

FAT3 EXERCISE: STRESS INTENSITY FACTOR CALCULATIONS

Problem

Let us consider an arch bridge hanger made of an S690 steel bar with a diameter of 100 mm. It is welded at each end to a fitting piece and then to a plate as shown in Figure 1. The weld is fully penetrated but may have imperfections. The measured Charpy impact energy for this steel is 135 J (valid down to -60°C). This is a guaranteed minimum value, so it can be taken as the design value in this exercise (i.e. partial factors taken as unity).

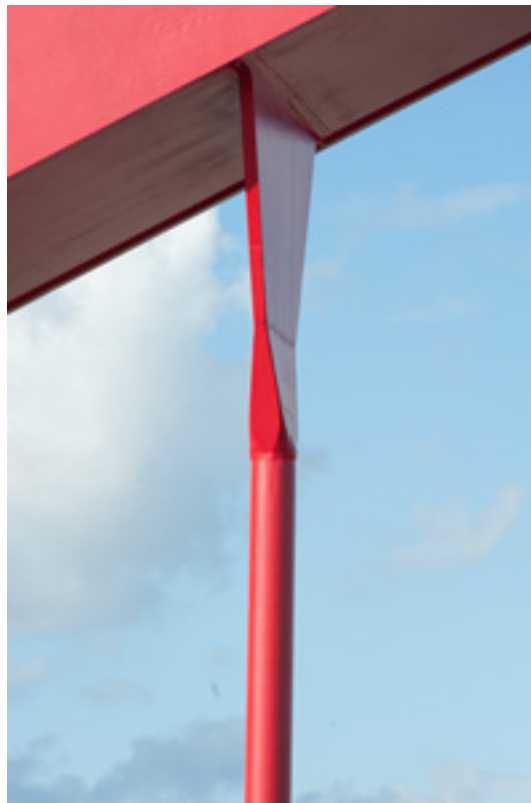


Figure 1: hanger of an arch bridge (ref.: ASDO catalogue, <http://asdo.com/hangers>)

Questions

1. Determine the maximum size of an internal imperfection, which is assumed to be circular in shape, knowing that the bar is designed for a maximum tensile stress of 80% of its tensile strength.
2. Determine whether a surface imperfection of 30 mm (admitted semi-elliptical, $a/c = 0.5$) is critical, assuming that in addition to the tensile stress, a bending stress corresponding to 10% of the tensile strength is to be taken into account.

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