

## Students' Reinforced Concrete Thesaurus

(with due reverence to Mr Roget)

This paper is meant to give an introduction to the common terms used in reinforced concrete construction. It should not be regarded as definitive, but a starting reference for students and laymen to delve deeper in their quest for knowledge.

All suggestions as to how to improve this paper for future readers will be gratefully accepted.

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Term	Definition
$A_{st} \cdot f_{sy}$	Product of reinforcing steel area ( $A_{st}$ ), $\text{mm}^2$ and reinforcement yield stress ( $f_{sy}$ ), MPa - gives force that can be taken by a piece of reinforcement - so a smaller area bar of higher strength will have a similar capacity to that of a larger diameter, lower strength bar - units generally kilo Newtons (kN)
Autoclaved Aerated Concrete (AAC)	Very light weight concrete, also called Hebel Blocks after Australia's now only manufacturer, CSR Hebel. Main product is blocks for residential construction (not reinforced) but also produce wide beams (only lightly reinforced if at all) - growing market for these in sound barriers for highways where CSR market the system complete with Universal Column posts.
Band Beam	Wide beam, significantly wider than deep, generally about 1200 to 2400 wide, used in high rise to minimise structural depth. Generally post tensioned rather than reinforced
Beam	Horizontal member in a building structure
Bending Moment	The algebraic sum of the moments of the external forces acting on one side of a beam section about an axis through that section.
Bond Strength	Refers to ability (or lack of) of reinforcement to anchor into concrete - critical in reinforced concrete design - deformed reinforcement has about twice the bond capacity of plain bars
Centre Heave	Generally refers to deformation of a housing slab caused by the contraction of the expansive (clay) soils around the edge of a house - generally caused by drying out of the soils around house edge - opposite would be edge heave.
Column	Generally vertical member in a building structure
Compression	If directly opposing collinear forces are acting on a body, then the body is considered to be in a state of compression
Compression Member	A structural member which has predominantly compression forces acting on it.
Cover	Clear distance from concrete surface to closest bar - not just to main bars but to closest bar which is generally a stirrup or a tie - lack of cover major cause of reinforcement corrosion in concrete.

Creep	Property of concrete (dependant upon its constituents) where a concrete element will shorten during its life - very important in prestressed/post tensioned concrete design as element can loose a significant portion of its prestress - related to shrinkage and additives
Deflection	Sag of generally a slab or beam away from the horizontal - code limited with respect to usage of beam or slab.
Design Load	The combination of factored loads which the structural element will be designed to adequately support.
Detailing	Process whereby an engineer's sketch is transformed into an engineering drawing - generally performed by a draftsman - this is then used by the reinforcing scheduler.
Ductility (Reinforcement)	See Uniform Elongation
Ductility (Structure)	Ability of a structure to undergo large plastic deformations (generally rotations), and generally at a joint, under ultimate load conditions - relevant to moment redistribution and especially important for seismic design of structures.
Edge Beam	Generally the beam around the edge of something !! - normally refers to beam around edge of a house, generally cast integrally with slab on ground.
Edge Heave	Generally refers to deformation of a housing slab caused by swelling of the expansive (clay) soils around the edge of a house - generally caused by excessive moisture around house edge - opposite would be centre heave
Edge Rebate	Notch cast in corner of beam - common in edge beam footing of brick veneer house to allow for brickwork to start below level of timber framing - done for aesthetic and waterproofing reasons.
Elastic Design	Design of structural elements whereby the stresses assumed in the design will remain within the linear range limits of the stress/strain characteristics of the material to be used.
Embedment	The length of reinforcement which is assumed to provide a bond to the surrounding concrete.
Finite Element Analysis	A form of analysis where structure is represented by a system of elements connected together by nodes - generally applied to statically indeterminate structures and due to the large number of items, is almost always nowadays analysed by computer.
Flexural Strength	The bending strength of a material which is normally measured using a beam test.
In Situ	In the actual position at the job site.
Lapping of Mesh	The over-lapping of two adjacent sheets of mesh which is necessary in order to achieve a continuity of the reinforcement.
Ligatures	General term for stirrups or ties - term more used in reinforcing manufacture than in design
Light Weight Concrete	Density of less than 1800 kg/m <sup>2</sup> - outside scope of AS 3600 - generally not used structurally (some use polystyrene beads to attain lightness) - one usage is in toppings for floors and roofs.
Lintel	Beam type element generally supporting masonry over an opening - can be concrete but more often than not is a steel angle.

Load Factor	Factor by which design load is increased to ultimate load for ultimate design purposes.
Modulus of Elasticity	Slope of elastic portion of stress/strain curve (same as Young's Modulus) - Symbol generally E
Moment Redistribution	Reduction in negative bending moment (and corresponding numerical increase in positive bending moment) to allow for the plastic behaviour of a building element at the ultimate load condition. Magnitude of amount of redistribution depends on the ductility of the structure which in turn depends amongst other things, upon amount and (from July 96) type of reinforcement.
Negative Bending Moment	A bending moment, where the forces tend to bend the beam so that it assumes a shape which is convex upwards, is deemed to be negative by convention.
Negative Moment Region	Area of negative bending moment in a bending moment diagram - can extend from a support to around 20% of the span.
Negative Reinforcement	Reinforcement in the negative bending moment region of a building element (beam, column, slab, etc)
Normal Weight Concrete	AS3600 covers concrete in the range 1800 to 2800 kg/m <sup>2</sup> - these are also referred to as structural concretes. Concrete density is usually assumed to be 2400 kg/m <sup>2</sup>
Perimeter Edge Footing	Edge beam around outside edge of house - may or may not be cast integrally with slab.
Piles	Elements used to support a structure in poor soil/foundation conditions - based on the pile bearing on a good stratum at some distance below the structure to be supported - typically are steel, precast or cast in situ concrete - steel and precast used for long lengths and would be generally end bearing piles onto rock - cast in situ used for shorter length, and combination of end bearing onto a soil plus skin friction on the surrounding soil.
Positive Bending Moment	A bending moment, where the forces tend to bend the beam so that it assumes a shape which is concave upwards, is deemed to be positive by convention.
Positive Reinforcement	Reinforcement in the positive bending moment region of a building element (beam, column, slab, etc). In a simply supported beam or slab, it refers to the bottom reinforcement
Post Tensioned Concrete	Concrete element where the concrete is poured with hollow tubes where strand or bar is placed at a later time and then stressed - extensively used in bridges, now being used in high rise beams and slabs - strand has the ability to be "draped" (held towards the top of a beam at the ends and towards the bottom of the beam at the mid span) so as to induce an uplift force in the beam - strand more suitable than bar where long lengths are required.
Precast	Concrete element that is cast off site and then delivered to site - prestressed and post tensioned beams for bridge constructions are popular forms of this in Australia as are factory walling panels ("tilt up"). Precast beams and columns for buildings are the norm in NZ.

Prestressed Concrete	Generic term for any beam, slab or column containing stressed wire or bars - but correctly speaking refers to a concrete element cast around previously placed and stressed wire - just on all prestressed concrete is precast but not vice versa - main examples would be hollow core, bridge planks - wire is stressed in long lengths, concrete poured, cured and set then wires relaxed - long beams cut to required lengths - not to be confused with post tensioned concrete.
Raft	Usually applied to slabs where the whole area of the slab is considered to act as a "raft" slab which relies on the underlying ground for support.
Reinforcement Surface Condition	The state of the surface on the exterior of reinforcing bars - note: hot rolled bars normally have a thin layer of mill scale on the surface. Rusting on the surface of reinforcement is not considered to be deleterious to the bond of the steel to the concrete.
Shear Reinforcement	The reinforcement which caters for shear forces in the member.
Shrinkage	Property of concrete where strains are induced into the element by the drying of the concrete - related to creep and additive
Slipform	Form of construction used for building service cores, towers, etc - involves formwork moving continuously as concrete and reinforcement is placed.
Slump	Simple on-site measure of consistency (and maybe workability) of concrete in the as-mixed fluid state - involves a standard test using a metal cone.
Spacing of Reinforcement	The distance between adjacent reinforcing bars
Stack Cast	Flat slabs which are cast alternately, one on top of the other.
Starter Bars	Short reinforcing bars which are cast in at a joint to provide continuity of strength and shear transfer across the joint.
Statically Indeterminate Structure	A structure that cannot be analysed by the simple laws of statics - a multi span beam or a truss with too many members in it are examples of this.
Stiffness	Correctly speaking, it is a function of $EI/L$ - Young's Modulus times the Moment of Inertia of the section divided by the length of the element.
Stirrups	Same as ligatures - generally provided in a beam as shear reinforcement (there by engineering design) or there as an aid to hold the main reinforcement in the correct place.
Strain	Ratio of elongation to original length of a tensile test specimen - there are no units to strain
Strength	Term for force, not to be confused with stress
Stress	Force in an element or member divided by the area of that element or member - Units MPa or kPa
Strip Footing	Beam around the perimeter of a house, generally supporting a continuous line of masonry - generally not connected to the floor slab.
Tensile Development Length	A particular term in AS3600 referring to the length of embedment of a piece of reinforcement into concrete required to develop the yield stress of the reinforcement - related to bond stress (or strength)

Tensile Strength	Generally a corrupt term for Tensile Stress but may also refer to the strength (force capacity) of a member
Ties	Used in columns to prevent main column reinforcement from buckling - generally at closer spacing than stirrups in beams - important to ensure ends of ties are adequately anchored
Tilt Up	Process of casting flat wall slabs on the concrete floor on site and then lifting and securing in place using a mobile crane.
Torsion	Force applied to a building element (beam, column, etc) which induces twisting in the element - can be caused by off centre loading - semicircular beams also have this problem - reinforced by stirrups in the case of beams.
Total Elongation	Elongation of tensile test specimen at fracture - generally measured as elongation over a gauge length of 5 diameters in the case of reinforcement.
Ultimate Strength Design	Design based on factoring loads and therefore action effects on a structure and comparing these with the ultimate strength of the structure - most present design codes are based on Ultimate <u>Strength</u> Design - previous codes based on Working <u>Stress</u> Design
Uniform Elongation	Elongation of tensile test specimen up to the point where stress/strain curve starts to turn down (at the point of maximum load) - symbolised as Agt or Eu
Yield Strength	Corrupt term for Yield Stress
Yield Stress	Point at which stress/strain curve deviates from elastic slope.
Young's Modulus	Slope of elastic portion of stress/strain curve (same as Modulus of Elasticity) - Symbol generally E