Plug project

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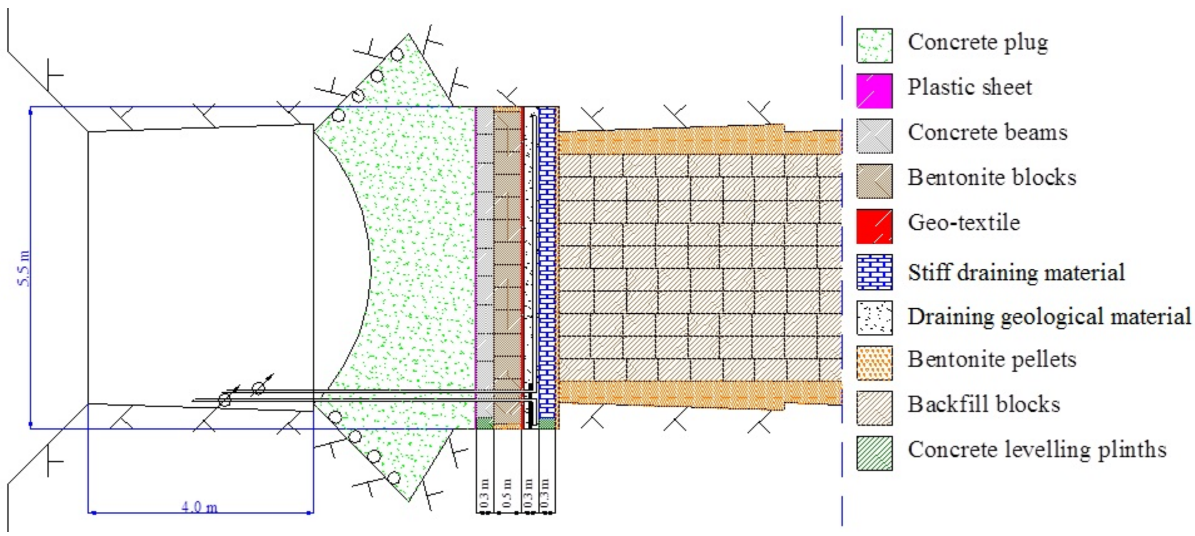

***Figure 1**. Schematic drawing of the plug design.*

The deposition tunnels in a planned repository for nuclear waste will be sealed with a plug at the end of the tunnels in order to withstand the swelling of the backfill and to seal off out-flowing ground water. The principle design of the plug consists of several components, among which the most important are the concrete dome, the bentonite seal and the filter. The water leakage past the plug has to be small enough in order to build up a water pressure inside the plug, and to keep eroding water from the tunnel at an acceptable level. The concrete part of the plug needs time (about 3 months) for hardening and contact grouting, and during that time the concrete section must be kept free from water. Wet tunnels therefore require a drainage system which can take care of the water coming from the inner parts of the tunnel.

A number of criteria need to be fulfilled by the tunnel plug. Besides strength to withstand loads of tens of thousands of tons the plug also need to be water proof. The ability of controlled draining and artificial water filling is also desired in the design. The plug must be functional until the main tunnel also is backfilled, which will be done after up to one hundred years. These issues and demands have been addressed in the SKB project "System design of dome plug for deposition tunnels". The project aims to ensure that the reference configuration of the KBS-3V deposition tunnel end plug works as intended.

The full-scale test consists of a number of components, each with its own purpose (Figure 1). The concrete plug was constructed as a dome plug and was casted in-situ. The next component was the bentonite sealing. This component consists of a stack of highly compacted bentonite blocks and with a filling of bentonite pellets between the blocks and the tunnel wall/ceiling. The purpose of this is to seal off the tunnel flow and hold the water pressure. The next section was the filter which is composed of a macadam filling and LECA-beams. This section allows for artificial wetting of the bentonite sealing as well as drainage of the tunnel flow. The sealing and the macadam filter are separated by a geo-textile which has helped to distribute the water over the sealing. The innermost component is the backfill which consists of a stack of bentonite blocks and a pellets filling.

Clay Technology has had a central role in this project and has been responsible for the design and installation of the filter and sealing parts as well as the instrumentation and the follow up of measurements. Much work has been performed in testing and evaluating the material properties of the included components such as the bentonite blocks and pellets as well as the draining filter and geotextile. A large number of laboratory test have been performed. This includes a total of six mock-up tests in lab scale where the draining and sealing function of the design was demonstrated and evaluated. The final goal of the project has been a full scale field test in SKB's Hard Rock Laboratory in Äspö, which is still ongoing.

In Figure 2 two photos from the field test installations are provided. To the left the emplacement of a bentonite block in the sealing is seen. To the right the LECA-beam and the macadam in the filter section is visible together with the geotextile, a bentonite block and bentonite pellets.

Figure 2. *LEFT: emplacement of bentonite block in the sealing. RIGHT: filter section (LECA-beam and macadam) together with geotextile, bentonite block and bentonite pellets.*