
Certificate in Civil Structural Engineering (Portugal)

Concrete Structures

AASHTO: American Association of State Highway and Transportation Officials, an organization that sets standards for highway construction, including concrete structures, in the United States, related terms include ASTM, ACI, and transportation engineering.

Abrasion: The process of wearing away a concrete surface due to friction or impact, often caused by traffic or environmental factors, related terms include erosion, corrosion, and durability.

Acceleration: The rate of change of velocity of an object, important in concrete structures subject to seismic or dynamic loads, related terms include velocity, displacement, and earthquake engineering.

ACI: American Concrete Institute, a professional organization that develops standards and guidelines for concrete construction, including the building code, related terms include AASHTO, ASTM, and civil engineering.

Admixture: A chemical substance added to concrete to improve its workability or durability, related terms include additive, mixture, and concrete technology.

Aggregate: A mixture of sand, gravel, and crushed stone used as the primary component of concrete, related terms include cement, water, and concrete mix design.

Air-entraining admixture: A type of admixture that introduces air bubbles into the concrete to improve its workability and resistance to freeze-thaw cycles, related terms include air content, air void, and durability.

Allowable stress: The maximum stress that a material or structure can withstand without failing, related terms include ultimate stress, yield stress, and strength of materials.

Aluminum sulfate: A chemical compound used as a set accelerator or retarding admixture in concrete, related terms include calcium chloride, sodium nitrite, and admixtures.

Anchorage: A system of fasteners or ties that secure a structure to its foundation or adjacent structures, related terms include anchor, tie, and connection details.

Arch: A curved structure that spans an opening, often used in bridge construction, related terms include vault, dome, and structural systems.

Asbestos: A group of mineral fibers that were once commonly used in building materials, including concrete, but are now known to be hazardous to health, related terms include hazardous materials, health risks, and safety protocols.

ASTM: American Society for Testing and Materials, an organization that develops standards for testing and materials science, related terms include AASHTO, ACI, and standards development.

Axial load: A force that acts along the longitudinal axis of a structural member, related terms include compressive load, tensile load, and structural analysis.

Bearing capacity: The maximum load that a foundation or soil can support without failing, related terms include settlement, stability, and geotechnical engineering.

Beam: A horizontal or sloping structural member that resists loads from any direction, related terms include

girder, joist, and frame structures.

Bending moment: A measure of the force that causes a beam or other structural member to bend, related terms include shear force, torsion, and structural analysis.

Blowout: A type of failure that occurs when a concrete structure is subjected to excessive pressure or explosive forces, related terms include explosion, implosion, and safety risks.

Bond: The adhesion between two materials, such as concrete and steel, related terms include bond strength, bond stress, and interface mechanics.

Box girder: A type of girder that consists of two parallel beams connected by a web, related terms include plate girder, beam, and bridge construction.

Bracing: A system of members that provide lateral support to a structure, related terms include diagonal, strut, and stability systems.

Bridge: A structure that spans a physical obstacle, such as a river or valley, related terms include viaduct, overpass, and transportation infrastructure.

Brittleness: The tendency of a material to fail suddenly and without deformation, related terms include ductility, toughness, and material properties.

BS 8110: A British Standard for the design and construction of concrete structures, related terms include Eurocode, ACI, and building codes.

Building code: A set of regulations that govern the design and construction of buildings, related terms include zoning ordinance, safety standards, and compliance.

Caisson: A type of foundation that consists of a watertight chamber or box that is sunk into the ground, related terms include cofferdam, shaft, and deep foundation.

Cantilever: A structural member that is supported at one end and projects into space, related terms include beam, slab, and frame structures.

Carbonation: A chemical reaction that occurs when carbon dioxide from the air reacts with the calcium in concrete, related terms include corrosion, degradation, and durability.

Cathodic protection: A method of protecting metal from corrosion by applying an electric current, related terms include anode, cathode, and electrochemistry.

Cement: A binding agent that holds the aggregate particles together in concrete, related terms include concrete, mortar, and construction materials.

Centrifugal force: A force that acts on a rotating object, such as a rotating beam or structure, related terms include inertia, momentum, and dynamic analysis.

Chemical attack: A type of degradation that occurs when concrete is exposed to aggressive chemicals, related terms include corrosion, erosion, and durability.

Chloride: A type of ion that can penetrate concrete and cause corrosion of the reinforcement, related terms include sulfate, nitrite, and admixtures.

Civil engineering: The discipline that deals with the design, construction, and maintenance of infrastructure, related terms include structural engineering, transportation engineering, and urban planning.

Coefficient of thermal expansion: A measure of how much a material expands or contracts with temperature changes, related terms include thermal conductivity, thermal resistance, and material properties.

Cold joint: A type of joint that occurs when two concrete pours are made at different times, related terms include construction joint, expansion joint, and concrete placement.

Column: A vertical structural member that resists compressive loads, related terms include pier, post, and frame structures.

Composite beam: A type of beam that consists of two or more materials with different properties, related terms include composite material, composite structure, and structural analysis.

Compression: A type of stress that occurs when a material is subjected to a compressive force, related terms include tension, shear, and material properties.

Concrete: A composite material made from cement, water, and aggregate, related terms include mortar, grout, and construction materials.

Concrete cancer: A type of degradation that occurs when concrete is exposed to aggressive environments, related terms include corrosion, erosion, and durability.

Concrete mix design: The process of selecting the optimal combination of cement, water, and aggregate for a particular concrete application, related terms include concrete mixture, concrete proportioning, and construction materials.

Connection: A joint or interface between two or more structural members, related terms include fastener, anchor, and structural analysis.

Construction joint: A type of joint that is intentionally created during concrete placement, related terms include cold joint, expansion joint, and concrete placement.

Continuity: The condition of being continuous or unbroken, related terms include discontinuity, joint, and structural analysis.

Corrosion: A type of degradation that occurs when a material is exposed to a corrosive environment, related terms include rust, decay, and durability.

Coupling beam: A type of beam that connects two or more structural members, related terms include link beam, connector, and frame structures.

Cover: The distance between the surface of the concrete and the reinforcement, related terms include concrete cover, reinforcement cover, and durability.

Crack: A fracture or split in a material, related terms include crack width, crack spacing, and structural analysis.

Creep: A type of deformation that occurs over time, related terms include shrinkage, relaxation, and material properties.

Curing: The process of maintaining a controlled environment to promote the hydration of concrete, related terms include curing time, curing temperature, and concrete placement.

Damping: The process of reducing the amplitude of vibrations or oscillations, related terms include damping ratio, damping coefficient, and dynamic analysis.

Dead load: The weight of a structure, including its permanent components, related terms include live load, imposed load, and structural analysis.

Deformation: A change in the shape or size of a material or structure, related terms include strain, displacement, and material properties.

Degradation: A type of damage or deterioration that occurs over time, related terms include corrosion, erosion, and durability.

Density: A measure of the mass per unit volume of a material, related terms include unit weight, specific gravity, and material properties.

Design load: The maximum load that a structure is expected to carry, related terms include ultimate load, service load, and structural analysis.

Detailing: The process of creating detailed drawings or specifications for a structure, related terms include drafting, drawing, and construction documents.

Deterioration: A type of degradation that occurs over time, related terms include corrosion, erosion, and durability.

Diaphragm: A type of structural element that resists lateral loads, related terms include shear wall, bracing, and frame structures.

Displacement: A change in the position of a material or structure, related terms include deformation, strain, and material properties.

Ductility: The ability of a material to deform without breaking, related terms include toughness, brittleness, and material properties.

Durability: The ability of a material or structure to resist degradation or damage over time, related terms include degradation, deterioration, and concrete technology.

Dynamic analysis: A type of analysis that takes into account the time-dependent behavior of a structure, related terms include static analysis, seismic analysis, and structural dynamics.

Earthquake engineering: The discipline that deals with the design and analysis of structures to resist seismic loads, related terms include seismic design, earthquake resistant design, and structural engineering.

Elasticity: The ability of a material to return to its original shape after being deformed, related terms include plasticity, viscoelasticity, and material properties.

Embedment: The process of embedding a material or object into another material, related terms include anchorage, connection, and structural analysis.

Epoxy: A type of adhesive or coating used to bond materials together, related terms include resin, hardener, and composite materials.

Expansion joint: A type of joint that allows for thermal or structural movement, related terms include construction joint, cold joint, and concrete placement.

Fatigue: A type of failure that occurs when a material is subjected to cyclic or repetitive loads, related terms include fatigue life, fatigue strength, and material properties.

Fiber: A type of reinforcement used in concrete, related terms include fiber concrete, fiber reinforced polymer, and composite materials.

Fiber-reinforced polymer: A type of composite material made from fibers and a polymer matrix, related terms include fiber concrete, reinforced polymer, and structural analysis.

Flexural strength: A measure of the strength of a material in flexure or bending, related terms include compressive strength, tensile strength, and material properties.

Flexure: A type of bending or curvature of a material or structure, related terms include bending moment,

shear force, and structural analysis.

Fluidity: The ability of a material to flow or deform under stress, related terms include viscosity, rheology, and material properties.

Foundation: The base or support of a structure, related terms include footing, pier, and geotechnical engineering.

Frame: A type of structural system that consists of connected members, related terms include beam, column, and structural analysis.

Freeze-thaw cycle: A type of environmental condition that can cause degradation of concrete, related terms include frost, ice, and durability.

Friction: A type of force that opposes motion or sliding between two surfaces, related terms include friction coefficient, friction factor, and material properties.

Girder: A type of beam that is supported at both ends, related terms include beam, joist, and frame structures.

Grout: A type of material used to fill gaps or voids in concrete, related terms include mortar, concrete, and construction materials.

Hardness: A measure of the resistance of a material to indentation or abrasion, related terms include hardness test, hardness scale, and material properties.

Hydration: A chemical reaction that occurs when cement is mixed with water, related terms include hydration reaction, hydration products, and concrete technology.

Impact: A type of load that occurs when a structure is subjected to a sudden or dynamic force, related terms include impact load, impact resistance, and structural analysis.

Impregnation: The process of treating a material with a chemical or coating, related terms include coating, sealing, and surface treatment.

Inertia: The resistance of an object to changes in its motion, related terms include mass, velocity, and dynamic analysis.

Inspection: The process of examining a structure or material to evaluate its condition, related terms include testing, evaluation, and quality control.

Interface: The boundary or surface between two materials or structures, related terms include bond, connection, and structural analysis.

Isotropic: A type of material that has the same properties in all directions, related terms include anisotropic, orthotropic, and material properties.

Joint: A separation or interface between two materials or structures, related terms include construction joint, expansion joint, and concrete placement.

Lateral load: A type of load that acts perpendicular to the longitudinal axis of a structure, related terms include wind load, seismic load, and structural analysis.

Limit state: A condition in which a structure or material fails to meet its design requirements, related terms include ultimate limit state, serviceability limit state, and structural analysis.

Load: A force or pressure that is applied to a structure or material, related terms include dead load, live load, and structural analysis.

Load factor: A multiplier that is used to increase the load on a structure to account for uncertainty, related terms include load combination, load case, and structural analysis.

Maintenance: The process of preserving or repairing a structure or material, related terms include repair, rehabilitation, and asset management.

Masonry: A type of construction that uses stone, brick, or block to build structures, related terms include masonry wall, masonry column, and building construction.

Material properties: The characteristics of a material that affect its behavior, related terms include strength, stiffness, and material science.

Mechanics: The science that deals with the behavior of objects under forces or loads, related terms include statics, dynamics, and structural analysis.

Microcrack: A small crack or fracture in a material, related terms include macrocrack, crack width, and material properties.

Mix design: The process of selecting the optimal combination of cement, water, and aggregate for a particular concrete application, related terms include concrete mixture, concrete proportioning, and construction materials.

Modeling: The process of representing a structure or material using mathematical or computational methods, related terms include simulation, analysis, and structural analysis.

Modulus of elasticity: A measure of the stiffness of a material, related terms include Young's modulus, modulus of rigidity, and material properties.

Mortar: A type of material used to bind masonry units together, related terms include cement, sand, and construction materials.

Movement joint: A type of joint that allows for thermal or structural movement, related terms include expansion joint, construction joint, and concrete placement.

Natural frequency: The frequency at which a structure or material vibrates naturally, related terms include resonance, vibration, and dynamic analysis.

Non-destructive testing: A type of testing that does not damage the material or structure, related terms include ultrasonic testing, acoustic emission testing, and quality control.

Normal weight concrete: A type of concrete that has a density similar to that of normal weight materials, related terms include lightweight concrete, heavyweight concrete, and concrete technology.

Orthotropic: A type of material that has different properties in different directions, related terms include isotropic, anisotropic, and material properties.

Pavement: A type of structure that is designed to support traffic or loads, related terms include road, highway, and transportation infrastructure.

Permeability: A measure of the ability of a material to allow fluids to pass through, related terms include porosity, absorption, and material properties.

Pile: A type of deep foundation that is used to transfer loads to the ground, related terms include pier, caisson, and geotechnical engineering.

Plasticity: The ability of a material to deform without breaking, related terms include ductility, brittleness, and material properties.

Poisson's ratio: A measure of the lateral strain of a material, related terms include modulus of elasticity, shear modulus, and material properties.

Pore: A small cavity or void in a material, related terms include porosity, permeability, and material properties.

Porosity: A measure of the volume of pores or voids in a material, related terms include permeability, absorption, and material properties.

Post-tensioning: A type of technique used to apply compressive forces to a structure, related terms include pre-tensioning, tensioning, and concrete construction.

Precast concrete: A type of concrete that is cast in a factory or plant, related terms include cast-in-place concrete, pre-stressed concrete, and construction materials.

Pre-stressed concrete: A type of concrete that is stressed before being loaded, related terms include post-tensioning, pre-tensioning, and concrete construction.

Prestress: A type of force that is applied to a structure to improve its behavior, related terms include pre-stressed concrete, post-tensioning, and concrete construction.

Quality control: The process of ensuring that a material or structure meets its design requirements, related terms include inspection, testing, and certification.

Rebar: A type of reinforcement used in concrete, related terms include reinforcement, reinforcing steel, and concrete construction.

Reinforcement: A type of material used to strengthen or reinforce concrete, related terms include rebar, fiber, and composite materials.

Relaxation: A type of deformation that occurs over time, related terms include creep, shrinkage, and material properties.

Repair: The process of fixing or restoring a damaged structure or material, related terms include rehabilitation, maintenance, and asset management.

Resilience: The ability of a material or structure to absorb energy or impact without failing, related terms include toughness, ductility, and material properties.

Resonance: A type of phenomenon that occurs when a structure or material vibrates at its natural frequency, related terms include natural frequency, vibration, and dynamic analysis.

Restraint: A type of condition that limits the movement or deformation of a structure or material, related terms include support, fixity, and structural analysis.

Retarder: A type of chemical that is used to slow down the hydration reaction of concrete, related terms include accelerator, admixture, and concrete technology.

Rheology: The science that deals with the behavior of fluids or materials under stress or strain, related terms include viscosity, fluidity, and material properties.

Rib: A type of structural element that is used to strengthen or reinforce a material or structure, related terms include beam, girder, and frame structures.

Rigid body: A type of object that does not deform under stress or strain, related terms include flexibility, stiffness, and material properties.

Rigid frame: A type of structural system that is stiff and resistant to deformation, related terms include

flexible frame, beam, and frame structures.

Robustness: The ability of a material or structure to resist damage or failure under uncertain or unexpected conditions, related terms include resilience, redundancy, and structural analysis.

Sealant: A type of material used to seal or fill gaps or voids in a structure or material, related terms include caulk, adhesive, and surface treatment.

Seismic design: A type of design that takes into account the seismic loads or forces that a structure may be subjected to, related terms include earthquake engineering, seismic analysis, and structural analysis.

Self-consolidating concrete: A type of concrete that can flow and consolidate without the need for vibration or mechanical compaction, related terms include self-compacting concrete, flowing concrete, and concrete technology.

Sensitivity analysis: A type of analysis that is used to evaluate the effect of uncertainty or variability on a structure or material, related terms include probabilistic analysis, reliability analysis, and structural analysis.

Service load: The load that a structure is expected to carry under normal operating conditions, related terms include dead load, live load, and structural analysis.

Set: The process of hardening or solidifying of concrete, related terms include setting time, setting temperature, and concrete technology.

Setting time: The time it takes for concrete to set or harden, related terms include setting temperature, curing time, and concrete technology.

Shear: A type of force that causes a material or structure to deform by sliding or rotating, related terms include shear stress, shear strain, and material properties.

Shear wall: A type of structural element that is used to resist lateral loads, related terms include diaphragm, bracing, and frame structures.

Shrinkage: A type of deformation that occurs when a material contracts or shrinks, related terms include creep, relaxation, and material properties.

Silica fume: A type of admixture that is used to improve the strength and durability of concrete, related terms include fly ash, slag, and concrete technology.

Slab: A type of structural element that is used to support loads or weight, related terms include beam, girder, and frame structures.

Slip: A type of failure that occurs when a material or structure slides or moves relative to another material or structure, related terms include bond, anchorage, and structural analysis.

Slump: A measure of the workability of concrete, related terms include slump test, slump cone, and concrete technology.

Sodium nitrite: A type of admixture that is used to improve the durability of concrete, related terms include calcium chloride, aluminum sulfate, and concrete technology.

Soil-structure interaction: The behavior of a structure and the soil it is founded on, related terms include foundation, geotechnical engineering, and structural analysis.

Spalling: A type of failure that occurs when a material or structure breaks or fractures due to impact or overload, related terms include impact, explosion, and safety risks.

Stability: The ability of a material or structure to resist collapse or failure under loads or forces, related terms

include stability analysis, stability criteria, and structural analysis.

Static analysis: A type of analysis that takes into account the time-independent behavior of a structure or material, related terms include dynamic analysis, seismic analysis, and structural analysis.

Steel reinforcement: A type of reinforcement used in concrete, related terms include rebar, fiber, and composite materials.

Stiffness: A measure of the resistance of a material or structure to deformation or bending, related terms include modulus of elasticity, flexibility, and material properties.

Strain: A measure of the deformation of a material or structure, related terms include stress, deformation, and material properties.

Strength: A measure of the ability of a material or structure to