

Durable and robust concrete bridges for the PPP-project E18 in Norway

Gerhard ZEHETMAIER

Civil Engineer, Dr.-Ing.,
Bilfinger Berger Civil
Wiesbaden, Germany
gzeh@civil.bilfinger.com

Gerhard Zehetmaier, born 1973, received his Ph.D. in civil engineering from the Technical University Munich, Germany. He is head of the Structural Design Department of Bilfinger Berger Civil.



Alfred KRILL

Civil Engineer, Dr.-Ing.,
Bilfinger Berger Civil
Wiesbaden, Germany
Alfred.Krill@civil.bilfinger.com

Alfred Krill, born 1962, received his Ph.D. in civil engineering from the RWTH Aachen, Germany. He is the head of the Bridge Design Team of Bilfinger Berger Civil in Wiesbaden.



Summary

The paper presents key aspects in the design of concrete structures for Norway's largest on-shore infrastructure project, the new motorway E18 between Grimstad and Kristiansand. The DBFO project includes 38.5 km of four lane motorway along Norway's southern coast, a considerable amount of secondary roads, 12 km of tunnels and some 60 bridges – realized between 2006 and 2009. The bridges have to meet highest demands regarding robustness, durability and low maintenance in rough environmental conditions. To achieve this, bridges were primarily designed as semi-integral structures thus minimizing the number of bearings and joints. The paper highlights the design approach for bridge structures. The basic principles are explained on the basis of built examples

Keywords: DBFO-Project, concrete bridges, durability, low maintenance, semi-integral structures

1. Introduction

On August 26th, 2009 – 5 days ahead of the contractual handover date – King Harald V opened a 38,5 km long stretch of the European highway E18 between Grimstad and Kristiansand along Norway's southern coast. The construction of the motorway with its numerous bridges and tunnels started in 2006 and was at that time Norway's largest on-shore infrastructure project. In parallel, the motorway was realized as Design-Build-Finance-Operate (DBFO)-project in public-private-partnership (PPP) with an operational period of 25 years. The construction of the new motorway and some 60 km of secondary roads in topographically challenging terrain was undertaken by Germany based Bilfinger Berger Civil and Danish Phil & Son, tied together in the construction joint venture CJV E18.

In view of the efficient operation of the stretch the bridges have to meet highest demands regarding robustness, durability and low maintenance in rough environmental conditions.

2. The project E18 Grimstad - Kristiansand

2.1 Overview

The European Highway E18 is a vital traffic artery and links Oslo to southern Norway with Kristiansand and Stavanger as major economic centres with ferry connections to Denmark and further to the pan-European road network and the Skagerrak coast being Norway's favourite leisure region (*Fig. 1*). The increasing traffic volume led to the decision to replace the old two-lane coastal road between Grimstad and Kristiansand with a modern four-lane-motorway. The complete stretch with a construction volume of approx. 400 m€ was realized as Norway's third and largest public-private-partnership project [1].