Collapse of the River Verde Viaduct scaffolding system

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Summary

Explicit risk analysis, a powerful structural safety decision-making tool, was applied to investigate the collapse of a movable scaffolding system (MSS) during construction of the River Verde Viaduct at Almuñécar, Spain in 2005, in which six workers lost their lives. Systematic qualitative risk analysis was conducted to identify the MSS structural safety hazards that may have theoretically caused the collapse. Based on exhaustive experimental and theoretical studies, these hazards were classified by their relevance to the accident. Logical combinations of the hazards were subsequently established to ascertain possible failure scenarios. This was followed by quantitative risk analysis, in which probabilistic methods were deployed to corroborate the likelihood of occurrence of the scenarios envisaged. Without such methods, no credible conclusions could have been drawn.

Keywords: bridge construction, automated solution, movable scaffolding system, collapse, forensic engineering, risk analysis, failure scenario, probabilistic analysis

1. Introduction

Cost efficiency of the movable scaffolding systems (MSS) used in bridge construction is generally based as fully as possible on automating operating procedures to minimise construction labour costs. Theoretically, automated procedures should also contribute to enhancing on-site safety. The use of sophisticated ancillary equipment generally entails considerable risk, however, as denoted by a number of accidents taking place over a fairly short period of time in recent Spanish history [1]. One such accident involved the collapse of the underslung movable scaffolding used to build the viaduct over River Verde at Almuñécar, Spain, in which six workers plummeted to their death. The severity of the accident and especially its timing contributed to undermining public confidence in the professionals who design and build large-scale civil works and prompted considerable concern in the professional community itself.

The examining magistrate assigned to the case asked an interdisciplinary team of experts from the Eduardo Torroja Institute for Construction Science (IETcc-CSIC), the University of Granada (UGR) and the Polytechnic University of Madrid (UPM) to draw up a forensic report with a dual purpose: on the one hand, to establish the causes of the failure and the mechanism involved, and on the other, to determine whether in spite of the collapse the structure met minimum reliability standards.

The present paper addresses the studies conducted in connection with the first of the aforementioned purposes. The investigation was based on explicit risk analysis, divided into two clearly distinct stages: qualitative and quantitative assessment. The former entailed identifying possible failure scenarios, and the latter calculating the likelihood of those scenarios by means of probabilistic analysis.

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