

## Investigation based management of hinged deck bridges in the UK

### Tony Harris

Technical Director – Bridge Engineering  
WSP (UK)

Cardiff, Wales, United Kingdom  
[Tony.Harris@wsp.com](mailto:Tony.Harris@wsp.com)

Tony is a Technical Director within the Bridges group of WSP UK. He has extensive experience in the design, checking, assessment and rehabilitation of bridges both in the UK and internationally.

### Richard Owen

Senior Engineer – Civil, Bridge & Ground.  
WSP (UK)

Cardiff, Wales, United Kingdom  
[Richard.Owen@wsp.com](mailto:Richard.Owen@wsp.com)

Richard is a Senior Engineer within WSP Cardiff's bridge team. He has 35 years industry experience managing and maintaining a wide range of bridge assets including thrust-hinge bridges.

**Contact:** [Tony.Harris@wsp.com](mailto:Tony.Harris@wsp.com)

## 1 Abstract

During the 1960s and 70s, the UK motorway network underwent rapid expansion and a significant number of bridges were constructed within a relatively short timeframe. A novel family of structures was developed incorporating modified Mesnager hinges within their decks. Over one hundred such structures were constructed.

The incorporation of hinge details within bridge decks was seen at the time as being an innovative approach to simplifying the design and standardising details on bridges having a range of span and functional requirements. However, over 50 years later they now represent a significant maintenance challenge to bridge owners as a result of the critical hinge reinforcement being inaccessible for inspection therefore constituting hidden, critical elements. In addition, significant variations in placing and restraining the reinforcement during construction added to their vulnerability to the chloride contaminated water that inevitably seeps through these joints as deck waterproofing breaks down over time.

Highways England funded a research project by the UK Transport Research Laboratory between 2000-2004 that led to the publication of Interim Advice Note 40/01, 51/03 and ultimately Advice Note 93/09 to establish guidelines on how these structures should be managed. This paper will outline how the BA 93/09 approach has been supplemented during the management of the 16 hinge deck structures along the M4 corridor in Wales that are operated by Welsh Government.

**Keywords:** Concrete, motorway, bridge, deck, hinge, standard, chloride, management, fatigue.

## 2 Introduction

The reinforced concrete 'thrust-hinge' is a modified Mesnager hinge, adopted as a standardised articulation detail used in the horizontal plane within bridge decks, the concept was developed in the early 1960's by one of the country's pioneering Consulting Engineers of that era, Sir Owen Williams and Partners.

At that time, the UK road infrastructure was developing at a rapid rate, with several of the major motorway arteries such as the M4, M5 and M6 being constructed simultaneously. The function of the thrust-hinge is similar to that of deck half-joints in that, it primarily transfers shear forces along the deck, whilst accommodating rotational effects. There were a number of perceived benefits of this insofar as it simplified the design analysis,