

A business case for risk-informed bridge monitoring using the value of information

Manu Sasidharan^{1,2}, Ajith Kumar Parlikad^{1,2}, Jennifer Schooling²

¹*Institute for Manufacturing, University of Cambridge, Cambridge, CB3 0FS, UK*

²*Centre for Smart Infrastructure and Construction, University of Cambridge, CB3 0FA, UK*

Contact: mp979@cam.ac.uk

Abstract

While the benefits of monitoring bridges are fairly understood, securing the resources necessary for their development and installation is often difficult. The premise of the article is that infrastructure owners will take action to provide those resources when they can see value accruing to them; therefore narratives around value generation and business cases are required to motivate and support that action. This paper explores the application of the value of information methodology to the challenge of developing a business case for bridge monitoring using an illustrative case study on a simulacrum of a road bridge in the UK. To this end, this paper presents a systematic approach for setting risk-informed bridge monitoring strategies while considering the reliability and accuracy of data capture offered by different monitoring techniques and the gains to be made downstream if it contributes to setting timely maintenance strategies.

Keywords: structural health monitoring; condition monitoring; bridge; value of information; life cycle costs; decision making; asset management;

1 Introduction

Infrastructure asset managers face the challenge to manage the ageing and deteriorating bridge portfolio as disruption to their operation or failure can have significant effects beyond the damage to the physical infrastructure, including undesirable health and safety, economic, environmental and political consequences. They must optimally allocate scarce resources among competing objectives and assets within their network. Even if they restrict their attention to devote to the mitigation of a particular risk (e.g. scour), it is not easy to determine how to rationally distribute the available resources. To assess and maintain the bridges effectively, quality information about their condition is essential.

Structural health monitoring (SHM) is becoming a standard feature of infrastructure assets across the world. Many bridges in the UK have or have had SHM systems installed; for example, Humber bridge, Nine wells bridge, Ferriby road bridge and Hammersmith flyover (1). While there has been significant research (2,3) that discusses how to deploy SHM systems and obtain data, there is a lack of a business case for monitoring as the risks of bridge failure and associated costs are not well understood, and there are no systematic frameworks for addressing the same (4). In other words, there is a gap when it comes to aiding the decisions on if a bridge needs to be monitored and to what level.

While rehabilitation or repairing interventions are effective in reducing the structural vulnerability of