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for Mustla Bridge in Estonia

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# Pärnu Graniit Provides Custom Solution for Mustla Bridge in Estonia

**Pärnu Graniit was sub-contracted to design, supply, and install the first bridge abutments in Europe using the Redi-Rock Positive Connection (PC) blocks for the Mustla Bridge along Highway 2 in Estonia. The 90 meters of near vertical, mechanically stabilized earth (MSE) walls that reached 4.16 meters (13.7 feet) tall was a technically challenging project for the young company, and it got even more technical when it was discovered just prior to construction that the traffic barrier would need to be moved back 1 meter (3 feet).**

With the shift in layout, only 350 millimeters (14 inches) remained between the back of the road restraint system and the front of the two load bearing columns for the bridge along the north wall. Rather than insist that someone else involved in the project solve the problem, Pärnu Graniit adapted their solution to suit the new site scenario, knowing it furthered their goal of becoming the premier resource in the Baltics for concrete products in the construction industry.

"We could have let them redesign the road and the road barrier, but we wanted to show how flexible the Redi-Rock system can be in our hands," said Teet Rehtla, sales specialist for Pärnu Graniit.

## The Growth of Pärnu Graniit

Kasper Ojamets purchased a 3,000-m<sup>2</sup> (32,300-square-foot) paving stone production facility in Audru, Estonia, in 2011. By 2014 he phased out production of the paving stones and started producing interlocking bin blocks to fill a void in the construction industry. In 2018 Pärnu Graniit expanded their business two-fold - they began creating custom precast products and licensed Redi-Rock.

"Demand for higher retaining walls got bigger," said Rehtla. "2017 was the year we really understood that we needed an alternative solution for our blocks and also an alternative for the blocks most commonly used in infrastructure construction."



*The custom Redi-Rock blocks used to overcome the conflict with the bridge support columns.*



*Originally slated to be MSE panel walls, over 600 Redi-Rock PC blocks in the Ledgerstone texture create the wingwalls for the Mustla Bridge.*

Rehtla and Ojamets found Redi-Rock precast modular blocks online and began exploring the system that launched in the United States in 2000. They liked what they saw in the massive wetcast blocks that interlock together with patented knob and groove technology to create solutions for many applications, including rail, stormwater, infrastructure, and more. With both solid and hollow-core blocks, as well as the PC reinforcement system for MSE walls, Redi-Rock gravity walls can be built to over 6 meters (20 feet) and reinforced walls can be built to over 15 meters (50 feet).

The straightforward production process for Redi-Rock was also appealing. To pour the steel forms with rubber liners that create natural stone textures on the face of the block, they could continue to utilize a forklift equipped with a concrete hopper.

"Redi-Rock equipment is very easy to use. The molds are well designed, and we like that the forms are independent units, so we can put them wherever we like in our facility," said Rehtla.

Overall, the simplicity of production, the ability to be engineered to taller heights, and the natural stone aesthetics made Redi-Rock a good fit for Pärnu Graniit. As Rehtla said, "In the end the wall needs to retain earth, but it also needs to look good."

### Getting Started with Redi-Rock

Within six months of their initial order of four forms, Pärnu Graniit had won their first project and realized they wanted to expand their Redi-Rock production capacity.



*The Mustla Bridge is the first in Europe with wingwalls to be constructed out of Redi-Rock Positive Connection blocks.*

"We decided to get more forms when we saw that even the smallest backyard projects consist of 60-100 blocks. With our initial configuration we would have been able to do only one or two projects per season," said Rehtla.

When they increased to 16 forms they had the ability to produce a broader array of Redi-Rock products, including solid gravity blocks of various widths, PC blocks, steps, caps, and columns. Pärnu Graniit started to pursue larger civil projects knowing they could now supply the solutions.

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*The standard Redi-Rock forming system is versatile and can be modified to produce a broad array of products including Positive Connection blocks for reinforced walls.*

The first large civil project won by Pärnu Graniit was the walls for the Mustla Bridge, beating out the original specification for an MSE panel wall. Pärnu Graniit was able to cut the overall project cost for the client, as well as eliminate any concern over corrosion of the steel reinforcement for panels due to salty runoff from the bridge.

### **Mustla Bridge Project Customization**

With the first project of this stature, Rehtla leaned heavily on Redi-Rock's support system including European technical manager Liam Donohoe to ensure they executed the project to perfection.

Donohoe helped with the initial concept for the project and then connected Rehtla to Geoman Ltd., a geotechnical engineering firm with locations in Belfast, Ireland, and Granada, Spain. As consulting engineers, Geoman Ltd. helped Pärnu Graniit fully understand the scope of their first reinforced retaining wall project.

"Our responsibility was to ensure Pärnu Graniit turned up familiar with reinforced earth systems and all of the nuances that can lead to issues further down the line," said Ken Knox, EIT, of Geoman Ltd.

In order to overcome the cultural differences between the typical specifications in the UK and what was customary in Estonia, Knox's design and report for the project called out all the technical details – from the 605 710-mm (28-inch) PC blocks and Tencate RR 3000 geogrid to the radius of the curves and specific characteristics of the backfill materials.

Knox, Rehtla, and Donohoe also worked closely together to overcome the issue with the traffic barrier.

"The Redi-Rock system is already quite flexible in terms of dealing with obstructions in the backfill," said Knox. "You can usually for small obstructions just splay the grid around it. There's also another standard detail for large obstructions where you use a waler beam along the back of the blocks, but neither of those worked well for this particular case because of the limited space."

With both of the standard options off of the table, they created a plan to reduce the width of the blocks where they conflicted with the bridge columns. Pärnu Graniit would create custom block faces about 300 mm (12-inches) thick with rebar that protruded from the back of the blocks. The rebar would be utilized to bolt the blocks together with steel channels, as well as thread behind the columns into a system of galvanized steel pipes for the geogrid to wrap through.

"Redi-Rock is a simple idea, but when it gets complicated, we can adjust it to work around a problem," said Donohoe. Forty blocks were custom created to overcome the conflict with the bridge columns.

One of the typical benefits of manufacturing Redi-Rock is that much of the product line is standard and can be inventoried. However, for this particular project, in addition to the 40 custom blocks, Pärnu Graniit needed to special cast the entire project in C30/37 XC4; XD3; XF4; KK4 – the concrete spec for all public sector projects in Estonia due to the high salt content used to deice roads.

Once they were awarded the project, Pärnu Graniit started special casting the 605 blocks necessary for the two walls.

"Since it was the winter and we cannot produce concrete during winter [because our aggregate storage is outside], we outsourced it from a ready-mix company who delivered concrete everyday for us," said Rehtla. In 14 weeks, single casting Monday through Friday, they created the special inventory for the project.

### Finishing the Job

When it came time to start installation, Donohoe was once again on hand to help. Although it was Pärnu Graniit's first time installing a PC project of this size and scope, they were able to install the wall faster than anticipated.

As the crew of three on the jobsite got the hang of the process – setting each course of blocks with a 13-ton excavator, threading the 300-mm (12-inch) strips of geogrid through the core slots of the PC blocks, and then backfilling and compacting before moving to the next course of blocks – they picked up speed. The finished walls stood 10 courses tall with a Ledgestone textured face.

"For us it was a very difficult project, but we were very confident when we were constructing it because we know we had Redi-Rock support," said Rehtla. "Liam was here when we laid the first stone, so it was quite easy to do because everything was explained."

As the overall highway construction project was lagging behind schedule, Pärnu Graniit was once again able to exceed expectations by installing the two walls faster than expected.

"They ended up actually recuperating four weeks on the overall project," said Donohoe.

The Mustla Bridge project was one of 10 projects that Pärnu Graniit fulfilled in their first two years producing Redi-Rock, accounting for 20% of their yearly sales, and they have confidence they'll continue to grow.

"The biggest opportunity for us with Redi-Rock is the starting Rail Baltic railroad construction. We aim to build at least some of the bridges in that project," said Rehtla. ■

### FURTHER INFORMATION

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