

Applying composites in the infrastructure industry

Consultation during
every project phase



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The use of composites is changing the face of the construction industry. Lightweight and low maintenance structures such as bridge decks and lock gates are increasingly being made using composite materials, such as fibre-reinforced polymers (FRP).

Royal HaskoningDHV is at the forefront in using FRP in infrastructure, particularly for projects in the Netherlands, and is involved in the development of design guidance on both a national and European level.

FRP has proven to be a viable alternative to steel, timber or concrete. Strong, versatile, light and requiring little maintenance, the FRP has many sustainable benefits that give structures a longer lifespan than conventional wood or steel structures. Other structures it can be used for include curved or complex shaped sandwich panels for facades, roof structures and edge elements. Prefabricated parts of FRP are easy to handle and allow for fast installation and reduced costs. The benefits of composites can be used to reduce life cycle costs and environmental impacts. These advantages can be used strategically and can result in differentiated solutions and shorter lead times for the installation phase.

Royal HaskoningDHV has extensive design experience and knowledge of both the composites and FRP market

we can support you in every phase of your project.

Feasibility studies

Our experts will work in close consultation with you to help evaluate and select the best option for your project.

We have substantial experience working with a range of materials including steel, concrete and FRP for architectural design and civil structures and will choose the best combination for you. Here are two examples of our project work in the Netherlands.

Doesburg, near Nijmegen: Renovation of a steel traffic bridge for the Dutch Directorate for Public Works and Water Management (RWS). The project involved the reconstruction of the main traffic lanes and the extension

of the bicycle track. We evaluated different solutions in FRP, concrete and steel. FRP was selected to replace the original concrete deck as it allowed for the transformation of the bicycle lane into a temporary traffic lane. FRP was capable of offering the required increased capacity, without any need for additional reinforcement to the main load-bearing steel structure, reducing costs and risks.

Province of Friesland: Renovation of a moveable bridge deck. We evaluated different solutions and compared steel, FRP and a combination of the two materials. A new FRP deck on a part of the existing steel structure proved to be the most economical solution.



Composites or fibre-reinforced polymers?

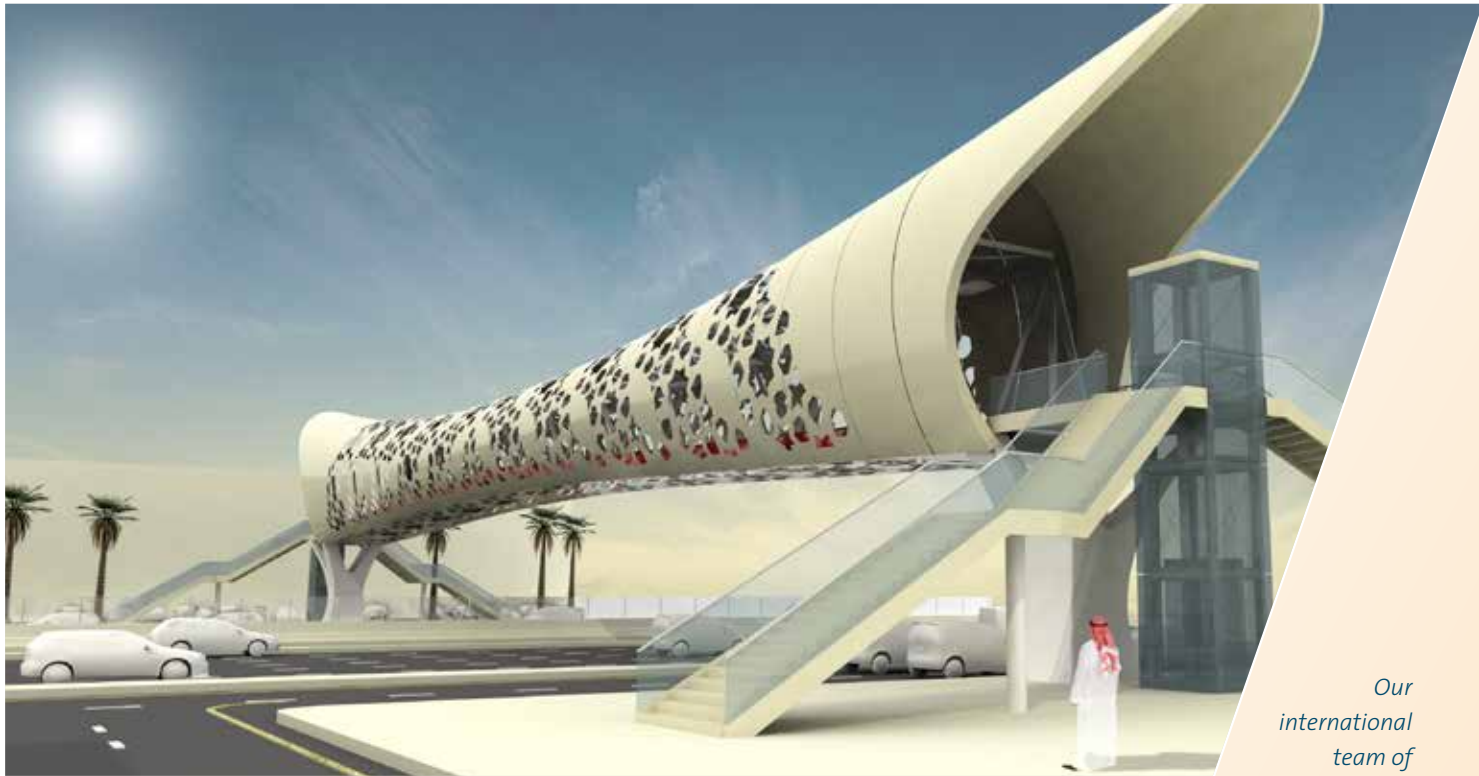
Composites are materials consisting of two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components. Examples are mixtures of clay and straw; reinforced concrete; and fibres and polymers. Fibre-reinforced polymer (FRP) therefore is a type of composite.

Benefits of FRP:

- Lightweight
- Strong
- Versatile
- Fatigue resistant
- Large freedom in shape
- Low maintenance
- Easy to prefabricate
- Quick to install

Composite edge elements:

FRP contributes to the aesthetic and functional finishing of infrastructural works. FRP elements can be easily installed and used as accessible guidance for cables and pipes without generating excessive extra loads to the foundation (see cover picture of the Juliana Bridge in Zaandam).



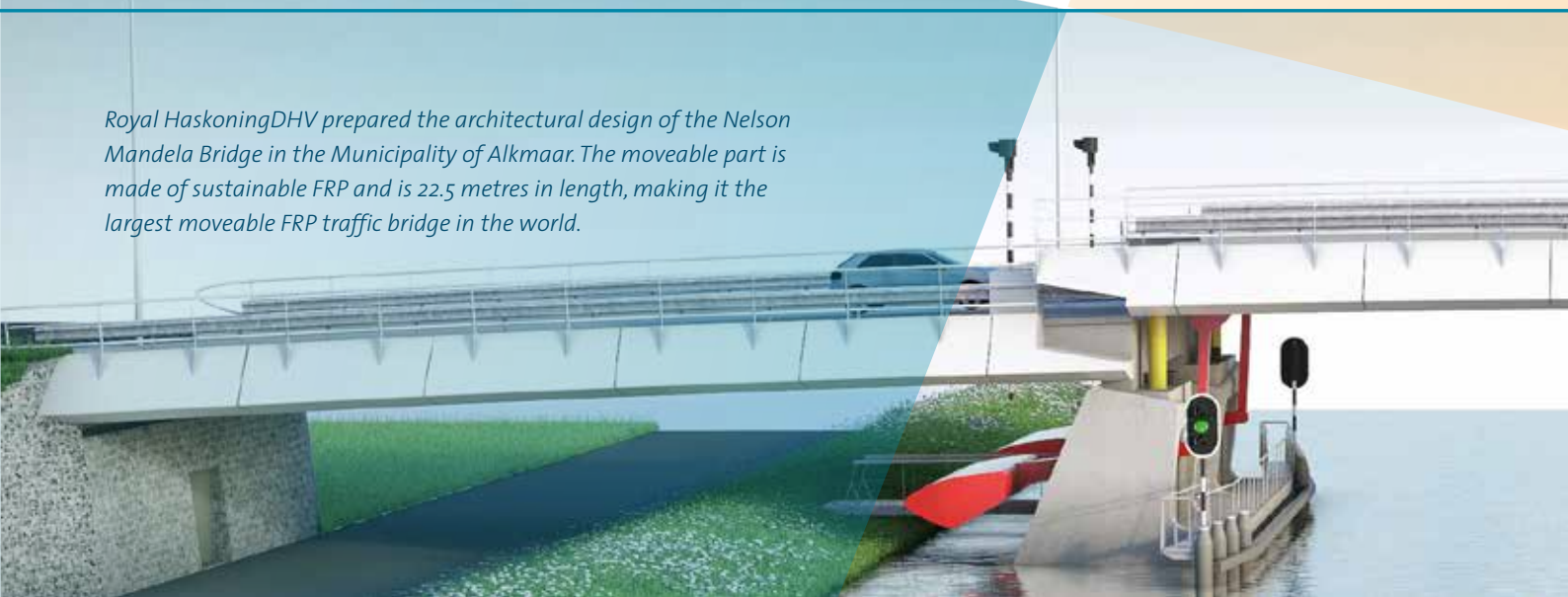
Design and engineering

Our architects and engineers prepare preliminary and detailed designs in all materials. We optimise the design to fit the purpose of the structure, taking into account the opportunities and limitations of the materials available to us. Using the latest software programmes, we can analyse FRP structures which allows us to develop a cost effective solution, determine material lay ups and prepare cost estimates for steel, concrete as well as FRP.

The combination of our expertise in structural engineering, geotechnics, mechanical and electrical engineering, allows us to prepare integrated structural designs. This is particularly relevant for moveable bridges and large complex projects as our multi-disciplinary design approach provides an opportunity to reduce construction costs and minimize execution risks.

Our international team of infrastructure experts and engineers designed and engineered the standard design of 20 modular footbridges, as part of the development of the city of Jeddah, Saudi Arabia. The objective of this project is to provide safe pedestrian access at strategic locations, thereby reducing pedestrian accidents. FRP cladding panels provide a unique and attractive finish to the low cost standard steel truss bridges.

Royal HaskoningDHV prepared the architectural design of the Nelson Mandela Bridge in the Municipality of Alkmaar. The moveable part is made of sustainable FRP and is 22.5 metres in length, making it the largest moveable FRP traffic bridge in the world.



We provided the system based contract management for the renovation of the Elburg bridge in the Province of Flevoland. The steel deck was replaced by an FRP deck.

Implementation and contract management

In the event of an unexpected implementation problem, we will make the necessary updates to the plan or changes in the design. We can support you with our expertise and help to assess and mitigate risks and make sure that the required design changes will not affect the quality. Tests are often carried out to check whether a design meets the stipulated requirements. You can rely on the tests or the expertise of the FRP supplier, but with our extensive design experience in FRP structures, we can also assist you in conducting a comprehensive and efficient review of the quality of both design and finished product.



Design Guidance

Royal HaskoningDHV has supported the Dutch Government in the preparation of design guidance for the use of FRP.

In an assignment for RWS (the Directorate for Public Works and Water Management), we coordinated the revision of the CUR96 guidelines for use of FRP in the construction industry. Internationally, we represent the Netherlands in the preparation of the Eurocode on the use of FRP in the construction industry.





Procurement and Tendering phase

Our knowledge and expertise of the market, materials and procurement procedures allows us to quickly develop contracts or tender offers.

In addition, we can support clients in the assessment of the quality of the proposed project as well as any construction risks.

We prepare clear and comprehensive contracts to support timely project implementation. This also involves

anticipating any potential differences in the interpretation of contract specifications by governmental authorities or other parties involved with the project.

We also add value to the project by translating the contract specifications in differentiating designs and winning concepts, in which FRP can make the difference. Our architects are capable of making attractive and convincing designs that make optimal use of the properties of FRP materials.

To reduce the maintenance effort and hindrance, we developed a full FRP bridge concept for the Bridge Paradis in Norway as an alternative to a conventional steel truss. Great attention was paid to achieve maximum durability, by the selection of the material, and clever detailing. This way the structure is well prepared for the harsh Scandinavian climate.



We reviewed the design of the FRP lock doors for the Dutch Directorate for Public Works and Water Management (RWS). This involved advice on technical specifications during the commissioning of works and on the asset management and maintenance protocols as part of the delivery documentation of the works. Our expertise enables RWS to act quickly and independently of the supplier in the event of unexpected damage.



Royal HaskoningDHV is an independent, international engineering and project management consultancy with more than 130 years of experience. Its head office is in the Netherlands and other principal offices are in the United Kingdom, South Africa, and India. We also have established offices in South-East Asia and North and South America, and have a long standing presence in Africa and the Middle East.

With over 6,000 colleagues, spread over 150 countries, combine global expertise with local knowledge to deliver a multidisciplinary range of professional engineering and project management consultancy services in aviation, buildings, energy, industry, infrastructure, maritime, mining, rural and urban planning, and water all over the world.

By showing leadership in sustainable development and innovation, together with our clients, we are working to become part of the solution towards a more sustainable society now and into the future.

If you have any queries about composites and FRP in the infrastructure industry, please feel free to contact:

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