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AILSA WHARF FOOTBRIDGE: CREATIVITY THROUGH COLLABORATION

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Summary

This paper will discuss the positive outcomes which early collaboration can have on the overall design of a bridge, focusing on the relationship between Knight Architects and COWI throughout the early stages of design. It will discuss the key benefits gained and how a balanced workflow can be achieved, using Ailsa Wharf; a live project currently awaiting planning submission, as an exemplar project. It will take the reader through the design process showing the different decisions and influences that informed the overall design of the bridge.

Keywords: collaboration; perforation; footbridge; steel

1. Collaboration

In bridge design, it is often the case that the best solutions - both aesthetically and structurally - come from the successful collaboration between architect and engineer. The Design Manual for Roads and Bridges states that *'there are at least two ways not to design a bridge:*

- 1. To decide what it should look like and then work out how to make it stand up and how to build it;*
- 2. To work out the most economical structural/constructional solution and then decide how to make it look nice.'*



Fig. 1. Two ways not to design a bridge as outlined in DMRB. 1. Architects Pitfall 2. Engineers Pitfall – common ground should be found between these two extremities, Smith, UK, 2017

The first is the architect's pitfall, the second the engineer's. Finding common ground between these two extremes will help to avoid a poor outcome, however, this prescribes early engagement between both parties and a continued transfer of knowledge throughout a project.

A collaborative methodology was used for the design of the Ailsa Wharf footbridge which is located in London and spans the River Lea. The 60m bridge will carry pedestrians and cyclists and will form part of the adjacent Ailsa Wharf residential development.

To begin, the team outlined the structural typology in order to define basic parameters to work within. A 'Half-through girder deck', with the main spanning elements located above the deck, also forming the bridge's parapets was considered to be the appropriate type. The half-through form minimises the structural depth between the deck and the bridge soffit, reducing the length of the approach ramps. This typology was

informed by clearance constraints and the desire to not compete with the height of the future tall buildings, instead creating a bridge that compliments its pedestrian scale.

In order to facilitate views across the Lea Valley for bridge users, we decided to perforate the web, which delivers an aesthetic driven from function that requires the use of modern steel cutting techniques, seen most recently in the work of Ney and Partners. The perforation of the web offers performance benefits by removing material from lightly-stressed areas of the bridge, reducing the steel tonnage and dead load of the structure alongside visual interest.

The reductive process continued by simply adding stiffeners for the web and a varying top flange width, both adhering to the developing functional aesthetic. By designing through this process, purely decorative features were avoided, preferring instead for the carefully-detailed structural components to communicate the architectural intent.

The project emerged from iterative testing and a continued knowledge exchange between the team. It is important to note that the design never existed as a sketch in somebody's notebook. Sketching was used to assist development, but the evolution occurred through testing and modelling different ideas in compatible software packages.

Shared workflows allowed for a quick exchange of information, particularly with both teams using Rhino and Grasshopper. Parametric design was an integral part of the design process, however for this project we were not testing the capabilities of the tool, we were taking advantage of the cross-compatibility between the software. Effective integration allowed the collaborative process to flourish through an ease of information exchange.

Applying these digital workflows, we first tested different solutions to reduce the impact of tall structure over the river, focusing on a scale more suited to the user and context. We tested different solutions to reduce the impact of a tall structure over the river. By varying the depth of the girder to mirror the simply-supported bending moment diagram, views from the bridge were improved while also improving the structural efficiency.

Compatibility with LUSAS enabled testing of structural systems as the design progressed. This was particularly useful when understanding the forces in the web. The pattern of the perforations was developed through analysis of the web which showed us where we could and could not perforate, ultimately creating a pattern that portrays the structural behaviour. Finite element analysis informed a varying pattern of perforation, with a greater degree of transparency in areas where the load effects are less severe. The resulting design is a sculptural form which responds to site constraints and its changing context.

The design process creates an opportunity for reflection upon the two ways 'not to design a bridge' as set out in the DMRB, using Ailsa Wharf to help establish a criteria for collaborative design. Both 'pitfalls' suggests only one information exchange between designers, both working in isolation and a result that bears the badge of post-rationalised design. Ailsa Wharf shows that the skillset of each member is vital and sharing knowledge between team members even more so. The design process showed that continued information exchange nurtured the architecture and engineering to influence each other and create a design that is both logical and aesthetically pleasing, and ultimately a fitting addition to its site.

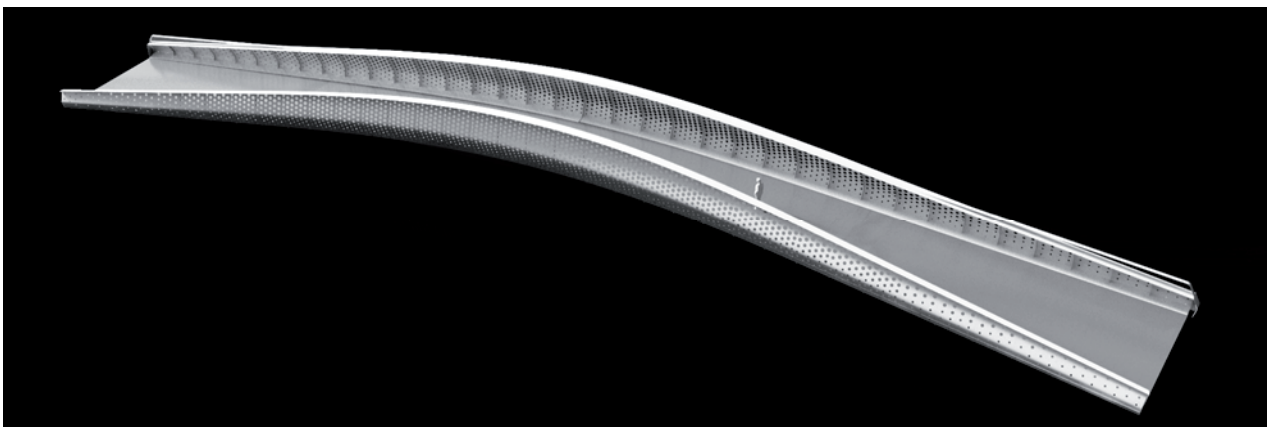


Fig. 2. 3D Aerial View showing form of bridge, Smith, UK, 2017