



# Modular construction and component-based bridge design to minimise waste

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## Abstract

Modular construction and component-based design present significant opportunities to improve the efficiency of the design and construction process for bridges. Development of a lean system for the construction of bridges in recent years has driven significant increases in construction productivity. The associated programme savings have led to environmental benefits including carbon savings from reduced timescales on site and reductions in associated preliminaries. The system also facilitates reduction in numbers of people required on site.

A modular system was developed for construction of bridges for HS2 at Birmingham Interchange. Here the system resulted in savings of 8 weeks in the construction of bridge abutments, as well as an 8% reduction in embodied carbon for the abutments and wingwalls, and a reduction of construction labour for the abutments of 84%. Subsequent schemes have seen further development of the system and repeating and increasing benefits.

**Keywords:** DfMA, modular, sustainability, concrete, bridges

## 1 Introduction

While components such as precast beams have been used for bridge superstructures for a number of years, the use of component-based design and construction has been less common for bridge substructures. A component-based system was used for four new bridges for HS2 at Birmingham Interchange, and this has led to significant improvements in productivity and reductions in embodied carbon. This challenges traditional design methodologies and workflows. It has also enabled learning to be carried through to subsequent schemes, driving continuous improvement.

## 2 Development of modular bridges for HS2 Birmingham Interchange

### 2.1 Background to modular bridges

Offsite manufacture has the potential to deliver improvements to bridge construction processes, by allowing elements to be constructed in advance in factory-controlled conditions, thereby taking construction activities off the critical path. It has the potential to move work activities from site to factory, smoothing labour demands, allowing more of the labour force to work close to home and in