Robustness and risk evaluation of bridge falsework structures

João André

Research Assistant
LNEC
Lisbon
jandre@lnec.pt

Rob Beale

Reader in Mechanical
Engineering Engineering
Oxford Brookes University
Oxford
rgbeale@brookes.ac.uk

António M. Baptista

Senior Research Officer
LNEC
Lisbon
ambaptista@lnec.pt

ABSTRACT

This paper concerns the risk analysis of bridge falsework structures. There are various types of structural systems available in the market: from towered systems made of steel built-up members, frame systems of steel beams and columns with structural profiled sections, to proprietary modular 3-D systems of metallic elements connected by special couplers.

Since 1970, several falsework collapses have been reported worldwide with a growing trend in developing countries like China, India and Dubai where a boom in construction works has taken place. The majority of these failures are caused by design errors (e.g. sub-strength elements) and planning errors (e.g. insufficient inspection plans). To contribute to a better knowledge about the structural behaviour, reliability and robustness of bridge falsework systems a joint research programme between Oxford Brookes University and LNEC was initiated in 2010.

The main differences between the design of permanent and temporary structures are summarised, highlighting the need for specific design approaches for the latter.

In order to determine if for these structures a comprehensive risk analysis is justified, an estimate of the probability of failure and of the individual risk per annum were obtained based on the results of a survey of reported collapses of bridge falsework structures since 1970.

A novel robustness index will be presented and based on this index, a risk-based methodology for the design of structures, considering their whole working life will be presented. An example of a bridge falsework structure will be presented to demonstrate the benefits of the new methodology over existing practices.

Keywords: Robustness, Fragility, Risk, Bridge falsework.