

Crane rail selection

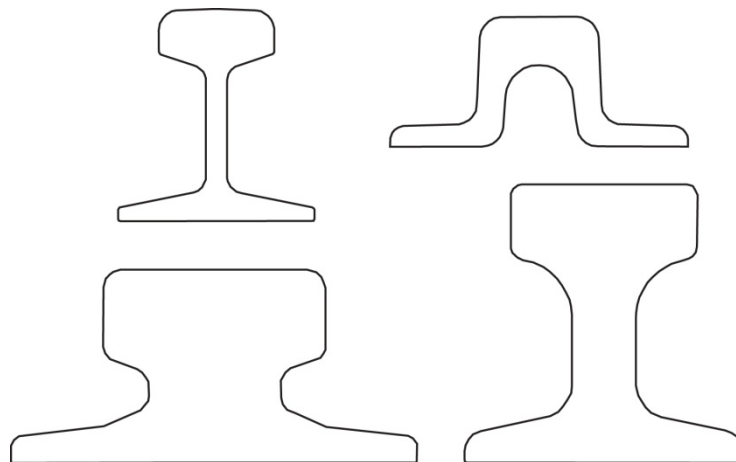


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There are over 100 rail selections that may be used for cranes. Sometimes it is necessary to suggest a rail for a particular application or to check that a rail is suitable. Unfortunately, the guidance on crane rail selection in national and international standards is not always easy to use. This is because it requires information that may not be available at the time the rail installation is being designed, typically by the civil or structural engineer. This note sets out some simple guidance that can be used in checking or suggesting a rail for a particular application. It should be used with caution and the final customer should be warned that a more thorough check might be prudent.

TYPES OF RAIL USED

There are several shapes of rail used for crane rail applications. These are shown below. Some are tall, some are squat and some are quite weak in some applications.



RAIL HEAD WIDTH

The crane design codes gives guidance on the design of crane wheels and by inference rail head width.

Points to note are as follows:

Rails other than in North America, are made in steel grades from 690 N/mm² to 1100 N/mm². In North America rails may be made from harder steels than most other parts of the world but the largest sizes are typically smaller than elsewhere. It is sensible to assume that steel with 690 N/mm² tensile strength will be supplied unless other information is available. The crane wheels in North America tend to be much harder for the heaviest duty cranes.

Thus it is important to have rails that are compatible with the crane wheels. In heavy duty applications or where the customer is concerned to have a long life, consider specifying an increased strength grade.

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The national design standards typically call for the radii at the edge of the rail head to be subtracted from the total width. In practice the crane flattens the rail head quite quickly. As the radii are not a consistent proportion of head width, it is suggested that one uses a figure of 95% of the total width as the effective head width when comparing rails for a given application.

CALCULATION OF REQUIRED RAIL HEAD WIDTH

The simplest method for calculating rail head width is to allow 2.5 mm head width per tonne for vertical wheel load for heavy duty cranes. Allow 1.7 mm for normal and light duty cranes. More conservative figures can be calculated by using the following formula: (Derived from Kempe's Engineers' Year Book).

$$H = \frac{(1580 \times W)}{D} \text{ (for heavy duty cranes)}$$

Where;

D = wheel diameter in mm

W = wheel load in tonnes force

H = full rail head in mm

Example: Find H when $D = 600$ mm and $W = 35$ tonnes force

Note: If W is in kilo Newtons, divide by 9.81 to give tonnes force.

$$H = \frac{(1580 \times 35)}{600}$$

$$H = 92.2\text{mm}$$

Suitable rails for this application would be:

Continental Europe DIN 536 A100 at 77 Kg/metre with 100 mm head

Luxembourg Acelor MRS 87 at 86.8 Kg/metre with 101.6 mm head

China QU 100 at 86.8 Kg/metre 100 with mm

In Europe the FEM rules also carry guidance. However, they require knowledge of the crane operation that is often not available to the crane rail installer.

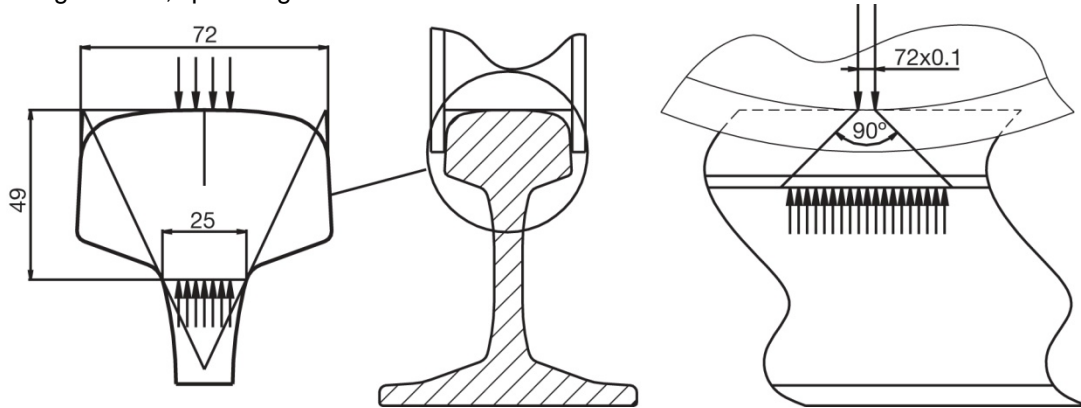
CURVED RAIL HEADS

It will be noted from rail catalogues that railway type rails and some crane rails have curved running surfaces. While some standards call for an increase in head width when the head is not flat, it is suggested that this can often be ignored as cranes soon flatten the head. When the Gantrail pad is used, the rail head stresses are reduced as the rail can rotate to take up the position imposed by the crane wheel.

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WEB CRUSHING

Railway rails can be quite light in section. They may have a web (the section between the head and the base) that is thin in relation to true crane rails. If so, they should be checked for web crushing strength. Gantrail make a calculation assuming that the load spreads from the crane wheel into the rail through a strip of rail along the head. The length of this along the rail is taken as 10% of the head width. The load then passes down through the rail, spreading out at 45°.



Gantrail considers the maximum web crushing stress should be limited to 130N/mm^2 . This allows for compression and some bending. For example, consider the UIC 60 with a wheel load of 32 tonnes.

$$\begin{aligned} 32 \text{ tonnes} &= 32 \times 1000 \times 9.81 \text{ Newton} \\ &= 313,920 \text{ Newton} \end{aligned}$$

Maximum web stress will be at the top of the web. Its position is determined by inspection of a drawing of the rail Stressed area is {width (25 mm)} x {length ($0.1 \times 72 + (49 \times 2)$)}

$$\text{Total area} = 25 \times 105^2$$

$$\text{Total area} = 2630\text{mm}^2$$

$$\text{Stress} = \frac{313,920}{2630}$$

$$\text{Stress} = 119\text{N/mm}^2$$

This is just O.K.

DESIGN RESPONSIBILITY

This technical guidance note has been prepared on the basis of many years experience at Gantry Railing Limited.

However, crane rails are significant structural items in many designs and installations, and it is not possible for Gantry to fully appreciate all the local circumstances.

Thus the ultimate responsibility for the design and installation must normally rest with the competent local engineer.

A world of crane rail expertise.

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