

## Fixed link crossings: a global perspective

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### Abstract

This paper benchmarks the challenges involved with major sea, or fixed link, crossings from their planning to final construction. Initially it gives an overview of existing major crossings globally, including statistical information such as length and inflation adjusted project costs. Well known links such as the UK Channel Tunnel and the more recent Hong Kong Zhuhai Macau crossing have been included in the data. The paper considers the construction methods required to surmount the challenges of bridging or tunnelling such crossings. The paper presents statistics on the construction time period for these crossings and considers links between construction time and cost. Finally, the paper looks to the future: How the data can be used to better bound estimates of time and costs for fixed link projects. The paper also considers other potentially important future benchmarking data such as carbon emissions.

**Keywords:** Bridges, tunnels, cost, construction, carbon emissions.

### 1 Introduction

This paper introduces the challenges involved with major sea, or fixed link, crossings. A fixed link crossing is defined as an unbroken connection (by road, rail or both) across the sea. It may use bridges, tunnels, causeways or a combination of all three (Figure 1). This paper considers the crossings that are primarily constructed of bridges and tunnels. A review of existing global fixed links has been considered. 15 have been chosen and details and data given. The examples were selected to illustrate the different types of crossings; from viaducts and long span bridges; tunnels, bored or immersed tube construction; or various combinations of bridge, viaduct and tunnel. The method of construction and construction period of

each is noted as is its cost. Published costs for the projects vary significantly, however, latest estimates of cost and construction time are noted in Table 1.



Figure 1. Øresund Link with a bridge and island forming the tunnel portal.