

Design of the Forth Replacement Crossing, Scotland, UK

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Summary

The Forth Replacement Crossing will be built across the Firth of Forth in Scotland to maintain and enhance a vital transport link. The wide estuary will be crossed by a cable stayed bridge with 3 towers and a pair of 650 m main spans. In the centre of each main span the stay cables will overlap to stabilise the central tower, a unique design feature for a bridge of this scale.

The scheme design of the crossing has been carried out by the Jacobs Arup joint venture in accordance with the Eurocodes and project specific design criteria. The structure will provide a fitting 21st century icon, to stand alongside the existing cantilever rail bridge from the 19th century and road suspension bridge from the 20th century, both Grade A listed bridges.

Keywords: cable-stayed bridge; Eurocode; wind tunnel testing.

1. Introduction

The Firth of Forth is a dramatic estuary which separates the Scottish capital of Edinburgh from the Kingdom of Fife to the north. The downstream crossings of the Forth at Queensferry are a pair of historic bridges, the iconic cantilever rail bridge constructed in the 1880's [1] and the Forth Road Bridge [2], Britain's first long span suspension bridge, which was opened in 1964.

Despite significant investment and maintenance over its lifetime, the Forth Road Bridge is showing signs of deterioration as a result of increased traffic and the influence of weather. In 2005, investigations of the main cables [3] revealed serious corrosion, which if left unchecked could lead to the bridge being closed to heavy goods vehicles as early as 2014, and to all traffic by 2019. A comprehensive study into the future transport needs concluded that a replacement crossing is required to maintain this crucial link for the economies of Fife, Edinburgh and the East coast of Scotland.

The replacement bridge will be slightly to the west of the existing bridges, making use of a natural granite outcrop in the middle of the Forth to allow the wide estuary and two navigation channels to be crossed by a cable stayed bridge with a pair of 650 m main spans, with an approach viaduct to the south. Selection of the scheme with the minimum impact on the environmentally constrained area and the reasoning behind the overall structural layout are described in [4].



Fig. 1: Visualisation: Three centuries of engineering in the Firth of Forth