



Carbon efficiency in selection of overbridge options to cross a motorway

Alessandra Villa, Tim Chapman

Ove Arup and Partners, London, UK

Contact: Alessandra.villa@arup.com

Abstract

How can a bridge designer improve the sustainability credentials of the structures that he designs?

This paper illustrates how the designer of a bridge makes a difference in terms of sustainability by trying to minimize the quantities of “Capital Carbon”.

The study starts with the premise that an over-bridge is required to cross a road and 3 different bridge solutions are examined: single span, double span and triple span bridge.

A first conclusion was that the difference between concrete and steel options was smaller than the authors expected and that the double span overbridge option was most efficient, although not always feasible. This study also demonstrates clearly the Carbon advantages in using cement replacement materials in the UK. This very pronounced advantage would matter less in countries where cement can be manufactured using less carbon-based energy.

Keywords: Bridges, Conceptual Design and Realization, Structural Shapes and Forms, Sustainability

1 Introduction

How can a bridge designer improve the sustainability credentials of the structures that he designs?

The daily job of a structural engineer doesn't usually include making decisions on whether a structure must or must not be built. More normally the influence of the structural engineer starts with improving the structure itself, because he generally has little power on location and the main characteristic of the bridge, as they are related to the alignment and many other requirements. Thus the best opportunity for the designer of a bridge over a new road to make a difference in terms of sustainability is by trying to minimize the quantities of embedded carbon of the structure itself, acting on the structure's “Capital Carbon” (CapCarb) rather than on the

whole life carbon of the road and bridge in operation. This paper illustrates how such standard decision making can be made.

The study starts with the premise that an over-bridge is required to cross a road and 3 different bridge solutions are examined: single span, double span and triple span bridge.

A first conclusion was that the difference between concrete and steel options was smaller than the authors expected and that the double span overbridge option was most efficient, although not always feasible.

This study also demonstrates clearly the Carbon advantages in using cement replacement materials in the UK. This very pronounced advantage would matter less in countries where cement can be manufactured using less carbon-based energy.