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Concrete Pipe Replaces Two Year Old HDPE Storm Sewer



Reinforced Concrete Pipe with gaskets ready for installation

In the fall of 2009 construction commenced on the replacement of a High Density Polyethylene (HDPE) storm sewer in a small town in South Dakota. Over 4,000 feet (1,220 metres) of 48" (1,200mm) diameter HDPE was replaced with reinforced concrete pipe (RCP). The HDPE had been installed only two years previously. The cost of the project in 2007 was \$1,728,264. This project should be of interest to municipalities, consulting engineers and contractors in Ontario and across Canada as there are valuable lessons to be learned.

Tyndall, population 1,102, is a small community in south central South Dakota. In March of 2007 the City of Tyndall tendered a large storm sewer and street improvement project. The South Main Street Utility and Street Improvements project was designed by SPN Associates of Mitchell, SD. The low bidder on the project, Northern Plains Construction of Winner, South Dakota, was awarded the contract. The project included over 4,000 feet (1,220 metres) of 48" HDPE pipe with heights of cover approaching four metres in places. A significant portion of the pipeline was designed as a twin line. This increased the sensitivity of the installation since the compaction between the pipelines would be more difficult to achieve.

Given these site conditions the consulting engineer, SPN Associates, stipulated that a representative from the company supplying the HDPE, should attend the preconstruction meeting. The HDPE representative was also required to be present on the jobsite at the start of the construction in order to offer advice and comments on, among other things, construction techniques and bedding materials.

In the spring of 2009 City of Tyndall employees noticed that the asphalt roadway was developing unusual cracks and settlement of the roadway. A preliminary investigation indicated that the HDPE pipeline had severely deflected from its original shape. SPN Associates was notified and the entire pipeline was inspected. The results of the inspection showed that the pipeline was deflected as much as 25% in some places. Fearing a catastrophic failure of the pipeline, the contractor was informed that replacement of the pipeline was inevitable. The insurance company holding the performance bond eventually got involved and investigated the cost of replacing the failed HDPE pipeline. The insurance company requested bid proposals from several area contractors for the replacement of the pipeline using HDPE again. Subsequent to negotiations a settlement amount was agreed upon and a cheque was written to the City of Tyndall.



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Scott Hofer, General Manager with Hanson Pipe & Precast from Sioux Falls, SD contacted the contractors bidding the reinstallation of the HDPE storm sewer. Hofer worked with fellow Hanson employees, Don Lepley, P.E. - Senior Technical Resources Engineer, and Ed Page, P.E. - Regional Engineering Manager, to determine the proper bedding details for an RCP installation. Hanson Pipe & Precast recommended a SIDD Type 3 bedding for the concrete pipe option. This recommendation took into consideration the height of cover and the material available on site.

Reinforced concrete pipe is a reinforced concrete structure. It has inherent pipe strength. The strength is built into the concrete pipe in the plant and the concrete pipe producers test the strength of the pipe in the plant before it is shipped to the jobsite. Rigid concrete pipe is less dependent upon the bedding material than a flexible HDPE or CSP pipe. Flexible HDPE pipe has little inherent strength and depends on a properly installed and compacted bedding material completely around the pipe for its strength. Hofer discussed with the bidders the differences in bedding and backfill materials required for the two products, the extra labor and equipment required for proper installation of the HDPE pipe, and the risk of the HDPE replacement pipe failing again similar to the original installation compared to the minimal risk or zero risk using reinforced concrete pipe.

H&W Contracting of Sioux Falls, SD was selected to replace the failed HDPE storm sewer. H&W President, Tom Hurd, subsequently elected to use RCP for several reasons.

- The risk of the HDPE replacement pipe failing was far too great.
- The extra cost for bedding material for the HDPE option and the trucking costs to get that material to the jobsite,
- The extra labour costs associated with proper compaction of the bedding material in the pipe envelope around the HDPE pipe.

Mr. Hurd addressed Tyndall City Council and spoke to the many advantages of using RCP. The council was unanimous in its approval of RCP. Hurd said "The City Council members were extremely happy that RCP was going to be used to replace the failed HDPE."

Scott Hofer made the following assessment at the end of the project: "This project was complex and offered a higher risk of failure with the use of flexible conduits. The use of RCP simplified the replacement project and reduced the risk to all involved because of the inherent strength and durability concrete pipe offers." Construction on the replacement project started in the fall of



RCP being installed as HDPE is removed

2009 and was nearly three quarters complete before weather conditions prohibited further construction. Work started again in April of 2010 and was finished that summer.

Lessons to be learned:

- **Not all pipe systems are the same:** Rigid reinforced concrete pipe systems perform much differently than flexible steel or plastic pipe systems. Engineers and contractors need to understand that the two systems are designed differently and installed differently.
- **Financial Assessments:** Engineers and municipalities need to conduct a thorough financial assessment at the budget stage of a project and take into account the cost of proper installation of plastic or steel and not just the initial purchase price.
- **Design of HDPE:** Engineers need to understand the design process for HDPE pipe. They especially need to understand the importance of designing and specifying proper trench details and embedment details. In the Province of Ontario *The Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services* require design calculations for both concrete and plastic pipes - "Pipe strength design calculations shall be completed and provided to the Chief Municipal Engineer for review." This is a good practice that should be copied by other municipalities.
- **Deflection Testing:** Post installation deflection testing should always be specified in contracts where plastic pipe, HDPE or PVC, is allowed. In this case it was only because of the observations of visual defects at the surface that the serious defects with the installation were identified. An article in this edition of the Concrete Pipe Journal by Paul Imm, P. Eng. addresses deflection testing of plastic pipes.
- **Risk Assessments:** Engineers and municipalities need to conduct thorough risk assessments for the various pipe systems being considered.

