

Glossary: Bridges

Abutment: Part of a structure which supports the end of a span or accepts the thrust of an arch; often supports and retains the approach embankment.

Anchor span: Located at the outermost end, it counterbalances the arm of span extending in the opposite direction from a major point of support. Often attached to an abutment.

Anchorage: Located at the outermost ends, the part of a suspension bridge to which the cables are attached. Similar in location to an abutment of a beam bridge.

Aqueduct: A pipe or channel, open or enclosed, which carries water. May also be used as part of a canal to carry boats. Sometimes carried by a bridge.

Arch: A curved structure which supports a vertical load mainly by axial compression.

Arch barrel: The inner surface of an arch extending the full width of the structure.

Arch ring: An outer course of stone forming the arch. Made of a series of voussoirs. An archivolt is an arch ring with decorating moldings.

Ballustrade: A decorative railing, especially one constructed of concrete or stone, including the top and bottom rail and the vertical supports called ballusters. May also include larger vertical supports called stanchions.

Baltimore truss: A subdivided Pratt truss commonly constructed for the Baltimore and Ohio Railroad. It has angled end posts and a top chord which is straight and horizontal. Compare to camelback truss and Pennsylvania truss.

Bascule bridge: From the French word for "see-saw," a bascule bridge features a movable span (leaf) which rotates on a horizontal hinged axis (trunnion) to raise one end vertically. A large counterweight

is used to offset to weight of the raised leaf. May have a single raising leaf or two which meet in the center when closed. Compare to swing bridge and vertical lift bridge.

Beam: A horizontal structure member supporting vertical loads by resisting bending. A girder is a larger beam, especially when made of multiple plates. Deeper, longer members are created by using trusses.

Bearing: A device at the ends of beams which is placed on top of a pier or abutment. The ends of the beam rest on the bearing.

Bent: Part of a bridge substructure. A rigid frame commonly made of reinforced concrete or steel which supports a vertical load and is placed transverse to the length of a structure. Bents are commonly used to support beams and girders. An end bent is the supporting frame forming part of an abutment. Each vertical member of a bent may be called a column, pier, or pile. The horizontal member resting on top of the columns is a bent cap. The columns stand on top of some type of foundation or footer which is usually hidden below grade. A bent commonly has at least two or more vertical supports. Another term used to describe a bent is capped pile pier. A support having a single column with bent cap is sometimes called a "hammerhead" pier.

Bowstring truss: A truss having a curved top chord and straight bottom chord meeting at each end.

Box girder: A steel beam built-up from many shapes to form a hollow cross-section.

Brace-ribbed arch (trussed arch): An arch with parallel chords connected by open webbing.

Bridge: A raised structure built to carry vehicles or pedestrians over an obstacle.

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Buttress: A wall projecting perpendicularly from another wall which prevents its outward movement. Usually wider at its base and tapering toward the top.

Cable: Part of a suspension bridge extending from an anchorage over the tops of the towers and down to the opposite anchorage. Suspenders or hangers are attached along its length to support the deck.

Cable-stayed bridge: A variation of suspension bridge in which the tension members extend from one or more towers at varying angles to carry the deck. Allowing much more freedom in design form, this type does not use cables draped over towers, nor the anchorages at each end, as in a traditional suspension bridge.

Camber: A positive, upward curve built into a beam which compensates for some of the vertical load and anticipated deflection.

Camelback truss: A truss having a curved top chord and straight bottom chord meeting at each end, especially when there are more than one used end to end. Compare to Baltimore truss and Pennsylvania truss.

Cantilever: A structural member which projects beyond a supporting column or wall and is counterbalanced and/or supported at only one end.

Castellated girder: A steel beam fabricated by making a zig-zag cut along its web, then welding the two sides together at their peaks. This creates a beam which has increased depth and therefore greater strength, but is not increased in weight.

Catenary: Curve formed by a rope or chain hanging freely between two supports. The curved cables or chains used to support suspension bridges may be referred to as catenaries.

Centering: Temporary structure or falsework supporting an arch during construction.

Chord: Either of the two principal members of a truss extending from end to end, connected by web members.

Column: A vertical structural member used to support compressive loads. Also see pier and pile.

Continuous span: A superstructure which extends as one piece over multiple supports.

Corbelled arch: Masonry built over an opening by progressively overlapping the courses from each side until they meet at the top center. Not a true arch as the structure relies on strictly vertical compression, not axial compression.

Counter: A truss web member which functions only when a structure is partially loaded.

Cradle: Part of a suspension bridge which carries the cable over the top of the tower.

Cripple: A structural member which does not extend the full height of others around it and does not carry as much load.

Crown: On road surfaces, where the center is the highest point and the surface slopes downward in opposite directions, assisting in drainage. Also a point at the top of an arch.

Culvert: A drain, pipe or channel which allows water to pass under a road, railroad or embankment.

Deck: The top surface of a bridge which carries the traffic.

Deck truss: A truss which carries its deck on its top chord. Compare to pony truss and through truss.

Elliptical arch: An arch formed by multiple arcs each of which is drawn from its own center. Compare to a roman arch which is a semi-circular arc drawn from a single centerpoint.

Embankment: Angled grading of the ground.

End post: The outwardmost vertical or angled compression member of a truss.

Expansion joint: A meeting point between two parts of a structure which is designed to allow for movement of the parts due to thermal or moisture factors while protecting the parts from damage.

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Commonly visible on a bridge deck as a hinged or movable connection.

- Extrados:** The outer exposed curve of an arch; defines the lower arc of a spandrel.
- Eye bar:** A structural member having a long body and an enlarged head at each end. Each head has a hole through which a pin is inserted to connect to other members.
- Falsework:** Temporary structure used as support during construction. Falsework for arch construction is called "centering."
- Fill:** Earth, stone or other material used to raise the ground level, form an embankment or fill the inside of an abutment, pier or closed spandrel.
- Finial:** A sculpted decorative element placed at the top of a spire or highpoint of a structure.
- Fixed arch:** A structure anchored in its position. Compare to hinged arch.
- Floor beam:** Horizontal members which are placed transversely to the major beams, girders, or trusses; used to support the deck.
- Footing:** The enlarged lower portion of the substructure or foundation which rests directly on the soil, bedrock, or piles; usually below grade and not visible.
- Gabion:** A galvanized wire box filled with stones used to form an abutment or retaining wall.
- Girder:** A horizontal structure member supporting vertical loads by resisting bending. A girder is a larger beam, especially when made of multiple metal plates. The plates are usually riveted or welded together.
- Gusset plate:** A metal plate used to unite multiple structural members of a truss.
- Haunch:** The enlarged part of a beam near its supported ends which results in increased strength; visible as the curved or angled bottom edge of a beam.
- Hinged arch:** A two-hinged arch is supported by a pinned connection at each end. A three-hinged arch also includes a third pinned connection at the crown of the arch near the middle of a span.

Compare to fixed arch.

- Howe truss:** A type of truss in which vertical web members are in tension and diagonal web members in compression. Maybe be recognized by diagonal members which appear to form an "A" shape (without the crossbar) toward the center of the truss when viewed in profile. Compare to Pratt truss and Warren truss.
- Humpback:** A description of the sideview of a bridge having relatively steep approach embankments leading to the bridge deck.
- Impost:** The surface which receives the vertical weight at the bottom of an arch.
- Intrados:** The interior arc of an arch.
- Jersey barrier:** A low, reinforced concrete wall wider at the base, tapering vertically to near mid-height, then continuing straight up to its top. The shape is designed to direct automotive traffic back toward its own lane of travel and prevent crossing of a median or leaving the roadway. Commonly used on new and reconstructed bridges in place of decorative ballustrades, railings or parapets.
- Keystone:** The uppermost wedge-shaped voussoir at the crown of an arch which locks the other voussoirs into place.
- King Truss:** Two triangular shapes sharing a common center vertical member (king post); the simplest triangular truss system. Compare to queen truss.
- Knee brace:** Additional support connecting the deck with the main beam which keep the beam from buckling outward. Commonly made from plates and angles.
- Lag:** Crosspieces used to connect the ribs in centering.
- Lateral bracing:** Members used to stabilize a structure by introducing diagonal connections.
- Lattice:** An assembly of smaller pieces arranged in a gridlike pattern; sometimes used a decorative element or to form a truss of primarily diagonal members.
- Lenticular truss:** A truss which uses curved top and bottom chords placed opposite

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one another to form a lens shape. The chords are connected by additional truss web members.

Member: One of many parts of a structure, especially one of the parts of a truss.

Parabola: A form of arch defined by a moving point which remains equidistant from a fixed point inside the arch and a moving point along a line. This shape when inverted into an arch structure results in a form which allows equal vertical loading along its length.

Parapet: A low wall along the outside edge of a bridge deck used to protect vehicles and pedestrians.

Pennsylvania truss: A subdivided Pratt truss invented for use by the Pennsylvania Railroad. The Pennsylvania truss is similar in bracing to a Baltimore truss, but the former has a camelback profile while the latter has angled end posts only, leaving the upper chord straight and horizontal. Compare to camelback truss and Baltimore truss.

Pier: A vertical structure which supports the ends of a multi-span superstructure at a location between abutments. Also see column and pile.

Pile: A long column driven deep into the ground to form part of a foundation or substructure. Also see column and pier.

Pin: A cylindrical bar which is used to connect various members of a truss; such as those inserted through the holes of a meeting pair of eyebars.

Pony truss: A truss which carries its traffic near its top chord but not low enough to allow crossbracing between the parallel top chords. Compare to deck truss and through truss.

Portal: The opening at the ends of a through truss with forms the entrance. Also the open entrance of a tunnel.

Post: One of the vertical compression members of a truss which is perpendicular to the bottom chord.

Pratt truss: A type of truss in which vertical web members are in compression and

diagonal web members in tension. Many possible configurations include pitched, flat, or camelback top chords. Maybe be recognized by diagonal members which appear to form a "V" shape toward the center of the truss when viewed in profile. Variations include the Baltimore truss and Pennsylvania truss. Compare to Warren truss and Howe truss.

Pylon: A monumental vertical structure marking the entrance to a bridge or forming part of a gateway.

Queen Truss: A truss having two triangular shapes spaced on either side of central apex connected by horizontal top and bottom chords. Compare to king truss.

Reinforcement: Adding strength or bearing capacity to a structural member. Examples include the placing of metal rebar into forms before pouring concrete, or attaching gusset plates at the intersection of multiple members of a truss.

Revet: The process of covering an embankment with stones.

Revetment: A facing of masonry or stones to protect an embankment from erosion.

Rib: Any one of the arched series of members which is parallel to the length of a bridge, especially those on a metal arch bridge.

Rigid frame bridge: A type of girder bridge in which the piers and deck girder are fastened to form a single unit. Unlike typical girder bridges which are constructed so that the deck rests on bearings atop the piers, a rigid frame bridge acts as a unit. Pier design may vary.

Rise: The measure of an arch from the spring line to the highest part of the intrados, which is to say from its base support to the crown.

Segmental arch: An arch formed along an arc which is drawn from a point below its spring line, thus forming a less than semicircular arch. The intrados of a Roman arch follows an arc drawn from a point on its spring line, thus forming a

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semi-circle.

Simple span: A span in which the effective length is the same as the length of the spanning structure. The spanning superstructure extends from one vertical support, abutment or pier, to another, without crossing over an intermediate support or creating a cantilever.

Skew: When the superstructure is not perpendicular to the substructure, a skew angle is created. The skew angle is the acute angle between the alignment of the superstructure and the alignment of the substructure.

Span: The horizontal space between two supports of a structure. Also refers to the structure itself. May be used as a noun or a verb. The clear span is the space between the inside surfaces of piers or other vertical supports. The effective span is the distance between the centers of two supports.

Spandrel: The roughly triangular area above an arch and below a horizontal bridge deck. A closed spandrel encloses fill material. An open spandrel carries its load using interior walls or columns.

Splice plate: A plate which joins two girders. Commonly riveted or bolted.

Springer: The first voussoir resting on the impost of an arch.

Spring line: The place where an arch rises from its support; a line drawn from the impost.

Stanchion: One of the larger vertical posts supporting a railing. Smaller, closely spaced vertical supports are ballusters. Also see ballustrade.

Stiffener: On plate girders, structural steel shapes, such as an angle, are attached to the web to add intermediate strength.

Stringer: A beam aligned with the length of a span which supports the deck.

Strut: A compressive member.

Substructure: The portion of a bridge structure including abutments and piers which supports the superstructure.

Superstructure: The portion of a bridge

structure which carries the traffic load and passes that load to the substructure.

Suspended span: A simple beam supported by cantilevers of adjacent spans, commonly connected by pins.

Suspenders: Tension members of a suspension bridge which hang from the main cable to support the deck. Also similar tension members of an arch bridge which features a suspended deck. Also called hangers.

Suspension bridge: A bridge which carries its deck with many tension members attached to cables draped over tower piers.

Swing bridge: A movable deck bridge which opens by rotating horizontally on an axis. Compare to bascule bridge and vertical lift bridge.

Through truss: A truss which carries its traffic through the interior of the structure with crossbracing between the parallel top and bottom chords. Compare to deck truss and pony truss.

Tie: A tension member of a truss.

Tied arch: An arch which has a tension member across its base which connects one end to the other.

Tower: A tall pier or frame supporting the cable of a suspension bridge.

Trestle: While Bridge is the more general term (which may be a single span or multi-span, typically one span is longer than the others), Trestle is a longer, multi-span structure – a series of shorter spans in which most of the spans are of similar length. Trestle is a more common term in relation to railroads, while viaduct is a similar long, multi-span structure for streets. Neither term seems to be exclusive. Although described as a single structure, the Ohio Connecting RR bridge over the Ohio River at Brunot Island could be described as a pair of bridges (one over each river channel) with a trestle at each approach and a trestle connection in the center. But more often, a long structure which does not have a

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predominantly larger span could be described as a trestle.

Truss: A structural form which is used in the same way as a beam, but because it is made of an web-like assembly of smaller members it can be made longer, deeper, and therefore, stronger than a beam or girder while being lighter than a beam of similar dimensions.

Trussed arch: A metal arch bridge which features a curved truss.

Upper chord: Top chord of a truss.

Vault: An enclosing structure formed by building a series of adjacent arches.

Vertical lift bridge: A movable deck bridge in which the deck may be raised vertically by synchronized machinery at each end. Compare to swing bridge and vertical lift bridge.

Viaduct: A long, multi-span structure, especially one constructed of concrete. More commonly used in relation to

structures carrying motor vehicles.

Trestle is the term for a similar structure when used in relation to railroads.

Voussoir: Any one of the wedge shaped block used to form an arch.

Warren truss: A type of truss in which vertical web members inclined to form equilateral triangles. May be recognized by diagonal members which appear to form a series of alternating "V" and "A" shapes (without the crossbar) along the length of the truss when viewed in profile. Often the triangles are bisected by vertical members to reduce the length of the members of the top chord.

Compare to Pratt truss and Howe truss.

Web: The system of members connecting the top and bottom chords of a truss. Or the vertical portion of an I-beam or girder.

Wing walls: Extensions of a retaining wall as part of an abutment; used to contain the fill of an approach embankment

Source: [The pghbridges Project](#) (Accessed: 2023-05-08)