Flat and crowned pad

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The crowned pad came into being in the 1960s and resulted from a survey of the bottom surface of rails rolled by Lanarkshire Iron & Steel Company in Scotland. That company no longer rolls the relevant rails. It was often found that those rails were not flat on the bottom surface. The average depression in the centre of the rail in question was 1.5 mm. The rail surveyed was very heavy rail with a bottom surface width of 230 mm. Hence pad was made to suit this rail. Subsequently pad was made for all rails, this was 1.5 mm thicker in the centre than at the edges. In the 1970's, it was suggested that making the pad thicker in the centre could theoretically assist in centring the transfer of load between the rail and a steel girder with a centre web, particularly when there are angular misalignments of the top flange in the supporting structure. There are now far fewer applications where crane rails are mounted on steel girders than there was when the pad was designed. Some that are on steel have more complex structure.

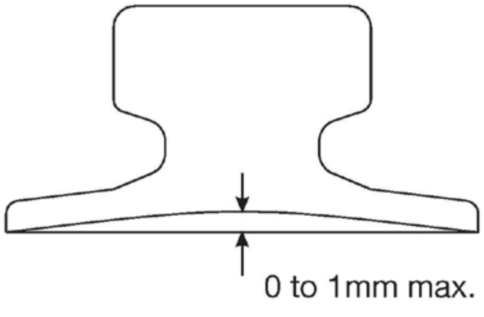
ANALYSIS

The main purpose of the pad is to spread the wheel load from the crane to a larger area of the rail support than would be the case without the pad. Tests using pressure sensitive paper and calculations with finite element techniques have demonstrated that this does happen.

The tests also showed that a flat rubber pad does to some degree concentrate the load to the centre of the rail support. This is due to the complex stress pattern in the rubber. In practice, it acts a little like a fluid. The edges of the pad are unrestrained. Thus they cannot carry the same vertical force per unit area as the centre of the pad. The steel reinforcement in the pad makes the centre of the pad stiffer in compression. This also helps to centre the load. The phenomenon is known in other branches of civil engineering. For example, it must be taken into account when rubber road bridge bearings are being specified.

The latest issue of the DIN standard DIN 536:1991 for crane rails allow a tolerance on the bottom surface of the rail. This merely reflects the actual shape that results when rolling rails. The bottom is allowed to be flat or to have a concavity. The maximum concavity allowed is 1.0 mm with the heaviest rail sections and 0.6 mm with the lightest. When a rail is placed on a pad, the maximum compression is approximately 1 mm. It therefore makes little sense to have the centre of the pad 1.5 mm thicker than the edge. The edge may never be compressed.

Gantrail produce two types of continuous pad to meet market demand, one is flat the other crowned i.e. 1.5 mm thicker in the centre. We believe today there is no need to use the crowned pad. Set out below are further reasons



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ARGUMENTS IN FAVOUR OF FLAT PAD

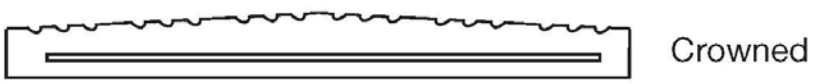
- The flat pad spreads the load more uniformly over the area of the rail support.
- The crowned pad concentrates the load too much in the centre of the rail support.
- Standards and Codes of Practice allow lower stresses in girders with pad but make no requirement that it is crowned.

Once pad has been introduced, fatigue problems in girders will be substantially eliminated. The crowning of the pad is not necessary. The crowned pad is noticeably softer than the flat pad, thus it use results in higher rail stresses. Thus failure of crane rail welds will be more likely to occur with crowned pad. This has been recognised as a problem as will be seen from the following extract from DIN 536 Part 1:1991.

"Explanatory Notes"

It was originally intended to prepare a new series of standards on crane rails, but after many justified objections were raised at the draft stage, the project was terminated, and the decision was made to update the specifications of the present standard. To ensure interchangeability with crane rails complying with the previous edition, no changes were made to the principal dimensions.

Over time, the crane systems have been modified, and new designs developed, which involve an increase in the load the wheel exerts on the rail and an improvement in the properties of the wheel material. In practice, this has meant that type A 120 rails suffered frequent fractures, particularly in the welded joints. Laboratory tests and analyses have shown that at the load levels currently involved, the strength of the welded joint zone falls below the fatigue strength at a stated number of cycles, i.e. the possibility of fracture cannot be ruled out."



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