Durable design of a 42m full FRP footbridge for Bergen, Norway.

Liesbeth Tromp, Kees van IJselmuijden, Ton Boeters

Royal HaskoningDHV

Stian Persson

Norwegian Public Roads Administration-Statens vegvesen

Contact: Liesbeth.Tromp@RHDHV.com

Abstract

A tender design was prepared for a bridge at Paradis, Bergen, Norway. It is a full Fiber Reinforced Polymer (FRP) structure. The material and detailing have been optimised for the application in the Norwegian wet and cold climate. With its free span of 42m, this bridge is one of the longest spans for bridges in full FRP worldwide. In close cooperation with the Client, Statens vegvesen, a design for a pedestrian bridge was prepared by the team consisting of architects and engineers of RoyalHaskoningDHV. Statens vegvesen requires a low maintenance solution to minimise life cycle costs and hindrance for traffic on road and rail. The choice for FRP was made to prevent durability issues due to thermal fatigue and salting in winter times. This paper presents the interaction of design, material and manufacturing process. It describes the results of the structural analysis and highlights the principle of the solutions for reliable and easy to assemble connections.

Keywords: Glass Fiber Reinforced Polymer (GFRP), bridge, low maintenance, design, lightweight engineering, structural analyses.

1 Introduction

The design of the FRP bridge at Paradis aims to realise an aesthetically pleasing FRP structure, that is optimised to be cost effective and maximises durability by choice of material, minimising the number of connections and clever detailing. The main motivation for Statens vegvesen to look into FRP structures is the policy emphasising durable infrastructure above high traffic roads and railways that does not demand periodic maintenance

The tender design is based on static analysis using FEA software.

For lightweight long span bridges human induced vibrations are one of the main design governing parameters. For this design also buckling is governing, as the design has some long slender members. Dynamic analyses formed an important part of the engineering, to determine the level of comfort the pedestrians will experience on the bridge.

Finite element analyses have been carried out to determine the dimensions and the behaviour under among others traffic loads, wind loads, based on analyses including buckling, Eigenfrequency analyses and global buckling analyses. In this paper the tender design of the bridge Paradis is described and choices are made

https://doi.org/10.2749/vancouver.2017.1832
Distributed by structurae