

Submerging geomembrane constructions

Submerging a geomembrane construction using a pontoon



Example project – Future Industrial area - Harbour 7 and 7A, Waalwijk

Roads and a sewer system were laid in preparation for future building developments. The sewer system is below ground-water level. Instead of de-watering the sewer trenches during sewer construction, a geomembrane construction was sunk in order to prevent the nearby nature reserve from drying out.

As the excavations were elongated and of a uniform width, it was decided to sink most of the geomembrane construction using a pontoon, based on the 'overpressure principle'.

After the excavation work was completed, the pontoon was covered with the geomembrane construction.

The geomembrane construction is made of PVC foil with a thickness of 0.8mm and a standard roll width of 2.00 m. The geomembrane was prefabricated at Genap into sheets of about 2,000m² and then, folded cross-wise, rolled up and delivered on location.

By means of a cable-operated crane fitted with a spreader beam, the rolls were unrolled on the pontoon and welded together to a size of about 15,000m².

The geomembrane construction was sunk using water overpressure. For this purpose, water is pumped from the front to the back of the pontoon. This causes overpressure at the rear end and presses the geomembrane construction to the bottom of the excavation.

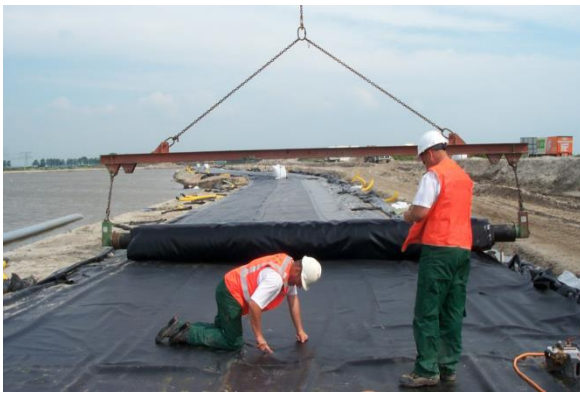
After it is sunk, the geomembrane construction is handed over to the client who applies a layer of sand to it using a hydraulic excavating machine and a sieve.

Submerging a geomembrane construction under its own weight

Example project - N31 Langdeel Aqueduct, Leeuwarden

As opposed to other aqueducts constructed in the Netherlands where a geomembrane construction has been applied, here and for the first time, large scale use is made of a new submerging technique developed by Genap.

The principle relies on submerging a geomembrane construction under its own weight, without using a sinking pontoon. The construction pit in which the geomembrane construction was sunk for the Langdeel Aqueduct measures 800m in length, 180m in width and is about 27m deep.



To enable the geomembrane construction to be submerged, it must be pulled over the water in one contiguous piece. To realise this, the entire geomembrane construction is assembled as one contiguous piece in front of the excavation on the long side of the construction pit, including the necessary floats, pulling strips and other facilities.

The geomembrane construction is sunk by pumping the water from under the geomembrane and discharging it onto the floating foil construction. This is known as pumping the water around in closed circuit. For this purpose, a drainage system was sunk into the construction pit. The drainage pipes are connected to drainage pumps at the top on the bank. The geomembrane construction is pulled over the water with cables using a winch system. The winch system's cables are connected to the pulling strip of the waiting geomembrane construction.

After all preparations have been made, and weather conditions are favourable, a start can be made with pulling the geomembrane construction. Because of the greater width in the middle of the aqueduct, the submerging operation is started by first pulling the middle of the geomembrane package onto the water, after which the sides slowly follow. The



geomembrane package is then pulled over the water in one movement. The entire front of the geomembrane package comes simultaneously onto the quay where the winches are anchored, and is then pulled onto the side and fixed. Excess geomembrane construction length (the diameter of the pit is greater than that of the water's surface) remains on the water.

Now the actual process of submerging the geomembrane construction can start. By means of drainage pumps 1 million m³ of water is pumped from under the geomembrane and discharged onto the floating geomembrane construction.

After all the water has been pumped from under the geomembrane construction and the latter rests on the bottom, extra water is added on top of it to press the geomembrane firmly on the ground. Eventually the sunken geomembrane construction is tested for water-tightness using a geo-electric measurement method and handed over to the main contractor who provides the geomembrane construction with the necessary ballast layer.



Submerging a geotextile construction

Example project - Settling reservoir, Veendam



Instead of applying a geomembrane construction under wet conditions, it is also an option to submerge a geotextile. Genap gained plenty of experience on the Veendam settling reservoir project and the N242 project at Alkmaar. In principle submerging a geotextile construction is the same as applying a geomembrane construction, except the material has a different purpose. On the one hand, a geotextile construction can be used to apply a protective layer under a geomembrane construction to be fitted later, as was the case of the project N242 at Alkmaar.

On the other hand it is possible to apply a separating layer between the bottom layer and the water, as was the case with the settling reservoir in Veendam.

The material chosen is 500-gramme non-woven geotextile. This is supplied prefabricated or is constructed on-site and is pulled over the excavation by means of a pulling strip and a winch system. Using a special technique developed by Genap, the geotextile sinks into the excavation where it acts as a filter sheet and/or protective sheet.

Connections for connecting geomembrane constructions to engineering structures



There are several methods to connect geomembrane to concrete structures so that they are watertight. Genap advises applying sills in both dry and wet environments. These synthetic profiles can be poured into the shuttering and are subsequently welded watertight to the geomembrane construction.