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THE KuBAaI FOOTBRIDGES IN BOCHOLT / GERMANY – THE CLIENT’S WISH TO USE LOW MAINTENANCE MATERIALS

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Summary

The small city of Bocholt owns a former industrial area of 25 ha which will be restructured to an urban and cultural district for people to work, live and explore. As part of the new urban development four footbridges with a span of up to 47 m have been designed to connect the two parts of this area which are separated by the river Aa. The bridges form the starting point for the future development and spaces for public events.

The connecting bridges are not only an architectural statement, but also show the transition from the former industrial origin to the new cultural urban district. The design of the bridges was chosen because it combines the future and the past. Three of the four bridges are newly designed whereas one former railroad bridge will be refurbished for the use as a pedestrian bridge.

This paper will focus on the client’s requirements to build architectural icons which will drive the development of the new quarter but to also design structures with low maintenance effort and long durability. Especially smaller cities often lack a dedicated bridge department; they require therefore good guidance by the engineer and would typically prefer low-maintenance materials. This has been achieved by utilizing weathering steel as well as GFRP decks. Even though the initial costs as well as the public approval process for this innovative construction are higher compared to conventional materials, it will be cost-beneficial for the client through reduced maintenance costs in the long run.

Keywords: weathering steel; GFRP composite; vibrations; lightweight structure; economic structures; sustainability; small cities



Fig. 1. Visualisation of “Podiumbrücke” ©SeARCH

1. The client's need

Typically, bridge owners are dedicated infrastructure authorities with experienced personnel, which know very well how to plan, procure, build and maintain bridges. As an engineer, one is used to work with highly experienced professionals with a clear understanding of bridge engineering. Small cities are an exception since they lack in a dedicated bridge department. Therefore, the client has limited knowledge of the technical requirements and limited manpower to maintain its asset.

As a bridge engineer, one should be aware of the following requirements when dealing with small cities as a client:

- Clarify the deliverables of all stakeholders in the project – bridge engineer, geotechnical advisor, architect (if any), third parties,
- Plan for low-maintenance structures to minimize future liabilities,
- Explain applicable codes and guidelines to the client, i.e. for accessible design, safe use, lightning requirements,
- Guide clients through the requirements of the technical approval process.

2. Accessibility

The bridges had to be designed for barrier-free or accessible use. In Germany, there is a guideline for barrier-free design which requires that a slope of max. 6% is used for a length of up to 6 m. After that, a pedestal of max. 3% slope and a length of 1.50 m has to be provided.

3. Weathering Steel Girders

The obvious difference between weathering steel and normal construction steel is that weathering steel is mainly used unprotected, i.e. without any coating. Directly exposed to weather conditions, the steel corrodes and forms a protective rust layer, resulting in a natural rusty colouring along with a special appealing aesthetic. Compared to normal construction steel, weathering steel has a much higher resistance to atmospheric corrosion. This means that after a few years the process of corrosion has nearly stopped and can be neglected. Although material costs for weathering steel might be slightly higher than for normal construction steel its use for steel structures has big economic benefits: No costs for anticorrosive coating and all associated work over the life cycle of the structure which is a 100 years.

4. GFRP Composite Deck

Glass-fibre reinforced plastic (GFRP) or Fiberglass is a composite material consisting of two components: glass fibres and polyester or epoxy resin. Both components on their own would not be useful for construction, but put together generate an ideal material behaviour.

The fundamental advantage of a composite material is the reduction of weight in comparison to steel or aluminium. The base material is light and can be optimised by choosing the material combination and the direction of the fibre. Furthermore, in comparison with the common composite material like concrete, fibre reinforced composites have advantages in corrosion, chemical resistance, and electrical and thermal insulation.

5. Vibrations

After consultation with a company specialised in vibration control, it was decided to make provision for dampers and conduct testing of the dynamic behaviour of the bridge when construction work is finished. After sufficient results will be available, it will be decided if the installation of dampers will be necessary. Loads due to dampers are taken into account in the bridge design preventively.