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Quality and Strength assessment of Butt Welds in Poland's Oldest Welded Railway Bridges

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ABSTRACT

Verifying the resistance of existing steel structures which contain cracks of technological, fracture and fatigue origin is not possible using current design codes. The resistance of members in such structures is calculated via bespoke fitness-for-purpose (FFP) assessment and fracture mechanics criteria.

In the paper, FFP assessment is used for calculation the durability of welded plate girders in Poland's four oldest welded railway bridges. The bridges are located on the Nasielsk and Toruń railway line (central Poland). For the girders, the 20.2 m span was designed. The bridges were constructed over the years 1937-1939 and now being readied for refurbishment.

The first radiographic tests on the butt welds in 18 bridge girders were conducted in 1958 during which 101 internal cracks in 49 butt weld splices were found, and which were subsequently riveted. The usefulness of such a strengthening will be assessed on:

- a) structural calculations for design and service loadings
- b) fatigue tests on specimens with internal cracks in the welds
- c) literature service strength of welds with cracks
- d) design fatigue strength of welds with cracks using FFP assessment.

The results provide a unique experimental database on the behaviour of welds with inadmissible imperfections. They also allow us to assess the likely length of their further service life.

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