**Glossary**
*Fundamental Terminology of Structural Behavior*

**A**

**Acceleration**: A [vector](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#vector) quantity equal to the rate that [velocity](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#velocity) changes with time.

**Axial force**: A [system of internal forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#system_of_forces) whose [resultant](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#resultant) is a force acting along the longitudinal axis of a structural member or assembly.

**B**

**Bending moment**: A [system of internal forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#system_of_forces) whose [resultant](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#resultant) is to bend a member. This term is most commonly used to refer to internal forces in beams.

**Body force**: An [external force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#external_force) acting consistently throughout the [mass](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#mass) of a body. [Gravity](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#gravity) is a body force.

**Brittle**: A brittle structure or material exhibits low [ductility](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#ductility), meaning that it exhibits very little inelastic deformation before complete failure. In other words, it is stiff until it breaks.

**C**

**Concentrated force**: A [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) considered to act along a single line in space. Concentrated forces are useful mathematical idealizations, but cannot be found in the real world, where all forces are either [body forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#body_force) acting over a volume or [surface forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#surface_force) acting over an area.

**Concentrated load**: An [external force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#external_force) which acts in a concentrated area or spot

**Connection**:. A connection restrains movement of one member with respect to another. For each restrained movement, there is a corresponding force transferred from one member to the other; See [fixed connection](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#fixed_connection) and [pin connection](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#pin_connection).

**D**

**Deflection**: The distance a member moves out of its normal shape due to an imposed load.

**Deformation**: A change in the shape of an object or material.

**Displacement**: A change in position. A displacement may be horizontal or vertical, or [rotation](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#rotation) or a combination of those.

**Distributed load**: An [external force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#external_force) which acts over a region of length, surface, or area: essentially any external force which is not a [concentrated force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#concentrated_force).

**Ductility**: Ductility generally refers to the amount of deformation which a material or structure experiences before complete failure.

**E**

**Elastic**: A material or structure is said to behave elastically if it returns to its original geometry upon unloading.

**Elastic energy**: The [energy](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#energy) stored in [deformed](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#deformation) elastic material (e.g., a watch spring). Elastic energy is sometimes called elastic potential energy because it can be recovered when the object returns to its original shape; see [potential energy](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#potential_energy).

**Elastic limit**: The point beyond which the [deformations](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#deformation) of a structure or material are no longer purely [elastic](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#elastic), meaning that the member cannot return to its original shape.

**Energy**: A property of a body related to its ability to move a [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) through a distance opposite the force's direction; energy is the product of the magnitude of the force times the distance. Energy may take several forms: see [kinetic energy](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#kinetic_energy), [potential energy](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#potential_energy), and [elastic energy](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#elastic_energy).

**Equilibrium**: An object is in equilibrium if the [resultant](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#resultant) of the [system of forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#system_of_forces) acting on it has zero magnitude. In other words, it has come to a balance of forces and does not move any more.

**External force**: A [surface force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#surface_force) or [body force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#body_force) acting on an object. External forces are sometimes called [applied forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#applied_force).

**F**

**Fixed connection**: In two dimensions, a fixed connection between two members restrains all [directions](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html%22%20%5Cl%20%22degree_of_freedom) of movement of the connected members with respect to one another. A fixed connection is sometimes called a rigid connection or moment-resisting connection.

**Flexibility**: Flexibility is the inverse of [stiffness](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#stiffness). When a [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) is applied to a structure, there is a [movement](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#displacement) in the direction of the force; flexibility is the ratio of the movement divided by the force. High flexibility means that a small load produces a large movement.

**Flexure**: Bending deformation, i.e., deformation by increasing curvature.

**Force**: A directed interaction between two objects that tends to change the momentum of both. Since a force has both direction and magnitude, it can be expressed as a [vector](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#vector)

**G**

**Gravity**: An attractive [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) between two objects; each object [accelerates](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#acceleration) at a rate equal to the attractive force divided by the object's mass. Objects near the surface of the earth tend to accelerate toward the earth's center at a rate of ; this value is often called the gravitational constant and denoted as g.

**I**

**Inelastic**: Not surprisingly, the opposite of [elastic](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#elastic). A [deformation](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#deformation) of a structure or material under load is described as inelastic when the deformation remains after the load is removed. The term plastic is often used with the same meaning.

**Inertia**: The tendency of an object at rest to remain at rest, and of an object in motion to remain in motion.

**Internal force**: Forces which hold an object together when [external forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#external_force) or other [loads](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#load) are applied. Internal forces are sometimes called resisting forces since they resist the effects of external forces.

**K**

**Kinetic Energy:** The [energy](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#energy) of a moving [mass](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#mass); equal to . Where m is mass and v is the [magnitude](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#magnitude) of the [velocity](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#velocity). Otherwise knows and mass times velocity, squared, divided by 2.

**L**

**Linear**: A structure is said to behave linearly when its’ deformation response is directly proportional to the loading (i.e. doubling the load doubles the movement response). For a material, linear means that the stress is directly proportional to the strain.

**Linear Elastic**: A force-displacement relationship which is both [linear](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#linear) and [elastic](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#elastic). For a structure, this means the deformation is proportional to the loading, and deformations disappear on unloading.

**Load**: An [external force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#external_force). The term load is sometimes used to describe more general actions such as temperature differentials or movements such as foundation settlements.

**M**

**Mass**: A property of an object measured by the degree that it resists acceleration.

**Moment resisting-connection**: see [fixed connection](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#fixed_connection).

**N**

**Normal strain**: [Strain](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#strain) measuring the intensity of [deformation](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#deformation) along an axis. Normal strain is often simply called strain.

**Normal stress**: [Stress](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#stress) acting perpendicular to an imaginary plane cutting through an object. Normal stress has two senses: compression and tension. Normal stress is often simply called stress.

**P**

**Potential Energy**: The energy stored in a raised object (e.g. the weights in a grandfather clock). Potential energy equals *mgh*, where *m* is mass, *g* is the acceleration of gravity, and *h* is the vertical distance from a reference location. It is called potential energy because the energy can be regained when the object is lowered. This type of potential energy is sometimes called gravitational potential energy in order to distinguish it from elastic potential energy:

**Pressure**: Pressure is a similar idea to [stress](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#stress), the force intensity at a point, except that pressure means something acting on the surface of an object rather than within the material of the object.

**R**

**Racking**: The distortion of a rectangular shape to a skewed parallelogram.

**Reaction**: A reaction is a [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) exerted by a [support](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#support) on an object: sometimes called support reaction. Using this definition, a reaction is an [external force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#external_force).

**Rigid**: An idealized concept meaning something which does not deform under loading. In fact, all objects deform under loading, but in modeling it can be useful to idealize very stiff objects as rigid.

**Rigid connection**: see [fixed connection](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#fixed_connection).

**Roller support**: In two dimensions, a roller [support](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#support) restrains one direction of movement.

**Rotation**: Motion of an object where the path of every point is a circle or circular arc. A rotation is defined by a point and [vector](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#vector) which determine the axis of rotation. The direction of the vector is the direction of the axis and the [magnitude](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#magnitude) of the vector is the angle of rotation.

**S**

**Shear**: An [system of internal forces](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#system_of_forces) whose [resultant](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#resultant) is a force acting perpendicular to the longitudinal axis of a structural member or assembly: sometimes called shear force.

**Shear strain**: Strain measuring the intensity of [racking](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#racking) in the material. Shear strain is measured as the change in angle of the corners of a small square of material.

**Stability**: Stability is best defined as the opposite of instability, which is the occurrence of large structural [deformations](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#deformation) which are not the result of material failure.

**Stiffness**: This is a general term which may be applied to materials or structures. When a force is applied to a structure, there is a displacement in the direction of the force; stiffness is the ratio of the force divided by the displacement. High stiffness means that a large force produces a small displacement.

**Strain**: The intensity of [deformation](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#deformation) at a point in an object.

**Strength**: A very general term that may be applied to a material or a structure. In a material, strength refers to a level of stress at which there is a significant change in the state of the material, e.g., yielding or rupture. In a structure, strength refers to a level of loading which produces a significant change in the state of the structure, e.g., inelastic deformations, buckling, or collapse.

**Stress**: The intensity of [internal force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#internal_force) acting at a point in an object. Stress is measured in units of force per area.

**Support**: A support contributes to keeping a structure in place by restraining one or more directions of movement.

**Surface force**: A [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) applied to the surface of an object.

**T**

**Translation**: Motion of an object where the path of every point is a straight line. Can be described as movement in the same direction.

**V**

**Vector**: A mathematical entity having a [magnitude](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#magnitude) and a direction in space.

**Velocity**: A [vector](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#vector) quantity equal to the rate that position changes with time. Or, the speed of an object shown as distance divided by time.

**W**

**Weight**: The [force](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#force) on an object resulting from [gravity](http://www.arch.virginia.edu/~km6e/references/glossary/struc-glossary.html#gravity).

**Y**

**Yield stress**: A material loaded beyond its yield stress, no longer can carry a load. Metals, particularly mild steel, generally have a very well defined yield stress compared to other materials. Yield stress is sometimes called yield strength.