



## Load-carrying capacity of two 110 year old steel portal frame bridges

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### Abstract

The load-carrying capacity of two old steel portal frame bridges, built in 1907 and 1912 has been determined, using FE-models and taking into account the damage due to corrosion, found during inspection. For this, adequate real traffic models have been used. The capacity of both bridges proved to be insufficient, mainly due to corrosion of the outside portals. The frame cross-sections are asymmetrical, since reduction of the area is considered for tension and not for compressed parts. Two alternatives are considered for refurbishment. Replacing corroded plates and profiles on site being impossible, the alternative to reduce dead weight seems more feasible.

**Keywords:** Heritage bridges, structural effect of corrosion, real traffic loads, section area reduction by holes, riveted structure, load-carrying capacity.

### 1 Introduction

As the city of Ghent is located at the confluence of rivers Lys and Scheldt, it is crossed by the various branches of these waterways. Hence, the city owns about 100 bridges, mostly smaller ones, many of them being steel bridges. In ancient times, the bridges were in brickwork, stone, wood and iron. Many of them had movable parts, allowing the passage of ships on the rivers. The 1913 World Exposition, held in Ghent at the dawn of world war 1, has been the motive for rebuilding many bridges. One goal was also to avoid movable parts, thus enabling simultaneous road, tram and ship traffic. However, a large number of movable bridges still exists today. About 60 years ago and apart from tourist boats, ship traffic almost disappeared from the rivers, since a circular deviation canal was built. This canal, integrated in

the Seine-Scheldt connection, allows traffic from 2000 tons vessels.

The St-George's bridge was built in 1907 and replaced 2 bridges (Red Tower and Pas bridge). It allows crossing of the river Lys, near to the original confluence. Because of its replacing 2 former crossings, it has excessive width. Its vertical clearance of 3.5 m allows passing of smaller vessels to access the yacht-basin of Ghent, called 'Portus Ganda', a long-term development project of the city.

The Cauldron bridge, built in 1912, crosses the canal, connecting rivers Lys and Scheldt, dug already in the 11<sup>th</sup> century delimiting the medieval city to the South. It carries road traffic to 2 important squares of the city, the commercial centre and the old court of justice. The bridge is also crossed by the main tramway line of the city.