



Diagnosis of a large steel bridge close to collapse during a fire

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Summary

The Mathilde Bridge is one of the six bridges over the Seine River in the city of Rouen and supports heavy traffic. It was built in 1976-79 and is composed of a single metal span 115 m long, consisting of an orthotropic steel deck resting on two girders. On October 29th, 2012, the Mathilde bridge was subjected to a heavy fire and was immediately closed to traffic. After recalling the events, the article describes the decisions that had to be taken in an emergency, then the extended diagnosis which was conducted in order to be able to take a rapid decision on repair or reconstruction.

The diagnosis consisted of a detailed inspection including the examination of cracks and the condition of the paint, extensive investigations carried out on samples of metal, an accurate measurement of the global deformations of the entire span, a recalculation of the stability of the burned areas, and an expertise of damaged support bearings.

Keywords: steel bridge, fire, emergency, diagnosis, assessment, investigations, recalculation, stability, repair, decision.

1. Introduction

The city of Rouen (100,000 inhabitants) is in the heart of an urban agglomeration of 450,000 inhabitants. It is organized around a bend of the Seine and its road crossings. Over the decades, the local authorities have decided to drive the transit traffic away from the center of the city without diverting the internal traffic within the agglomeration. Thus, when the Mathilde bridge was opened to traffic in 1979, the mayor of Rouen, also president of the Departmental Authority of the Seine-Maritime asked to the Government of the French State to study a new crossing in the west of Rouen. This new crossing was built 20 years later with the construction of the Flaubert lifting bridge. From a road perspective, the Rouen agglomeration is located at the intersection of flows coming from northern Europe and France and going to the West and to the Iberian peninsula, with flows between the Ile de France and western France.

The Rouen agglomeration having no ring road, the Mathilde Bridge plays a strategic role for the flow of traffic in the city. Before the fire, it supported more than 80 000 vehicles per working day, with nearly 20 % of transit traffic. Moreover, it supported a sewage pipe serving the north of the city, and an optical fiber network.

The Mathilde Bridge was built between 1976 and 1979 according to a SETRA (now CEREMA) design and has in particular two twin 115 m long steel spans; each span consists of an orthotropic deck resting on two girders which are 4 m high, 17.35 m apart and braced every 4 m. Each steel span is resting at one end on an abutment and at the other end on the extremity of a cantilever which is part of a continuous prestressed concrete box-girder bridge passing over the Lacroix Island (see figure 1).