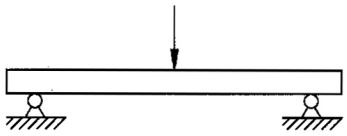
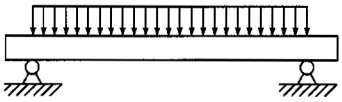
BEAMS

Beams are members which are subjected to loads at right angles (perpendicular) to their length. Most commonly, beams are horizontal and are therefore subjected to vertical loads usually related to gravity, i.e.- a shelf, platform or support for pipe or conduit. Loads cause beams to bend, called deflection. The ultimate consideration when designing a beam structure is whether or not it is strong enough. In other words, will it hold the anticipated load and provide a safety factor for unanticipated loads or other variations in conditions. A beam's ability to support a load is determined by its allowable bending moment and resulting amount of deflection. This load carrying ability is dependent on a number of factors: the amount of load, the type of load, the manner in which the beam is supported and the stiffness of the beam (a function of the beam's shape and the material from which it is made).

Types of Beam Loading

Point Load - A point load is concentrated at a single point along the beam's span (in reality, the load is concentrated over a very small length of the beam).

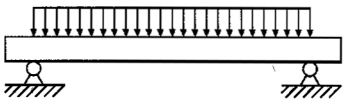


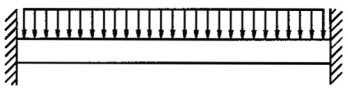


Uniform Load - A uniform load is spread evenly over the length of the beam from support to support.

Types of Beam Support Conditions

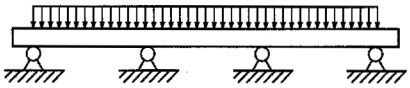
Simple Beam - A simple beam is supported at both ends by non-fixed connections which prevent vertical movement at the support point, but allow the beam to rotate or flex into a normal deflected shape. The majority of bolted metal framing connections closely approximate these conditions. The loading data presented in this catalog is based on simple beam analysis unless otherwise noted.

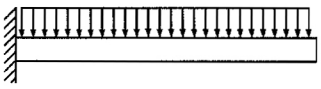




Fixed Beam - A fixed beam has rigid connections at each end that restrict the rotation of the beam and resist its deflection. The increased stiffness provided by this resistance to rotation provides a greater load capacity than that of an equivalent simple beam. A fixed-end beam would result when a channel span is welded to rigid upright supports.

Continuous Beam - A continuous beam rests on more than two supports. The outside spans of a continuous beam will act like simple beams, while the interior spans will behave in a manner similar to fixed beams.

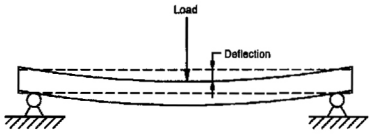




Cantilever Beams - A cantilever beam is supported by a fixed, rigid connection at one end and is totally unsupported at the opposite end. Shelf brackets and many of the strut brackets shown in this catalog are examples of cantilever beams.

Loading and Deflection

All beams will deflect or "sag" when a load is applied. The magnitude of the deflection is dependent on the following factors:



(a) The amount of load plus the weight of the beam itself.
(b) The manner in which the load is distributed.
(c) The method by which the beam is supported.
(d) The cross sectional shape of the beam.
(e) The material from which the beam is made.

The stiffness of the beam derived from its cross sectional shape is defined by its "Moment of Inertia' or "I". The greater the "I" value of a beam, the greater its stiffness and the smaller its deflection. "I" values are given for both major axis (X-X and Y-Y). Increasing the height of the strut channel (Y-Y axis) is a straightforward way to increase its stiffness and lower its deflection.

The stiffness of a beam derived from its material composition is defined by its "Modulus of Elasticity" or "E". The greater the "E" value of the beam's material, the stiffer it is, and the smaller the deflection. A material's elasticity does not necessarily relate to its strength but rather its deflection under a given load.

The beam capacities in this catalog include the weight of the beam itself. Therefore, the strut beam weight must be subtracted from the loading capacities given to provide the net beam capacity.