PIPE RELINING GUIDE 2017

Trenchless TECHNOLOGY

Keeping the Trains Running:

MuddRuckers Completes Challenging Trenchless Culvert Repairs for CN Rail

BY ANGUS W. STOCKING, L.S.

MUDDRUCKERS CONCRETE LEVELING & LIFTING, based in Winnipeg, Manitoba, are the pioneer users in their region of a well-tested trenchless pipe repair solution from AP/M Permaform known as CentriPipe, a centrifugally cast concrete pipe (CCCP) process.

"We were the first local contractors in our area. Prior to this, we'd completed 12 CentriPipe projects," explains general manager Doug Cook. "As people see the results and realize how useful it is as a cost-effective trenchless repair system, we're seeing more new opportunities for it."

Basically, CentriPipe uses a manually operated, sled-mounted spincaster, withdrawn through large diameter pipe, to spray thin, smooth layers of high-strength, fiber-reinforced fine aggregate composite concrete onto the inner surfaces of failing sewers, pipes, and culverts. In two to three passes, the process casts a brand new, structurally sound concrete pipe that adheres tightly to failing substrate (thus leaving no annular space for water flow) without relying on the substrate for support. In most cases, the new pipe is less than two inches thick, so flow capacities are only minimally affected. Additional advantages of CCCP include minimal staging areas; the ability to spincast onto virtually all existing materials, including CMP, brick, and cast iron; cure times of less than a day; the ability to spincast effectively in moist conditions; and cost-effectiveness. In large diameter pipe, CentriPipe's per foot costs compare very favorably to competing solutions such as cured-in-place pipe (CIPP).

All these advantages caught the attention of the Canadian National Railway (CN), Canada's largest railway and only transcontinental railway, and with significant trackage in the central United States along the Mississippi River valley from the Great Lakes to the Gulf of Mexico. As an alternative method of culvert repair, CN commissioned MuddRuckers to complete two pilot projects.

"CentriPipe was attractive to CN because it doesn't disrupt rail traffic, and because it can be applied in remote areas," Cook says. "And, during the first project, we found out that we could perform spincasting safely and effectively even while trains were passing over our work site—the vibration didn't seem to affect coverage at all. So, that's yet another advantage of this process."

The two projects were similar, in that they were both culverts running directly under high-traffic rail. But they also presented differing challenges that illustrate the utility of CCCP in various rehabilitation scenarios.

Fairmount Road – A Winter Project

This was a large project, twin 36-in. diameter CMP culverts, 62 ft long, running in parallel underneath a busy section of rail with trains passing over about hourly — "A good example of track that simply cannot be disturbed for a culvert rehabilitation," Cook says. "Pipe ramming might have been the choice here, if CentriPipe hadn't been available, but the available staging area was small and would have made ramming difficult. This was a perfect situation for CentriPipe."

The project took place in January, so cold was also a challenge. Not extreme cold, by Manitoba standards, about -20 C (4 F), but temperatures have to be considerably warmer for the cementitious grouts used to mix and flow well, and to cure. Fortunately, Muddruckers is well practiced when it comes to work in freezing temperatures. "We've got it down to a science."

4-ft x6-ft and 4-ft x 8-ft panels, made of plywood and rigid insulation were used to build walls around the culvert ends, and the walls were covered with insulated tarps to create large hoardings.

"This is a system that is fast and easy to put up," Cook says. "And it's flexible enough to match uneven grades." With end enclosures in place, ground thaw heaters and hoses were introduced and left in place for a few days; this brought temperatures up in the existing culvert, and melted ice so that dewatering could take

place. Muddruckers has also learned that heating mix water improves quality, so water heaters are used during actual spincasting.

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Another particular challenge of this project was the culvert condition. Though rusty, the CMP was mostly intact. However, the culvert was relatively clogged with mud and debris. After most physical debris was removed, MuddRuckers used a vacuum truck to remove mud and dewater the culvert, and completed the culvert preparation with scouring. In this case, the existing pipe was sound enough for spincasting to proceed, but on some projects pipe wall patching is needed and, fairly often, new inverts are poured to provide a smooth surface for even sled withdrawal. Unusually, there were some interior brackets in this culvert.

"We considered removing them," says Cook. "But instead we were able to do the application right over them, and feather around them — when we were done, they barely showed."

Once culverts are prepared, the actual CentriPipe work was straightforward. The hoarding around the work end of the culvert was greatly expanded to enclose the heaters, water tanks, winches, and pumps needed to supply and withdraw the CentriPipe spincaster, and half-inch layers were applied on two successive days. Layer thickness is judged by the on-sled operator, who can adjust withdrawal speed as needed. In some cases, pins or screws are set in existing pipes for use as depth gauges, and total volume of applied material can be calculated from the amount of bags of material used. Here, as is typical, MuddRuckers applied PL-8000, a fine aggregate composite concrete from AP/M Permaform that is fiber-reinforced for high strength and formulated to adhere tightly to most surfaces, even when moist, to avoid slumping or sloughing during spincasting.

Total time on site was less than two weeks, which included clean up and several non-active days when heat was maintained to facilitate curing. Hourly rail traffic was never affected, and train activity did not affect any phase of the CentriPipe work.

Wilkes Avenue

This project was completed during summer months, so cold was not a factor, but like all projects it had its unique challenges. It was 42-in. diameter pipe and it was longer at 85 ft, but both dimensions are well within CentriPipe capacity — runs of a few hundred feet are possible with CentriPipe. More significantly, this culvert was considerably more deteriorated than the Fairmount Road project, and several miles from the nearest railroad crossing, making logistics more difficult.

To repair the rotted-out invert, MuddRuckers poured two layers of PL-12,000, a self-leveling cementitious product from AP/M Permaform. This created the smooth, level surface needed for steady spincaster withdrawal. PL-12,000 was also used for patching and repair of peeling sections of CMP.

Site prep and staging included dewatering and a network of pallets to provide secure footing on the muddy terrain

Since the weather was warmer, and water wasn't freezing, dewatering was more difficult. "It was really saturated, and we couldn't pump over the tracks. So, we dug coffer dams and just kept pumping," Cook explains. "We also had to dig a small hole right in the middle of the culvert, barely a foot deep, basically to collect water and so we had a place to put a hose end in. We filled it with concrete just before spincasting." Mucky conditions also meant that the staging area needed extra attention; pallets were put down for secure footing and anchors were used as needed on the withdrawal winch.

As in the Fairmount Road project, actual application was routine once the culvert preparation was completed. Again, two passes on consecutive days were used to apply a total thickness of one inch. "I'm happy to say that both projects went very well and have held up, and that CN Rail was happy with the results," Doug Cook says. "I expect a lot more projects to be coming down the pipeline."

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