



## FLOW Bridge - A modular FRP footbridge designed Through an innovative procurement process.

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### Abstract

This paper showcases designing, prototyping, and developing the Network Rail FLOW footbridge, an innovative composite FRP bridge meant to replace level crossings in rural and semi-rural UK areas.

The design brief was to create a lightweight, cost-effective, eye-catching modular system as an alternative to existing structures in the Network Rail catalogue.

Adopting a centralised workflow, challenging traditional procurement routes, early involvement of fabricators, unconventional thinking, and a positive attitude led to delivering the first full-sized prototype in under a year. The final design iteration is now set for large-scale manufacturing.

The design prioritised user experience, aesthetics, functionality, material quality, cost, and structural performance. This comprehensive approach resulted in an innovative and visually appealing solution that integrates route-wide repeatability and off-site manufacturing, adaptable to local contexts.

**Keywords:** FRP; Fiber Reinforced Polymers; Carbon Fiber; Glass Fiber; Flax; Design; Parametric; Modular; Aesthetics; User Experience.

### 1 Introduction

In 2010, Network Rail, the railway operator in Great Britain, initiated a program to enhance the safety of level crossings, aiming to mitigate risks for the public and passengers while enhancing the network's capability and performance. Notably, the network comprises over 6,000 level crossings, with more than 2,000 dedicated solely to footpaths.

The most effective strategy for enhancing safety and eliminating risks involves eradicating level crossings by exploring alternative routes or substituting them with alternative structures like bridges and underpasses. While these alternatives maintain connectivity, their implementation may

entail significant costs, particularly in remote locations, or they may not align with the aesthetic preferences of local communities. For those reasons, the structures currently in Network Rail catalogue often not present a viable business case.

In response to these challenges, Network Rail engaged a multidisciplinary team comprising designers and manufacturers in 2020 to develop an innovative Fiber Reinforced Polymer (FRP) bridge. The primary goal was to create a cost-effective, aesthetically appealing, and easily constructible structure to address these concerns.

During the pandemic, the team developed the first design iteration within a year, adopting innovative processes necessitated by limitations on in-person meetings. They showcased a full-scale working