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REPLACEMENT OF A CULVERT UNDER HIGHWAY 25 : HDPE IS THE ONLY SOLUTION

A high-density polyethylene solution for refurbishment of a collapsed culvert located in soil with a low load-bearing capacity.

Last April, following heavy rainfall in the previous days, a galvanized corrugated steel culvert (GCSP) located under Highway 25 collapsed. A crater 7 m deep by 9 m wide was formed in the central strip of the highway, at the edge of the northbound passing lane. Highway 25 was then closed in both directions at Highway 339. To ensure the safety of motorists, a bypass road had to be set up at Exit 44 leading to Saint-Roch-de-l'Achigan.

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THE CONTEXT

In the case of Highway 25, where more than 14,000 vehicles go by each day, what happened was a complete deformation of the underground structure of the roadway, shoulder and curved surfaces. In 2001, a GCSP culvert with a diameter of 2.1 m was installed to allow a stream to flow under the highway. The junction of a catch basin connected directly to the crown of the pipe had weakened and collapsed due to corrosion; the road fill then penetrated slowly inside the culvert, which resulted in the collapse of part of the structure of the highway.

The Lanaudière area is known for its clay soil of low load-bearing capacity. Following preliminary studies carried out after the collapse, the data have been confirmed by the Ministère des Transports du Québec (MTQ). Further studies have therefore been necessary to specify the geotechnical and hydraulic characteristics in order to find a permanent solution for the replacement structure.

The MTQ worked quickly to find a durable and safe solution that took into account the low load-bearing capacity of the soil. It should be remembered that Highway 25 is a major communication route, and the objective set by the MTQ was to complete a complete refurbishment project in less than 90 days, whereas it would normally have taken more than 24 months for planning and the implementation of this project within standard timetables.

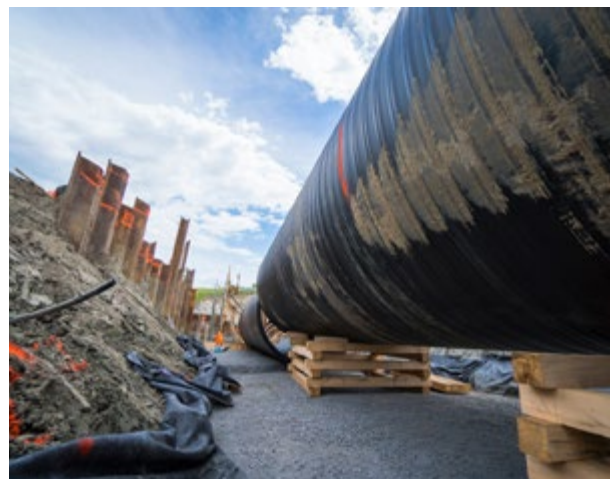
The preliminary study of the situation indicated the possibility of repairing only part of the culvert. However, on reading the results of further studies, the MTQ had to take the important decision to replace more than 100 meters of pipe, thus modifying the scope of the project.



THE SOLUTION

In order to carry out this emergency repair, the Government of Québec decided to award a private contract with L.A. Hébert, a contractor recognized for the quality of its work. The consulting engineering firm CIMA+ quickly assessed the possible materials for this project, concluding that the high-density polyethylene Weholite large-diameter pipe was the best, if not the only, valid alternative for the replacement of this culvert. Soleno's engineers were put to work in collaboration with CIMA+ and L.A. Hébert to draft plans and plan the work schedule.

To complete the work, the pipe diameter was increased to 3355 mm (132 in). Nine pipes totalling 105 metres were installed and welded in place to



THE SOLUTION (CONT'D)

ensure a perfect seal. Each of the welded joints under construction by the Soleno Service team was tested at a pressure of 103.5 kPa (15 psi) to ensure the integrity of the welds.

Taking into account the soil structure and providing for settlement in the medium term, the culvert was designed with a slight positive camber over both lanes. The engineers felt that the pipe would return to a perfectly horizontal position after the soil compaction, to ensure a flow of water without stress once the loads were applied. Both ends of the culvert were cast in concrete headwalls designed to protect the roadway structure.

In the schedule for completion between April and the end of July, Soleno and Soleno Service teams were active on-site in June to coordinate the delivery, installation and welding of the pipes. Support from the contractor and coordination of the work teams were paramount to the success of this project.



THE BENEFITS

Weholite pipes range in size from 450 mm (18 in) to 3355 mm (132 in). Their length, up to 15 m, makes it possible to reduce installation time. In this case, 10 days were sufficient to do the job. Unlike GCSPs, Weholite pipes offer increased resistance to corrosion, abrasion, chemicals, de-icing salts and soil movements, avoiding their degradation and ensuring the sustainability of the infrastructure. High-density polyethylene has an exceptional lifespan of more than 100 years. Its light weight and ease of connection by welding or by screwed joints allow for easy and fast handling which does not require the services of specialized contractors. Any qualified contractor for the installation of sewers and aqueducts may carry out the installation. Moreover, connections between pipe sections is done on site by the Soleno Service technical team using a proprietary thermal fusion process that ensures watertightness. Finally, their installed cost (material and installation) is extremely competitive and allows projects to be carried out quickly compared to traditional pipes.

From a hydraulic point of view, HDPE pipe is advantageous compared to traditional solutions; its Manning coefficient being low, it allows for a flow without constraints for a smaller diameter. Weholite HDPE pipes are a type of flexible pipes where compressive strength results from appropriate compaction of backfill materials. Flexible pipes allow installation in soils with low load-bearing characteristics or in difficult site situations, as the structure of the pipes can absorb a certain amount of deformation. For the culvert underneath Highway 25, these characteristics were exploited to a maximum extent in order to deliver a project where the constraints of installation were important.



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