GEO5

Location: Kose-Võõbu section on E263 Tallinn-Tartu-Võru-Luhamaa road

Construction period: 2018 – 2019

Designer: Geoman Ltd.

Software: GEO5 Redi-Rock Pro



Base rows of retaining Redi-Rock PC wall



Installation and laying of a reinforcing geogrids

Fine Project Gallery



Mustla Bridge - Estonia

Mustla Bridge description

The E263 is the main road linking the capital city, Tallinn, with Estonia's second largest city, Tartu, and is undergoing a major realignment between Ardu and Võõbu that will reduce the length of road from 12.5km to 11.5km. The Mustla interchange includes a bridge with a requirement for near-vertical abutment retaining walls, for which Parnü Graniit approached Geoman Ltd. in July 2018 to propose a solution using the Redi-Rock PC system that could compete with existing embedded retaining wall design. The abutments have a combined length of approx. 90m, with a maximum retained height of 4.16m with an additional 3.40m high crest slope up to the bank seats. A two-column pier is embedded in the retained soil within 1.70m of the wall face on each side of the bridge.

The ground is predominately silty fine SAND over shallow limestone bedrock, with the original ground level just below the formation level of the retaining walls. The retained material was site-won silty fine SAND, placed and compacted in layers. In order to proceed with the embedded retaining wall design the toe would have had to have been cored and cast in-situ within the limestone bedrock, which is both expensive and time consuming. By opting for Redi-Rock the client was able to avoid any excavation into the bedrock and delays due to curing time.







Design

The Redi-Rock PC is a reinforced earth retaining wall solution based on the standard Redi-Rock segmental mass-gravity system. A 300mm wide strip of geogrid is pulled through the core of the block and is laid with a layer level with the base of the block and one at the top. Any tension is balanced by that in the other layer, preventing the grid from being pulled through the block. This creates a strong, consistent facing connection that does not vary in capacity with depth. Avoiding a continuous layer of geogrid reinforcement reduces the probability of errors in installation and makes it easier to accommodate obstructions in the reinforced fill, as the strips can be splayed up to 15° without compromising the performance of the reinforcement.



Checks on the wall were carried out in the Geo5 Redi-Rock Pro software, which includes a database of the Redi-Rock retaining series blocks and compatible geogrid types, including interface shear and connection parameters, for streamlined setup of the stability calculations. Every check includes a detailed breakdown of the force vectors which made interpretation of the analysis output straightforward, and for checks on the global stability the program exports the analysis directly to the specialized module Slope Stability, which offers greater flexibility for defining complex strata and groundwater profiles where most needed.





Construction

Shortly before construction began it was noted that insufficient space had been allowed for the working width of the road restraint system in front of the northern abutment. Realignment of the wall to create the additional space left only 350mm between the front face of the top course of blocks and the load bearing columns. The solution developed in consultation with Parnü Graniit was to cast only the front 300mm of the Redi-Rock block and embed lengths of rebar that could be used to tie the blocks back to the geogrid reinforcement at the rear of the column. Additional care was taken to tie back the blocks prior to placing the fill directly behind and only use lightweight compaction plant near the reduced width blocks, as the interface shear and overturning stability was greatly reduced. Wall construction was completed in early June 2019.

Conclusion

The software was selected because:

- Database of Redi-Rock products
- Clear visual representation of the design output
- Full stability checks, including specialised module for bearing capacity, settlement and global stability
- Regular updates and improvements





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