Specifying Camber

The Steel Solutions Center

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structural steel fabricators, mills, and service centers and represents the most current national averages. These suggestions are based on the summarized results of the Steel Solution Center's research and will help you achieve the greatest benefit when specifying camber.

How is a beam cambered?

Cold cambering is the most common method of inducing camber on a beam. A common method is to place the beam in a press that is about 22' to 24' long with two hydraulic rams spaced at the third points. The rams push the stress in the beam past the yield point, which produces a permanent strain. This third-point loading produces a reasonably uniform camber curve that is ideal in counteracting the effect of uniform loading.

For camber greater than 1½" or 2", the beam will probably require multiple "pushes" in the machine to achieve the desired camber. For beams with a span of more than 40', the press is run three times: first at the beam center, and then the beam is re-positioned and run on each third point. For very long beams, it can be run up to five times. Most fabrication shops surveyed had machines that could handle up to 27"-deep beams. For deeper beams, contact your fabricator, as each shop has its own maximum and minimum sizes that it accommodates.

In most cases, this means you cannot camber:

- **Beams with a total length less than 24':** the pins to work.
- **Beams with web thickness less than or equal to ¼":** They are subject to web crippling in the camber jig.

The following conditions are unfavorable for cambering due to construction practicality issues:

- **Spandrel beams:** Cladding system connections are difficult to coordinate.
- **Beams in moment frames:** There are issues with fit-up for a connection that is supposed to be both rigid and 90º.
- **Beams shallower than 14" deep:**
- **Beams subject to significant twist.**
- **Beams with cantilevers.**
- **Beams with braces framing into them.**
- **Beams with a non-uniform cross-section:** They are difficult to fit in the jig.
- **Beams with significant non-symmetric loading:** Camber is designed to counteract uniform loads.

What is natural mill camber and how do I account for it?

Two types of camber exist in design: natural mill camber and induced camber. Natural mill camber happens as a result of the rolling and cooling processes inherent in steel manufacturing. Tolerances for standard mill camber are described in ASTM Specification A6. This standard gives a maximum natural mill camber for any beam as

⅛" times the length of the beam in feet divided by 10. For a 30' span this works out to be ⅜". Members specified with no camber must be erected with any natural mill camber in the upward direction. Most often, natural mill camber is not an issue and is not in the ballpark of the tolerances described above.

What camber tolerances should I specify on my drawings? What tolerances should I expect in the field?

Tolerances for induced camber are given in Section 6 of AISC's *Code of Standard Practice for Steel Buildings and Bridges*. It states that if a beam arrives at the fabricator's shop with 75% of its specified camber, no further cambering is required. All other members with a length less than or equal to 50' have a tolerance of –0"/ +½" for induced camber. All other members with a length greater than 50' have a tolerance of –0”/ + (½” + ⅛” per additional 10’). The beam will not have negative tolerance as long as the fabricator has to induce camber. The final camber measurement is verified in the shop, where an inadequacy can be corrected.

There will most likely be losses in camber as a result of transporting the steel from the mill or fabrication shop to the site. A rule of thumb is that these losses may be about 25% of the induced camber. They may also offset any extra camber induced in the beam as a result of the positive camber tolerance. Most often, a fabricator induces more camber than is necessary. By the time the steel is t/ Mo t’ th γ / te$!

various costs to find the most efficient bay framing layout. This spreadsheet takes camber costs into account in its recommendations, and is available to download free from **www.aisc.org/steeltools**.