixture—A concrete mixture containing a high proportion of cement.

Rider cap—See **Pile cap.**

Rigid frame—A frame depending on moment in joints for stability.

Rigid pavement—Pavement that will provide high bending resistance and distribute loads to the foundation over a comparatively large area.

Rock pocket—A porous, mortar-deficient portion of hardened concrete consisting primarily of coarse aggregate and open voids, caused by leakage of mortar from form, separation (segregation) during placement, or insufficient consolidation. (See also **Honeycomb.**)

Rod—Sharp-edged cutting screed used to trim shotcrete to forms or ground wires. (See also **Screed.**)

Rod, Dowel—See **Dowel.**

Rod, tamping—A round, straight, steel rod having one or both ends rounded to a hemispherical tip.

Rodability—The susceptibility of fresh concrete or mortar to compaction by means of a tamping rod.

Rod buster (colloquial)—One who installs reinforcement for concrete.

Rodding—Compaction of concrete or the like by means of a tamping rod. (See also **Rod, tamping** and **Rodability.**)

Rolling—The use of heavy metal or stone rollers on terrazzo topping to extract excess matrix.

Roman cement—A misnomer for a hydraulic cement made by calcining a natural mixture of calcium carbonate and clay, such as argillaceous limestone, to a temperature below that required to sinter the material but high enough to decarbonate the calcium carbonate, followed by grinding, so named because its brownish color resembles ancient Roman cements produced by use of lime-pozzolan mixtures.

Roof insulation—Lightweight concrete used primarily as insulating material over structural roof systems.

Rosiwal method—See **Linear traverse method.**

Rotary float (also called **Power float**)—A motor-driven revolving disc that smooths, flattens, and compacts the surface of concrete floors or floor toppings.

Rotary kiln—A long steel cylinder with a refractory lining, supported on rollers so that it can rotate about its own axis, and erected with a slight inclination from the horizontal so that prepared raw materials fed into the higher end move to the lower end, where fuel is blown in by air blast. (See also **Kiln, cement.**)

Rough grind—The initial operation in which coarse abrasives are used to cut the projecting chips in hardened terrazzo down to a level surface.

Rout—To deepen and widen a crack to prepare it for patching or sealing.

Rub brick—See **Rubbing brick.**

Rubbing brick—A silicon-carbide brick used to smooth and remove irregularities from surfaces of hardened concrete.

Rubbed finish—A finish obtained by using an abrasive to remove surface irregularities from concrete. (See also **Sack rub.**)

Rubber set—See **False set.**

Rubble—Rough stones of irregular shape and size, broken from larger masses by geological processes or by quarrying.

Rubble concrete—

1. Concrete similar to cyclopean concrete except that small stones (such as one man can handle) are used.
2. Concrete made with rubble from demolished structures.

See also **Cyclopean concrete.**

Runway—Decking over area of concrete placement, usually of movable panels and supports, on which buggies of concrete travel to points of placement.

Rupture modulus—See **Modulus of rupture.**

Rupture strength—See **Modulus of rupture.**

Rustic or washed finish—A type of terrazzo topping in which the matrix is recessed by washing prior to setting so as to expose the chips without destroying the bond between chip and matrix; a retarder is sometimes applied to the surface to facilitate this operation. (See also **Exposed aggregate finish.**)

Rustication—A groove in a concrete or masonry surface.

Rustication strip—A strip of wood or other material attached to a form surface to produce a groove or rustication in the concrete.

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S

Sack—See **Bag.**

Sack rub—A finish for formed concrete surfaces, designed to produce even texture and fill all pits and air holes (see **Bug holes**); after dampening the surface, mortar is rubbed over surface; then, before it dries, a mixture of dry cement and sand is rubbed over it with a wad of burlap or a sponge-rubber float to remove surplus mortar and fill voids.

Safe leg load—The load which can safely be directly imposed on the frame leg of a scaffold. (See also **Allowable load.**)

Sagging—Subsidence of shotcrete material from a sloping, vertical, or overhead placement; also, the condition of a horizontal structural member bending downward under load. (See also **Sloughing.**)

Salamander—A portable source of heat, customarily oil-burning, used to heat an enclosure around or over newly placed concrete to prevent the concrete from freezing.

Sand—

1. Granular material passing the ⅜-in. (9.5-mm) sieve and almost entirely passing the No. 4 (4.75-mm) sieve and predominantly retained on the No. 200 (75-μm) sieve, and resulting from natural disintegration and abrasion of rock or processing of completely friable sandstone; or

2. that portion of an aggregate passing the No. 4 (4.75-mm) sieve and predominantly retained on the No. 200 (75-μm) sieve, and resulting from natural disintegration and abrasion of rock or processing of completely friable sandstone.

See also **Fine aggregate.**

Note: The definitions are alternatives to be applied under differing circumstances. Definition (1) is applied to an entire aggregate either in a natural condition or after processing. Definition (2) is applied to a portion of an aggregate. Requirements for properties and grading should be stated in the specifications. Fine aggregate produced by crushing rock, gravel, or slag commonly is known as **Manufactured sand.**

Sandblast—A system of cutting or abrading a surface such as concrete by a stream of sand ejected from a nozzle at high speed by compressed air; often used for cleanup of horizontal construction joints or for exposure of aggregate in architectural concrete.

Sand box (or **Sand jack**)—A tight box filled with clean, dry, sand on which rests a tight-fitting timber plunger that supports the bottom of posts used in centering; removal of a plug from a hole near the bottom of the box permits the sand to run out when it is necessary to lower the centering.

Sand-coarse aggregate ratio—Ratio of fine to coarse aggregate in a batch of concrete, by weight or volume.

Sand equivalent—A measure of the relative proportions of detrimental fine dust or claylike material in soils or fine aggregate.

Sand grout—Any grout in which fine aggregate is incorporated into the mixture; also termed sanded grout.

Sanded grout—See **Sand grout.**

Sand jack—See **Sand box.**

Sand-lime brick—See **Calcium-silicate brick.**

Sand, Ottawa—See **Ottawa sand.**

Sand plate—A flat steel plate or strip welded to the legs of bar supports for use on compacted soil.

Sand pocket—A zone in concrete or mortar containing sand without cement.

Sandstone—A cemented or otherwise compacted sedimentary rock composed predominantly of sand grains.

Sand streak—A streak of exposed fine aggregate in the surface of formed concrete caused by bleeding.

Sandwich panel—A prefabricated panel which is a layered composite, formed by attaching two thin facings to a thicker core; such as a precast concrete panel consisting of two layers of concrete separated by a nonstructural insulating core.

Santorin earth—A volcanic tuff originating on the Grecian island of Santorin and used as a pozzolan.

Saturated surface dry—Condition of an aggregate particle or other porous solid when the permeable voids are filled with water and no water is on the exposed surfaces.

Saturation—Act or process of saturating, or state of being saturated.

Saw cut—A cut in hardened concrete utilizing diamond or silicone-carbide blades or discs.

Sawdust concrete—Concrete in which the aggregate consists mainly of sawdust from wood.

Sawed joint—A joint cut in hardened concrete, generally not to the full depth of the member, by means of special equipment.

Scab—A short piece of wood fastened to two formwork members to secure a butt joint.

Scaffolding—A temporary structure for the support of deck forms, cartways, or workmen, or a combination of these such as an elevated platform for supporting workmen, tools, and materials; adjustable metal scaffolding is frequently adapted for shoring in concrete work.

Scaling—Local flaking or peeling away of the near-surface portion of hardened concrete or mortar; also of a layer from metal. (See also **Peeling, Spalling,** and **Mill scale.**)

Note: **Light scaling** of concrete does not expose coarse aggregate; **medium scaling** involves loss of surface mortar to 5 to 10 mm in depth and exposure of coarse aggregate; **severe scaling** involves loss of surface mortar to 5 to 10 mm in depth with some loss of mortar surrounding aggregate particles 10 to 20 mm in depth; **very severe scaling** involves loss of coarse aggregate particles as well as mortar generally to a depth greater than 20 mm.

Scalper—A sieve for removing oversize particles.

Scalping—The removal of particles larger than a specified size by sieving.

Scarf connection—A connection made by precasting, beveling, halving, or notching two pieces to fit together; after overlapping, the pieces are secured by bolts or other means.

Scarf joint—See **Scarf connection.**

Scoria—Vesicular volcanic ejecta of larger size, usually of basic composition and characterized by dark color; the material is relatively heavy and partly glassy, partly crystalline; the vesicles do not generally interconnect. (See also **Aggregate, lightweight.**)

Scour—Erosion of a concrete surface, exposing the aggregate.

Scratch coat—The first coat of plaster or stucco applied to a surface in three-coat work; usually cross-raked or scratched to form a mechanical key with the brown coat.

Screed—

1. To strike off concrete lying above the desired plane or shape.

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2. A tool for striking off the concrete surface, sometimes referred to as a **Strikeoff.**

Screed guide—Firmly established grade strips or side forms for unformed concrete which will guide the strikeoff in producing the desired plane or shape.

Screed wire—See **Ground wire.**

Screeding—The operation of forming a surface by the use of screed guides and a strikeoff. (See also **Strikeoff.**)

Screen—See **Sieve.**

Screen analysis—See **Sieve analysis.**

Sealant—See **Joint sealant** and **Membrane curing.**

Sealing compound—See **Joint sealant** and **Membrane curing.**

Secant modulus—See **Modulus of elasticity.**

Secondary beam—A flexural member that is not a portion of the principal structural frame of a structure.

Secondary crusher—A crusher used for the second stage in a process of size reduction. (See also **Primary crusher.**)

Secondary moment—In statically indeterminate structures, the additional moments caused by deformation of the structure due to the applied forces; in statically indeterminate prestressed concrete structures, the additional moments caused by the use of a nonconcordant prestressing tendon.

Secondary nuclear vessel—Exterior container or safety container in a nuclear reactor subjected to design load only once in its lifetime, if at all.

Section modulus—A term pertaining to the cross section of a flexural member; the section modulus with respect to either principal axis is the moment of inertia with respect to either principal axis is the moment of inertia with respect to that axis divided by the distance from that axis to the most remote point of the tension or compression area of the section, as required; the section modulus is used to determine the flexural stress in a beam.

Segmental member—A structural member made up of individual elements prestressed together to act as a monolithic unit under service loads.

Segregation—The differential concentration of the components of mixed concrete, aggregate, or the like, resulting in nonuniform proportions in the mass. (See also **Separation.**)

Self-desiccation—The removal of free water by chemical reaction so as to leave insufficient water to cover the solid surfaces and to cause a decrease in the relative humidity of the system; applied to an effect occurring in sealed concretes, mortars, and pastes.

Self-furring—Metal lath or welded wire fabric formed in the manufacturing process to include means by which the material is held away from the supporting surface, thus creating a space for "keying" of the insulating concrete, plaster, or stucco.

Self-furring nail—Nails with flat heads and a washer or a spacer on the shank; for fastening reinforcing wire mesh and spacing it from the nailing member.

Self-stressing concrete (mortar or grout)—Expansive-cement concrete (mortar or grout) in which expansion, if restrained, induces persistent compressive stresses in the concrete (mortar or grout); also known as chemically prestressed concrete.

Semiautomatic batcher—See **Batcher.**

Semiflexible joint—A connection in which the reinforcement is arranged to permit some rotation of the joint.

Separation—The tendency, as concrete is caused to pass from the unconfined ends of chutes or conveyor belts, or similar arrangements, for coarse aggregate to separate from the concrete and accumulate at one side; the tendency, as processed aggregate leaves the ends of conveyor belts, chutes, or similar devices with confining sides, for the larger aggregate to separate from the mass and accumulate at one side; or the tendency for the solids to separate from the water by gravitational settlement. (See also **Bleeding** and **Segregation.**)

Sequence-stressing loss—In post-tensioning, the elastic loss in a stressed tendon resulting from the shortening of the member when additional tendons are stressed.

Service dead load—The dead weight supported by a member.

Service live load—The live load specified by the general building code or bridge specification, or the actual nonpermanent load applied in service.

Service load—See **Service dead load** and **Service live load.**

Set—The condition reached by a cement paste, mortar, or concrete when it has lost plasticity to an arbitrary degree, usually measured in terms of resistance to penetration or deformation; initial set refers to first stiffening; final set refers to attainment of significant rigidity; also, strain remaining after removal of stress. (See **Permanent set.**)

Setting shrinkage—A reduction in volume of concrete prior to the final set of cement, caused by settling of the solids and by the decrease in volume due to the chemical combination of water with cement.

Setting time—See **Initial setting time** and **Final setting time.**

Settlement—Sinking of solid particles in grout, mortar, or fresh concrete, after placement and before initial set. (See also **Bleeding.**)

Settling—The lowering in elevation of sections of pavement or structures due to their mass, the loads imposed on them, or shrinkage or displacement of the support.

Shale—A laminated and fissile sedimentary rock, the constituent particles of which are principally in clay and silt sizes; the laminations bedding planes of rock.

Sharp sand—Coarse sand of which the particles are of angular shape.

She bolt—A type of form tie and spreader bolt in which the end fastenings are threaded into the end of the bolt, thus eliminating cones and reducing the size of holes left in the concrete surface.

Shear—An internal force tangential to the plane on which it acts. (See also **Shearing force.**)

Shearhead—Assembled unit in the top of the columns of flat slab or flat plate construction to transmit loads from slab to column.

Shear modulus—See **Modulus of rigidity.**

Shear reinforcement—Reinforcement designed to resist shear or diagonal tension stresses. (See **Dowel.**)

Shear strength—The maximum shearing stress which a material or structural member is capable of developing, based on the original area of cross section.

Shearwall—A wall portion of a structural frame intended to resist lateral forces, such as earthquake, wind and blast, acting in or parallel to the plane of the wall.

Shearing force—The algebraic sum of all the tangential forces acting on either side of the section at a particular location in a flexural member.

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Sheath—An enclosure in which post-tensioning tendons are encased to prevent bonding during concrete placement. (See **Duct.**)

Sheathing—The material forming the contact face of forms; also called lagging or sheeting.

Sheet pile—A pile in the form of a plank driven in close contact or interlocking with others to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials; may be tongued and grooved if made of timber or concrete and interlocking if made of metal.

Sheeting—See **Sheathing.**

Shelf angles—Structural angles with holes or slots in one leg for bolting to the structure to support brick work, stone, or terra cotta.

Shelf life—Maximum interval during which a material may be stored and remain in a usable condition.

Shell construction—Construction using thin curved slabs.

Shelly structure—See **Perlitic structure.**

Shielding concrete—Concrete, employed as a biological shield to attenuate or absorb nuclear radiation, usually characterized by high specific gravity or high hydrogen (water) content or boron content, having specific radiation attenuation effects. (See also **Biological shielding.**)

Shim—A strip of metal, wood, or other material employed to set base plates or structural members at the proper level for placement of grout, or to maintain the elongation in some types of post-tensioning anchorages.

Shiplap—A type of joint in lumber or precast concrete, made by using pieces having a portion of the width cut away on both edges, but on opposite sides, so as to make a flush joint with similar pieces.

Shock—See **Thermal shock.**

Shock load—Impact of material such as aggregate or concrete as it is released or dumpted during placement.

Shooting—Placing of shotcrete. (See also **Gunning.**)

Shore—A temporary support for formwork and fresh concrete or for recently built structures which have not developed full design strength; also called **Prop, Tom, Post, strut.** (See also **L-head and T-head.**)

Shore head—Wood or metal horizontal member placed on and fastened to vertical shoring member. (See also **Raker.**)

Shoring—Props or posts of timber or other material in compression used for the temporary support of excavations, formwork, or unsafe structures; the process of erecting shores.

Shoring, horizontal—Metal or wood load-carrying strut, beam, or trussed section used to carry a shoring load from one bearing point, column, frame, post, or wall to another; may be adjustable.

Shoring layout—A drawing prepared prior to erection showing arrangement of equipment for shoring.

Short column—See **Column, short.**

Shotcrete—Mortar or concrete pneumatically projected at high velocity onto a surface; also known as air-blown mortar; also pneumatically applied mortar or concrete, sprayed mortar and gunned concrete. (See also **Dry-mix shotcrete, Pneumatic feed, Positive displacement,** and **Wet-mix shotcrete.**)

Shoulder—An unintentional offset in a formed concrete surface usually caused by bulging or movement of formwork.

Shrink-mixed concrete—Ready-mixed concrete mixed partially in a stationary mixer and then mixed in a truck mixer. (See also **Preshrunk.**)

Shrinkage—Volume decrease caused by drying and chemical changes; a function of time but not of temperature or of stress due to external load. (See also **Contraction** and **Expansion.**)

Shrinkage, drying—See **Drying shrinkage** and **Shrinkage.**

Shrinkage-compensating—A characteristic of grout, mortar, or concrete made using an expansive cement in which volume increase if restrained, induces compressive stresses which are intended to approximately offset the tendency of drying shrinkage to induce tensile stresses. (See also **Expansive cement.**)

Shrinkage crack—Crack due to restraint of shrinkage.

Shrinkage cracking—Cracking of a structure or member due to failure in tension caused by external or internal restraints as reduction in moisture content develops, or as carbonation occurs, or both.

Shrinkage limit—The maximum water content at which a reduction in water content will not cause a decrease in volume of the soil mass. (See also **Atterberg limits.**)

Shrinkage loss—Reduction of stress in prestressing steel resulting from shrinkage of concrete.

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

Shuttering—See **Formwork.**

Sieve—A metallic plate or sheet, a woven wire cloth, or other similar device, with regularly spaced apertures of uniform size, mounted in a suitable frame or holder for use in separating material according to size; in mechanical analysis, an apparatus with square openings is a sieve, one with circular apertures is a screen.

Sieve analysis—Determination of the proportions of particles lying within certain size ranges in a granular material by separation on sieves of different size openings. (See also **Grading.**)

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

Sieve number—A number used to designate the size of a sieve, usually the approximate number of openings per linear inch; applied to sieves with openings smaller than 6.3 mm (¼ in.).

Sieve size—Nominal size of openings between cross wires of a testing sieve, usually.

Silica—Silicon dioxide (SiO_2).

Silica flour—Very finely divided silica, a siliceous binder component which reacts with lime under autoclave curing conditions; prepared by grinding silica, such as quartz, to a fine powder; also known as silica powder.

Silica powder—See **Silica flour.**

Silicate—Salt of a silicic acid.

Silicon carbide—An artificial product (SiC) granules of which may be embedded in concrete surfaces to increase resistance to wear or as a means of reducing skidding or slipping on stair treads or pavements; also used as an abrasive in saws and drills for cutting concrete and masonry.

Silicone—A resin, characterized by water-repellant properties, in which the main polymer chain consists of alternating silicon and oxygen atoms, with carbon-containing side groups; silicones may be used in caulking compounds, coatings compounds or admixtures for concrete.

Sill—See **Mud sill.**

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

Simple beam—A beam without restraint or continuity at its supports.

Single-sized aggregate—Aggregate in which a major portion of the particles are of sizes lying between narrow limits.

Single-stage curing—Autoclave curing process in which precast concrete products are put on metal pallets for autoclaving and remain there until stacked for delivery or yard storage.

Sintering—The formation of a porous mass of material by the agglomeration of fine particles by partial fusion.

Sintering grate—A grate on which material is sintered.

Skew back—Sloping surface against which the end of an arch rests, such as a concrete thrust block supporting thrust of an arch bridge. (See also **Chamfer strip.**)

Skid resistance—A measure of the frictional characteristics of a surface.

Slab—A flat, horizontal or nearly so, molded layer of plain or reinforced concrete, usually of uniform but sometimes of variable thickness, either on the ground or supported by beams, columns, walls, or other framework. (See also **Flat slab** and **Flat plate.**)

Slab bolster—See **Bolster, slab.**

Slab spacer—Bar support and spacer for slab reinforcement, similar to slab bolster but without corrugations in top wire, no longer in general use. (See also **Bolster, slab.**)

Slab strip—See **Middle strip.**

Slag—See **Blast-furnace slag.**

Slag cement—See **Cement, slag.**

Slate—A fine-grained metamorphic rock possessing a well-developed fissility (slaty cleavage) usually not parallel to the bedding planes of the rock.

Slender beam—A beam, which if loaded to failure without lateral bracing of the compression flange, would fail by buckling rather than in flexure.

Slenderness ratio—The ratio of effective length or height of a wall, column, or pier to the radius of gyration; used as a means of assessing the stability of the element.

Slick line—End section of a pipe line used in placing concrete by pump which is immersed in the placed concrete and moved as the work progresses.

Sliding form—See **Slipform.**

Slip—Movement occurring between steel reinforcement and concrete in stressed reinforced concrete indicating anchorage breakdown.

Slipform—A form which is pulled or raised as concrete is placed; may move in a generally horizontal direction to lay concrete evenly for highway paving or on slopes and inverts of canals, tunnels, and siphons; or vertically to form walls, bins, or silos.

Sloped footing—A footing having sloping top or side faces.

Sloughing—Subsidence of shotcrete, due generally to excessive water in mixture; also called sagging. (See also **Sagging.**)

Slugging—Pulsating and intermittent flow of shotcrete material due to improper use of delivery equipment and materials.

Slump—A measure of consistency of freshly mixed concrete, mortar, or stucco equal to the subsidence measured to the nearest ¼ in. (6 mm) of the molded specimen immediately after removal of the slump cone.

Slump cone—A mold in the form of the lateral surface of the frustum of a cone with a base diameter of 8 in. (203 mm), top diameter 4 in. (102 mm), and height 12 in. (305 mm), used to fabricate a specimen of freshly mixed concrete for the slump test; a cone 6 in. (152 mm) high is used for tests of freshly mixed mortar and stucco.

Slump loss—The amount by which the slump of freshly mixed concrete changes during a period of time after an initial slump test was made on a sample or samples thereof.

Slump test—The procedure for measuring slump.

Slurry—A mixture of water and any finely divided insoluble material, such as portland cement, slag, or clay in suspension.

Slush grouting—Distribution of a grout with or without fine aggregate as required over a rock or concrete surface which is subsequently to be covered with concrete, usually by brooming it into place to fill surface voids and fissures.

Snap tie—A proprietary concrete wall-form tie, the end of which can be twisted or snapped off after the forms have been removed.

Soaking period—In high-pressure and low-pressure steam curing, the time during which the live steam supply to the kiln or autoclave is shut off and the concrete products are exposed to the residual heat and moisture.

Soffit—The underside of a part or member of a structure, such as a beam, stairway, or arch.

Soft particle—An aggregate particle possessing less than an established degree of hardness or strength as determined by a specific testing procedure.

Soil—A generic term for unconsolidated natural surface material above bedrock.

Soil pressure—See **Contact pressure.**

Soldier—A vertical wale used to strengthen or align formwork or excavations.

Solid panel—A solid slab, usually of constant thickness.

Solid volume—See **Absolute volume.**

Solution—A liquid consisting of at least two substances, one of which is a liquid solvent in which the other or others, which may be solid or liquid, are dissolved.

Solvent—A liquid in which another substance may be dissolved.

Sonic modulus—See **Dynamic modulus of elasticity.**

Sounding well—A vertical conduit in the mass of coarse aggregate for preplaced aggregate concrete, provided with continuous or closely spaced openings to permit entrance of grout; the grout level is determined by means of a float on a measured line.

Soundness—The freedom of a solid from cracks, flaws, fissures, or variations from an accepted standard; in the case of a cement, freedom from excessive volume change after setting; in the case of aggregate, the ability to withstand the aggressive action to which concrete containing it might be exposed, particularly that due to weather.

Spacer—Device which maintains reinforcement in proper position, or wall forms at a given distance apart before and during concreting. (See also **Spreader.**)

Spacing factor—An index related to the maximum distance of any point in a cement paste or in the cement paste fraction of mortar or concrete from the periphery of

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Spa

an air void; also known as Powers spacing factor. (See also **Philleo factor.**)

Spading—Consolidation of mortar or concrete by repeated insertion and withdrawal of a flat, spadelike tool.

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; a small spall involves a roughly circular depression not greater than 20 mm in depth nor 150 mm in any dimension; a large spall may be roughly circular or oval or, in some cases elongated, more than 20 mm in depth and 150 mm in greatest dimension.

Spalling—The development of spalls.

Span—The distance between supports of a member.

Span length—See **Effective span.**

Spandrel—That part of a wall between the head of a window and the sill of the window above it.

Spandrel beam—A beam in the perimeter of a building, spanning between columns and usually supporting floors or roof.

Spatterdash—A rich mixture of portland cement and coarse sand; it is thrown onto a background by a trowel, scoop, or other appliance so as to form a thin, coarse-textured, continuous coating; as a preliminary treatment before rendering, it assists bond of the undercoat to the background, improves resistance to rain penetration, and evens out the suction of variable backgrounds. (See also **Parge** and **Dash-bond coat.**)

Specific gravity—The ratio of the mass of a unit volume of a material at a stated temperature to the mass of the same volume of gas-free distilled water at a stated temperature.

1. **Apparent specific gravity**—The ratio of the mass in air of a unit volume of a material at a stated temperature to the mass in air of equal density of an equal volume of gas-free distilled water at a stated temperature. If the material is a solid, the volume is that of the impermeable portion.

2. **Bulk specific gravity**—The ratio of the mass in air of a unit volume of a permeable material (including both permeable and impermeable voids normal to the material) at a stated temperature to the mass in air of equal density of an equal volume of gas-free distilled water at a stated temperature.

3. **Bulk (saturated-surface-dry basis) specific gravity**—Same as bulk specific gravity except that the mass includes the water in the permeable voids.

See also **Absolute specific gravity.**

Specific gravity factor—The ratio of the weight of aggregates (including all moisture), as introduced into the mixer, to the effective volume displaced by the aggregates.

Specific heat—The amount of heat required per unit mass to cause a unit rise of temperature, over a small range of temperature.

Specific surface—The surface area of particles or of air voids contained in a unit weight or unit volume of a material; in the case of air voids in hardened concrete, the surface area of the air void volume expressed as square inches per cubic inch or square millimeters per cubic millimeter.

Spectrophotometer—Instrument for measuring intensity of radiant energy of desired frequencies absorbed by atoms of molecules; substances are analyzed by converting the absorbed energy to electrical signals, proportional to the intensity of radiation. (See also **Infrared spectroscopy** and **Flame photometer.**)

Spinning—The essential element of the process of producing spun concrete. (See also **Spun concrete.**)

Spiral reinforcement—Continuously wound reinforcement in the form of a cylindrical helix.

Spirally reinforced column—A column in which the vertical bars are enveloped by spiral reinforcement; i.e., closely spaced continuous hooping.

Splice—Connection of one reinforcing bar to another by lapping, welding, mechanical couplers, or other means; connection of welded wire fabric by lapping; connection of piles by mechanical couplers.

Split batch charging—Method of charging a mixer in which the solid ingredients do not all enter the mixer together; cement, and sometimes different sizes of aggregate, may be added separately.

Split block—See **Split-face block.**

Split-face block—Concrete masonry unit with one or more faces produced by purposeful fracturing of the unit, to provide architectural effects in masonry wall construction.

Splitting tensile strength—Tensile strength of concrete determined by a splitting tensile test.

Splitting tensile test (diametral compression test)—A test for tensile strength in which a cylindrical specimen is loaded to failure in diametral compression applied along the entire length.

Spray drying—A method of evaporating the liquid from a solution by spraying it into a heated gas.

Sprayed mortar—See **Shotcrete.**

Spread footing—A generally rectangular prism of concrete larger in lateral dimensions than the column or wall it supports, to distribute the load of a column or wall to the subgrade.

Spreader—A piece of lumber, usually about 1 x 2 in. (25 x 50 mm), cut to thickness of wall or other form and inserted to hold it temporarily at the correct dimension against tension of form ties; wires are usually attached to spreaders so they can be pulled up out of the forms as the pressure of concrete permits their removal; also a device consisting of reciprocating paddles, a revolving screw, or other mechanism for distributing concrete to required uniform thickness in a paving slab.

Spud vibrator—A vibrator used for consolidating concrete, having a vibrating casing or head, that is used by insertion into freshly placed concrete.

Spun concrete—Concrete compacted by centrifugal action, e.g., in the manufacture of pipes.

Stabilizer—A substance which makes a solution or suspension more stable, usually by keeping particles from precipitating.

Stage grouting—Sequential grouting of a hole in separate steps or stages in lieu of grouting the entire length at once.

Stalactite—A downward pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping water from the surface of rock or of concrete, commonly shaped like an icicle. (See also **Stalagmite.**)

Stalagmite—An upward pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping water, projecting from the surface of rock or concrete, commonly conical in shape. (See also **Stalactite.**)

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