Functional Design NL

Reference projects

Dutch Concrete Technology Award 2013

International Federation for Structural Concrete
Special Mention Prize by the Awards for Outstanding Concrete Structures

FDN GROUP

Company profile
FDN is an engineering and construction company located in The Netherlands specialised in constructions such as floating structures, ultra high performance concrete and other civil structures.

Our mission is:
• "Design and Construction of civil engineering projects worldwide and to be known as a trustworthy and high quality partner with the latest technologies."

Activities

- Conceptual Designs
- Preliminary Designs
- Detailed Designs
- Project Management
- Analysis & Tests
- Technical Assistance
- Product Development
- Engineering
- Construction
- Consultancy
- Innovation

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FDN GROUP

Clients

FDN clients are Governments, Contractors, Project developers, Consultancy and Engineering companies.

Gemeente Amsterdam

Gemeente Rotterdam

bam infra

Ballast Nedam

Lelystad

ARCADIS
Infrastructure, environment, buildings

Boskalis

mno VERVAT

Wegschap Tunnel Dordtse Kil

Rijkswaterstaat

oranjewoud

City of Oslo

FLUOR

Ministry of Infrastructure and the Environment

DHV Advies- en ingenieursbureau

Engineering & Construction

BRIDGE CONSTRUCTION

High Speed Railway Line Amsterdam - Paris

FDN has been extensively involved in the preparations for the bridge over the Hollandsch Deep River, which is the longest and most discussed bridge on the entire high-speed train line within Holland. FDN has participated not only in the drafting of preliminary designs and specifications of the bridge, but was also responsible for an in-depth risk analysis of ship collision, traveler comfort as well as a 3-dimensional analysis of the effects of ship collision on the different pier foundation designs. The bridge, which construction finished in 2008, has allowed FDN to acquire precious experience in all aspects of bridge design

Bridge for the High Speed train line Amsterdam-Paris

Artist's impression of the High-speed train line Bridge over the Hollandsch Deep (Design of Benthem Crouwel Architects and Ove Arup & Partners international)

The bridge in use

A5 flyover, The Netherlands

Design of the middle piers of the flyover A5 in 2002-2003

HSL Spoorviaduct, The Netherlands

For the project of the high-speed train line South-Holland, FDN has delivered much engineering advise to the project organization and for the contractor.

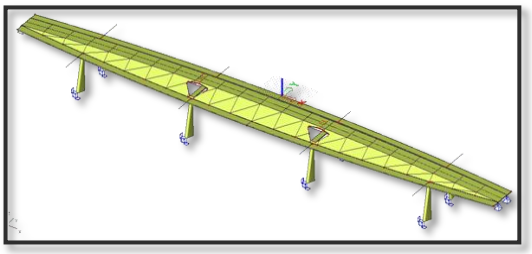
BRIDGE CONSTRUCTION

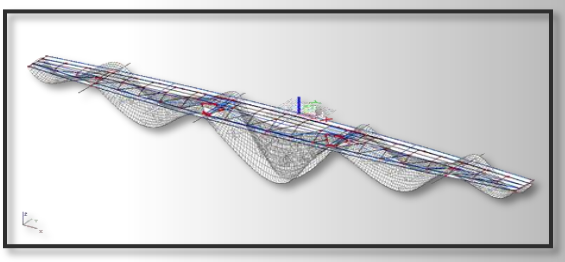
Pedestrian bridge, Nijmegen, The Netherlands

Two brand new bridges, which are part of the project 'Ruimte voor de Waal', are intended to be built in Nijmegen. The bridges will connect the new island and the north bank of the city of Nijmegen.

The pedestrian bridge is 240m long, which is supposed to be primarily used by pedestrians and cyclists. FDN was asked for review of initial architectural designs with the main focus on structural feasibility. The research of FDN comprised of 3D computer modelling with related research and proposals for the convenient pre-strestressing systems.

Architectural impression of the pedestrian bridge - Ney-Poulissen studio





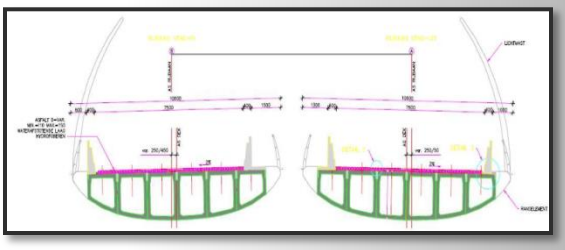
Example of 3D computer modeling with governing deformations

24 Octoberplein flyover, Utrecht, The Netherlands

FDN was involved in design of the 24 Octoberplein flyover, which solves a problematic traffic situation in the western part of Utrecht. The flyover is a highway bridge with five and six spans, depending on the direction. The spans vary from 30 to 40m.

The bridge consists of concrete pre-tensioned hollow girders, which are positioned on the concrete table. The tables are supported by steel tubular piers filled with concrete. Each direction has six girders, which are fixed together by transversal pre-stressing and a flexible mortar.

The client of FDN was MNO Vervat, as the main contractor of the project, and the County of Utrecht. The task for FDN was to design a tram portal, barriers and complete calculations of the sheet piling. In addition, FDN provided consultancy for several problematic issues, which emerged during the construction of the bridge.



Cross-section of the bridge

BRIDGE CONSTRUCTION

Kapelsbrug, Delft, The Netherlands

In cooperation with IBA engineering, FDN was responsible for a complete design and project management of a new bridge in Delft, which would replace old bridge from 17th century. In order to preserve historical appearance of this part of city, the side of the bridge facing the historical center remained architecturally unchanged, whilst the other side was completely rebuilt.

Old Kapelsbrug - before renovation

Old Kapelsbrug - demolition

Kapelsbrug - the new bridge (outer side of the bridge)

Poort van Bunnik, The Netherlands

In assignment of BAM groep nv, FDN was involved in reconstruction of 30km long highway section of A12 in the area of Utrecht Veendaal. The main purpose of the reconstruction was to widen the existing highway by adding extra lines. FDN was assigned to provide calculations and drawings, which are related to concrete bridges,tunnels and cesspits.

Renovation of A12 - Utrecht, Veendaal

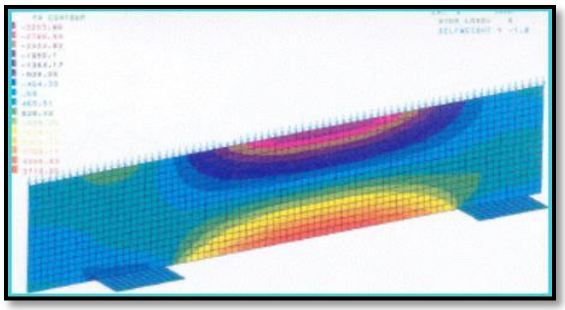
Tunnel for animals (left) and bridge construction (right)

BRIDGE CONSTRUCTION

Highway A10 Bos & Lommer viaduct, The Netherlands

In assignment of the Municipality Engineering firm, FDN was responsible for the engineering of the viaduct over the A10 highway in Amsterdam. The design concerned a new viaduct between two existing viaducts over the highway A10. The building time and phases were crucial as the highway could not be closed for long periods due to heavy traffic.

A10 and entrance to the tunnel underpass



3D STAAD analysis of the middle pillar of viaduct Bos & Lommer (left) and the current situation (right)

TUNNEL CONSTRUCTION

Tunnel Houtkade, The Netherlands

FDN performed the complete engineering of a bike- and pedestrian tunnel underneath the railway of Randstadrail. FDN was responsible for the entire design of the tunnel. The tunnel deck was built next to the railway and afterwards moved to its definite position in one day. This project provided FDN Engineering with a lot of knowledge about moving and/or sliding possibilities of the concrete decks.

Dordtsekil, the Netherlands

In assignment of 'HSL South-Holland-South' FDN did research on the structural design of a tunnel for the high-speed railway line.

Underpass Brandevoort II, Helmond, the Netherlands

The new infrastructure of the project "Brandevoort" has been being constructed. FDN, together with MNO Vervat and ProRail BV, were responsible for design and construction of two underpasses crossing the existing railways. The underpass "De Voort" will be used by vehicles only. The second underpass "De Marke" will provide service for cyclists and pedestrians. The finish of the construction is planned in 2013.

TUNNEL CONSTRUCTION

Project Noord/Zuidlijn tunnel Noord, Amsterdam, The Netherlands

The project was assigned to FDN by the county of Amsterdam and IBA. The project consisted of detailed design of a tunnel, which runs along the Noord-Hollandscanaal. FDN was asked to carry out preliminary, definitive and as-built drawings.

Tunnel Noord under the construction

Underpass Megensebaan, Oss, The Netherlands

This project is a part of the road N329 going through the province of North Brabant and Gelderland. The road will run from the traffic node Paalgraven, from Oss, to the ferry in Megen. The upgrade of N329 will give a huge improvement of the traffic flow and enable large boost of the area.

FDN was assigned by MNO Vervat and Prorail BV. The task was to carry out documentation for the tender phase of the concrete structure and sheet piling.

Underpass during construction.

Train tunnel Pannerdensch canal, Betuwe line, The Netherlands

Drilled tunnel underneath the Pannerdensch canal between the towns Bemmel and Zevenaar is a train tunnel, which was built by an unique building method. A special bore machine was used to drill two, 1600km long, adjacent tunnels for the trains. The total length of the tunnel is 2680m. The lining of the tunnel with internal diameter 8,65m is made up from concrete rings comprising seven segments complemented with a keystone. The tunnel was built in 1999-2004.

FDN was asked by Arcadis to design a caisson for the bore machine and to check project documentation regarding all calculations of the concrete structures.

HARBOUR CONSTRUCTION

Coal harbours, container harbours, yacht harbours and cruise terminals are projects, which FDN is specialised in. The FDN Group is specialised in the design of harbours, across the world, for large ships and exclusive yachts. Many governments and harbour authorities around the world are advised by FDN for realization of their projects

Olympic yacht harbour, Greece

The Olympic yacht harbour next to the new Olympic stadium in Athens (2004) has been designed by FDN for our client Archimedes Floating Marinas.

Pontoons in Messolonghi harbour, Greece

Small harbour for local ships creates a relaxing neighborhood for leisure.

Pontoons Retimon Harbour, Greece

Light-weight pontoons - convenient solution for the marinas

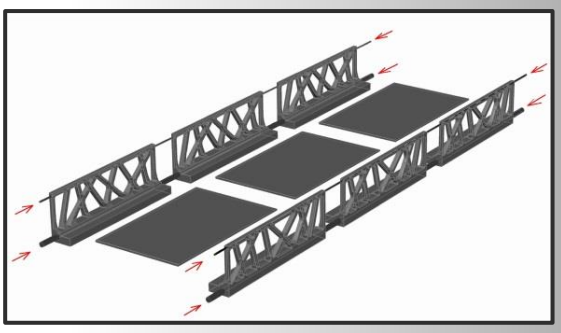
Souda Bay Harbour NAVO, Greece

Sonthaven, Amsterdam, the Netherlands

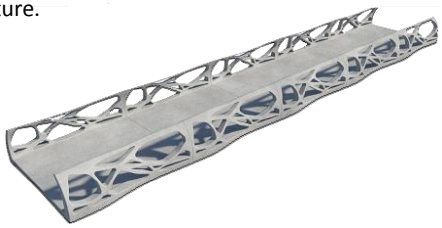
MODULAR BRIDGES

Nowadays slender structures play an important role in civil engineering. This is the reason, why material properties become more and more important. One possibility, how to make a structure slender, is to use ultra-high performance fibre reinforced concrete - UHPFRC.

FDN Engineering has developed a modular bridge from the UHPFRC. This project has won the prestigious fib concrete association award “most outstanding concrete structures in the world”. One of the reasons for this project is to satisfy increasing demand for replacing of old existing bridges, which are scattered around all different places in the Netherlands. The expectation is mainly based on the fact that the UHPFRC is a material with a great durability. Unlike other conventional materials, this property saves money on in the long term, because no maintenance or repair is needed during the whole life of the structure.



The basic principle of the design resides in the possibility to construct the bridge by connecting modular elements, which are easy to transport. The elements give options for a variable design with different bridge dimensions and pattern of the handrails. The proper connection between the elements is assured by pre-stressing cables. The transportation costs are reduced because the structure is light.



FLOATING CONSTRUCTION

Floating recreational building, Wessem, The Netherlands

FDN is a specialist in floating concrete structures and has designed a floating recreational building in Wessem, The Netherlands. The floating building is relatively large in order to accommodate facilities such as harbour offices, a restaurant and multiple areas for recreational activities.

Architectural impression of the floating building

Erection of the steel structure

The final result

Floating buildings in IJburg, The Netherlands

In co-operation with Mylos BV, FDN has been the lead structural engineer for the floating building complex 'IJburg'. An example of a floating building is the information center of IJburg in Amsterdam

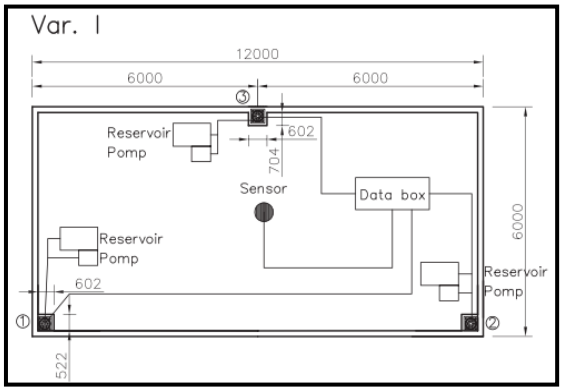
FLOATING CONSTRUCTION

Het Nieuwe Water project, The Netherlands

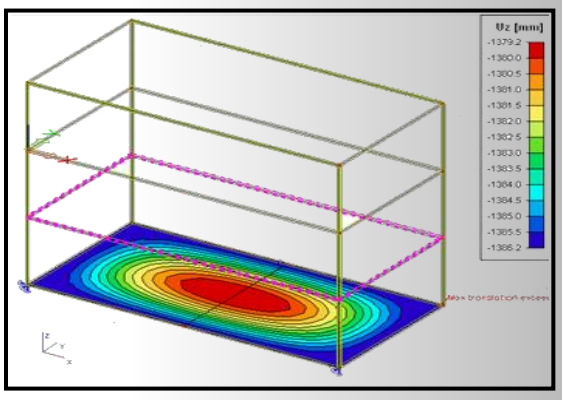
FDN ,together with Waterstudio.nl, has been involved in the unique project, which will be realized between the towns of Naaldwijk and ´s-Gravenzande. The project combines living and leisure on the water and it is the first of its kind in Europe. The new neighborhood will offer variety of floating apartments
and private islands.

FDN´s task was to design a semi-floating detached house supported by a special hydraulic system, which would change the position of the house according to variable conditions such as water tides or unbalanced load inside the house. The hydraulic system must assure a comfortable living without any ship-like behaviour of the house.

Example of an architectural impression of one house (Waterstudio.nl)



Top view of the house: The hydraulic system - three supporting piles with hydraulic pumps at the top. The system is connected to the sensors placed inside the house



The simplified computer model of the house

Floating islands Asia

FDN has started research about a floating island, which would enable a comfortable living on the sea near to shore. The idea comes from increasing demand for boutique hotels and exclusive living on the sea in South-East Asia.

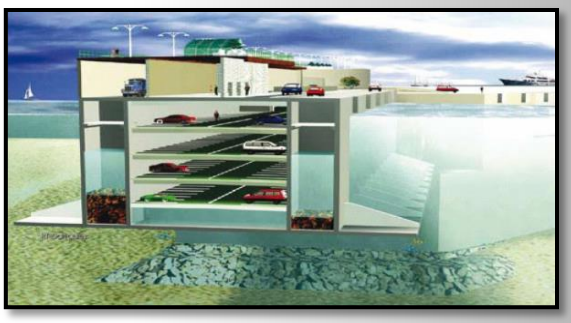
FLOATING BREAKWATER

Floating breakwater in Monaco

Floating breakwater structure in Monaco harbor is the largest project of its kind in the world. The structure is supposed to represent a floating jetty, which extends and protects the existing harbor. The whole structure is so large, that shopping center and parking garage are accounted in the hollow body of the jetty. FDN provided advisory to the engineering companies, which were responsible for the detailed design.

Top view of the harbor with the attached floating jetty on the left →

Construction of the main body



Idealized cross-section of the jetty [BBR technologies]

Floating breakwater structure in Messolonghi, Greece

FDN was asked to design and construct floating breakwater structure for Messolonghi harbour. It means that complete range of services was provided for this project. Starting with a wave analysis, through complete design up to construction and final installation. The last part of the whole process was monitoring of the structural behavior under the extreme weather conditions.

3D model of a floating breakwater

Breakwater structure in extreme conditions - hardly any waves on the right side

FLOATING BREAKWATER

Design criteria for the structure were the following:

- Water depth near breaker 9 m
- Wind speed 12 Beaufort (30 m/s)
- Occurring wave periods T =1 to 6 sec , corresponding wave lengths up to 60 m
- Wave height up to 2 m (significant wave height)
- Wave damping needed: up to 2 m waves with a period of 5 s should be damped up to 80%. Higher waves damped 50%
- Design extreme condition wave height up to 4 m (for design anchorage, concrete and connections)
- Design life structure 70 years
- Reference period of loads 100 years

Construction of the breakwater structure

Construction of the breakwater structure

Installation of the polystyrene blocks

FDN's flexible pontoon connector / Mega breakwater ready to bring to it's end position

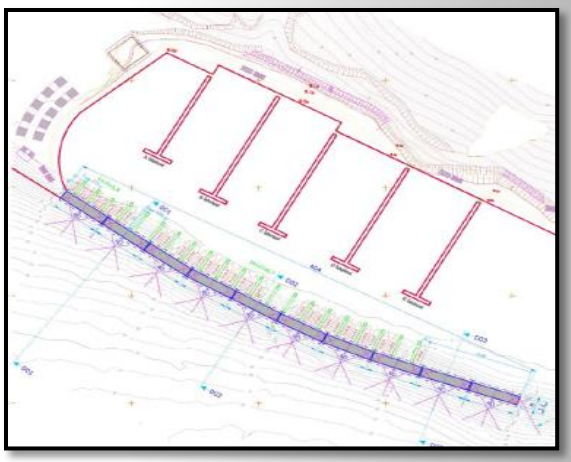
FLOATING BREAKWATER

Gokova Ören marina, Turkey

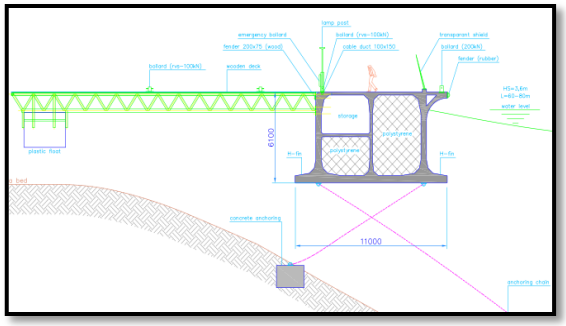
FDN Engineering has been involved in design of a breakwater structure, which is supposed to protect Gokova Ören marina located in the south of Turkey.

The main task was to design a concrete structure, which damps extreme waves coming from the open sea. In terms of damping, it is expected that the breakwater structure will be capable to decrease maximal incoming wave height of 3.6m to 0.4m. In other words, damping of the structure should be 80% for any wave direction and period.

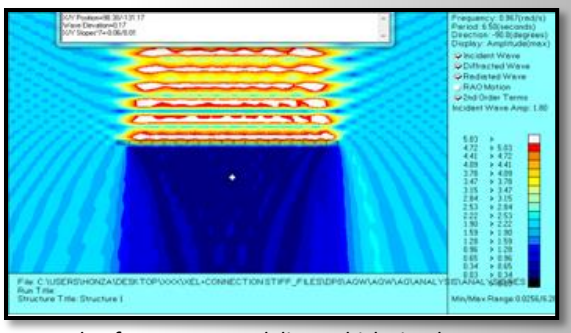
In order to protect whole marina, the overall length of the structure is 2x400m. According to the local conditions, the structure must be designed relatively large. The height of the main body is around 8m and the width is 11m (fins included). Its dimensions enable to use the structure as a jetty with walking path on the top and storage capacity inside the hollow body.



Top-view of the marina - disposition of the breakwater structure



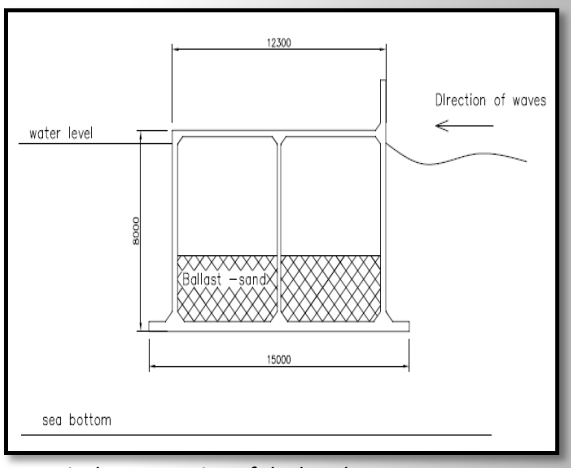
Cross-sectional view of the breakwater structure



Example of computer modeling, which simulates diffraction of the waves

Floating breakwater for Bataan terminal, The Philippines

The annual storms in the South-East Asia region make a lot of complications for berthing of the ships, especially in LNG terminals, where calm water for pumping of LNG is necessary. A well-designed floating breakwater structure can assure to keep height of the waves under one meter all over the year. For this kind of solution FDN was asked by Total Corporation.



Typical cross-section of the breakwater

PROJECT DEVELOPMENT

Messalonghi harbour, Greece

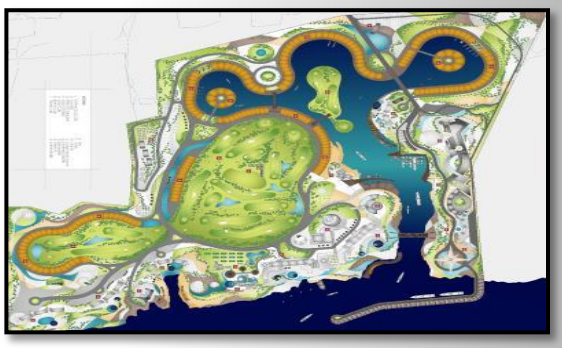
The new concept of the marina offers comfortable berthing and brand new facilities.. FDN can design and build marinas internationally.

Project Schilderskwartier, Woerden, The Netherlands

The modern urbanistic solution replaces old layout of the city from ´50 and ´60. From the assignment of Heddes, FDN carried out detailed engineering of new school and 48 houses.

Hotel resort and harbour in the Caribbean

Current situation

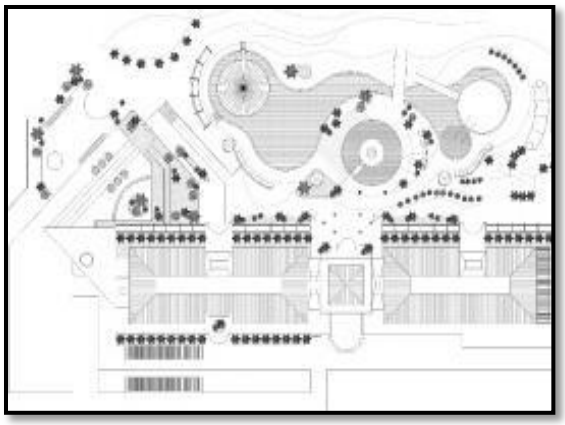


Top-view of the whole project

Hotel and Convention center

Concept of the hotel

PROJECT DEVELOPMENT



Top-views of the multi-functional facilities

The boulevard and conventional center

Project Ijsei, Amsterdam Centraal Station, The Netherlands

Project Ijsei is a magnificent project, which develops the area of current Central station of Amsterdam by construction of new tunnels, bridges and bus station. The new bus station together with attached areas will be roofed by translucent glass panels supported by a steel structure.

In assignment of MNO Beton, City of Amsterdam and Department of Infrastructure Traffic and Transport, FDN was responsible for design and construction of the cofferdam and other related casting walls.

The new bus station under the glass roof →

OIL AND GAS INDUSTRY

Petrom refinery, Romania

FDN Engineering was the lead engineer in civil constructions of the largest refinery in Romania. And has also been responsible for reviewing the designs and providing assistance to local Romanian engineers that performed the design work. The civil construction cost of the project was 100 million euros. The structures included steel pipe racks, exchangers, vessels, reactor structures, heater structures and all foundations.

Compressor shelter (left) and heat exchanger (right)

Heater structure

HydroCarbonHotel Westhaven, Amsterdam Noord, The Netherlands

The project Hydro Carbon Hotel dealt with eight steel storage tanks with total capacity of 140.000 m3. The tanks will be used for the export and mixing of petrol, and storage of petrol components and biofuels.

The works of FDN included design of the concrete foundations and steel fence of the tanks, control building, infrastructure including implementation of impermeable layers, design of sewerage, pump room and installations of the cooling water.

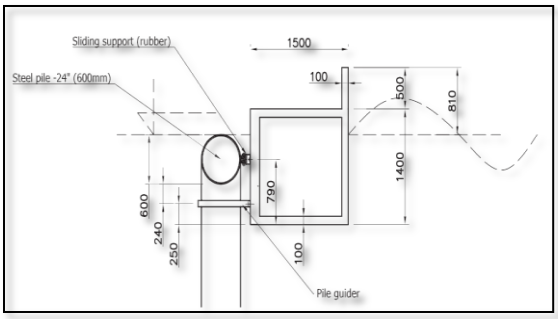
Piping installations

HCH project - construction

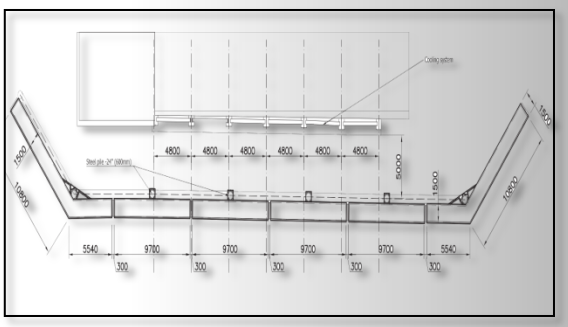
Shell rafinery, Rotterdam, The Netherlands

The assignment was given by Shell chemicals BV. The task was to provide a design for a protection of cooling system against debris coming from the watered area. FDN developed an effective system of floating concrete hollow blocks, which would prevent unintended accumulation of debris at the intake sieves. The concrete blocks are easy to build and install.

Current situation: intake sieves on the left and open water on the right



Cross-section of one block, attached to the steel piles (extreme situation)

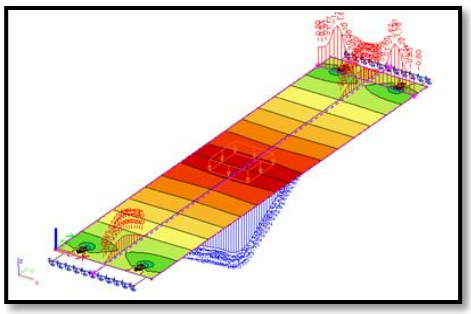


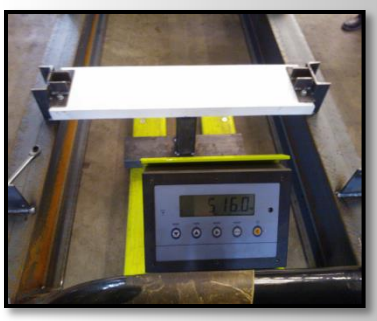
Top-view - disposition of the concrete blocks

RESEARCH AND CONSULTANCY

FDN has been assigned with many tasks, which requires various specific investigation and consultancy. In order to fulfill these assignments, FDN has a capacity for structural surveys, reviews, laboratory testing and other research, which are often in a close cooperation with universities. Only professional examination is the guaranty of the correct answer for Your question

Testing of the pedestrian bridge from UHPFRC





Computer modelling and testing of the stairs from high-strength concrete

SERVICES

FDN mainly delivers all-round consultancy and construction services for clients, who intend to realize large civil engineering projects. Our clients are governments, contractors and other engineering companies. We also provide our knowledge to project developers for the design and building of new resorts and harbours. On request FDN employees can be deployed to the client's location around the world. FDN successfully recognizes the need for new innovative products on the market and has already responded by developing new products. The products include several floating breakwater and floating structures, a pavement cable element and a modular bridge from ultra-high performance fibre-reinforced concrete (UHPFRC).