(Credits: RWE)

Constructing windmills on a sea-defense dike in The Netherlands with Enka Solutions

The Netherlands is a small, densely populated country where space for any type of construction is at a premium. This is particularly true when decisions on the construction of windfarms have to be made, and every effort is made to locate these away from centers of population. The construction of a windfarm in the north of the country is a good example of this.

To make the most of both available space and wind, it was planned to locate the windfarm on a primary sea-defense dike – a world first for this application. The dike was already scheduled for upgrading, and the additional design and construction work required for the foundations and working platforms was readily taken into account in the overall project.

Wind turbines on sea-defense dike

The windfarm Oosterpolderdijk, owned by the energy company RWE, is situated on a primary sea-defense dike in the northeastern tip of the Netherlands, near Eemshaven. The park went into operation at the end of 2021 and consists of three turbines with shaft heights of 98 m. Their construction at a location such as this was a world premiere and was preceded by technical analyses of the dike's hydraulic stability, its robustness, its overall stability, and the risk of a breach.

The sea-defense dike required improvements in both profile and stability. The construction of the windfarm was incorporated in the earthworks involved here, and the windmill foundations were incorporated in the profile of the dike. As the dike protects the lower-lying polders against storm events, floods, and high tides, ensuring hydraulic stability was a top priority both during construction and in the operational phase. This was of course the foremost requirement of the responsible Water Board Noorderzijlvest.

MCHS reinforcement

An additional challenge was the design and construction of the Main Crane Hard Stands (MCHS) and the turbine foundations within the limited working space. Challenged by the contractor, a joint venture of Boskalis and KWS, to come up with a suitable design, the Enka Solutions team proposed a solution including the use of the high-strength bi-axial geogrid Enkagrid MAX 60.

Based on the given parameters and requirements, the team came up with a design summarized as follows:

- Construction of hardstands, 15 x 15 m, next to the three wind turbines
- Application of three Enkagrid MAX 60 geogrid layers embedded in the MCHS structure to increase bearing capacity and stabilization
- Installation of Enkagrid MAX 60 layers at 90° to one another
- Wrap-around methodology used at the toe of the dike to ensure the stability of the platform's steep side slopes

Windfarm Oosterpolderdijk (Credits: RWE)

The use of a climbing construction crane allowed for a smaller hardstand.

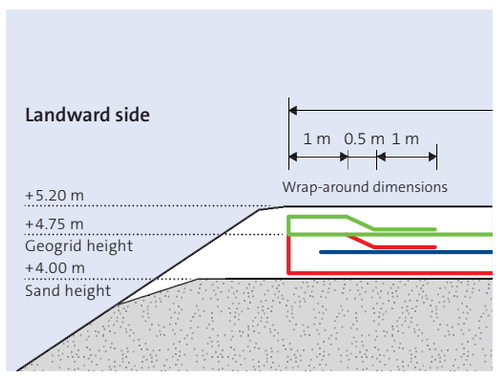
Benefits of the solution

The use of Enkagrid MAX 60 in the crane foundation allowed for a significant reduction in layer thickness and weight, while ensuring that crane loads were evenly distributed over the platform structure. The wrap-around method ensures that the structure can withstand the lateral strain at the edges along the steep slope on the landward side of the dike.

About Enkagrid

Enkagrid products include bi-axial and uni-axial geogrids in various tensile strengths. The bi-axial Enkagrid MAX provides the load-uptake capacities needed in the sub-base stabilization of roads, railways and foundations, whereas the uni-axial Enkagrid PRO products are applied in structures such as retaining walls, embankments, or in steep slopes up to 90° to ensure their internal stability.

A special and recently introduced Enkagrid combines the regular bi-axial grid with a nonwoven geotextile in a single product for increased project efficiency. Enkagrid geogrids are made of extruded polymer straps that are laser-welded at regular intervals, guaranteeing high performance and providing excellent interlocking between grid and aggregate.



Cross section of the working platform at the embankment toe

Enkagrid® MAX

Enkagrid is a product of Enka Solutions, a global pioneer that introduced the use of geosynthetics to the civil engineering world more than 60 years ago and has been at the forefront of developing many geosynthetic applications ever since. Apart from solutions for soil reinforcement, Enka Solutions products such as Enkamat, Enkadrain and Colbonddrain are used in projects where erosion control, horizontal or vertical drainage, or rapid soil consolidation are required in transportation infrastructure as well as in hydraulic and environmental engineering. A team of experts is ready to support projects from the design phase up to installation. Enka Solutions products are globally available.

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