Enka® Solutions

Case Study

Tunnel drainage of a high-speed line tunnel with EnkaDrain

“Tuneles de Udalaitz”, Spain

Product
EnkaDrain 5006H/5-2s/ M110PP

Function
Tunnel drainage

Contractor joint venture
Union Temporal de Empresas - Ute Sector 2

Installers
Orion tuneles and HISISA

Volume
155.000 m²

The main project was the construction of the Vitoria-Bilbao - San Sebastian high speed line. The unique geological conditions in the Mondragon - Elorrio - Bergara section near Udalaitz required the construction of a long underground tunnel. This solution, however, brought with it some typical tunnel construction problems, such as the drainage of excess water.

Challenge

Tunnelling is a special form of geotechnical engineering, one in which a lot of different factors have to be taken into consideration in design and construction. One of the main causes of many problems is water. Seepage or groundwater infiltration can damage the inner lining of tunnels, leading to water intrusion and general stability problems.

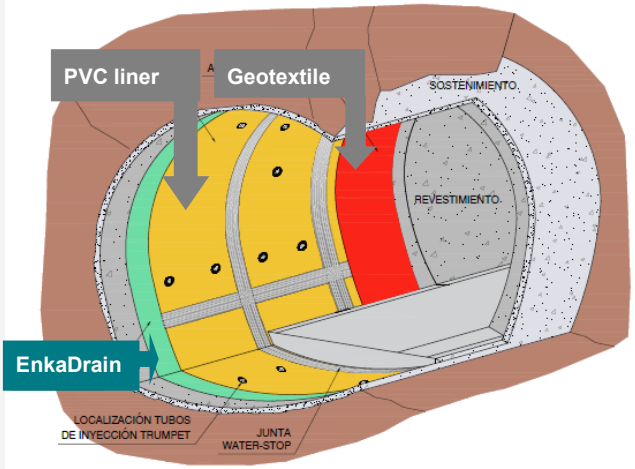
These are conditions that are obviously unacceptable for the safe operation of the tunnel during both the construction period and afterwards. That is where an effective tunnel drainage system comes into the picture.

Solution

The purpose of waterproofing is to capture leaks and drips that can damage the coating, and to prevent these from entering the structure.
In this project, the drainage system has two major functions:

- the primary waterproofing captures greater and potentially more dangerous penetrating water and leads this away through drainage pipes,
- the waterproofing is designed to deal with scattered drips by enveloping the whole cross section with a watertight sealing.

Installing the PVC membrane from the inside, connected to the EnkaDrain.



Perspective view of the tunnel sealing

About the sealing system

The main waterproofing system consists of multiple layers, as seen in one of the pictures below. From the outside to the inside, the layers and their functions are the following:

- drainage geocomposite (EnkaDrain): this leads away any water ingress from the overburden soil, so that it does not affect or harm the structure;
- laminated PVC geomembrane: a watertight membrane, it separates the potentially wet drainage product from the dry tunnel surface;
- protection geotextile: mechanical protection, protects the geomembrane from punching and tearing caused by irregularities in the tunnel coating surface.

The product used was EnkaDrain 5006H/5-2s/M110PP, which is a light and flexible geocomposite matting consisting of a three-dimensional polypropylene monofilament drainage core bonded to two polypropylene geotextiles. The core is thermally pre-formed in a V-shape configuration, making it optimally pressure resistant.

Benefits of the solution

This Enka Solution is a very good choice for this particular project, mainly because of EnkaDrain's excellent and long-term proven performance under very high loads. The product has a high flow transmission rate and good internal shear resistance properties.
The EnkaDrain Wide family is produced in 5 m wide, 100 m long rolls, which considerably eases the installation process. The drainage product is lightweight, easy to handle, and can be installed in all kinds of weather and construction site conditions, which is also an advantage in the case of tunnels.

Result

With the use of EnkaDrain, Low & Bonar was able to provide a cost-effective, long-term solution using recyclable materials, thus contributing to the overall sustainability of the project

Products used

EnkaDrain 5006H/5-2s/M110PP

Infiltrating water collected by EnkaDrain

2mm PVC liner installed in the arch structure

China	+86 519 6858 5555	Hungary	+36 23 610 870
France	+33 1 74 90 00 13	Netherlands	+31 85 744 1300
Germany	+49 6022 812020	USA	+1 800 365 7391