

PE Integrity and Effects of Rock Impingement

Description: To determine whether or not modern PE pipe materials are affected by rock impingement conditions and to eliminate the need to install clean fill in lieu of existing soil.

Status: Project has been initiated.

BENEFITS

The objective of this project is to verify that today's modern PE materials can be installed in many rocky-type soil conditions without the need for sand embedment. Allowing use of backfill materials that contain rocks will reduce the cost of construction for many companies. Although these cost reductions will vary from one company to the next, based on local operating and pavement restoration practices, it has been estimated that installation costs can be reduced by an average of \$3 to \$5 per linear foot of trench for many companies. This includes the cost of trucking, obtaining

clean fill and material handling. For some companies, the savings has been estimated to be well over \$100,000 annually.

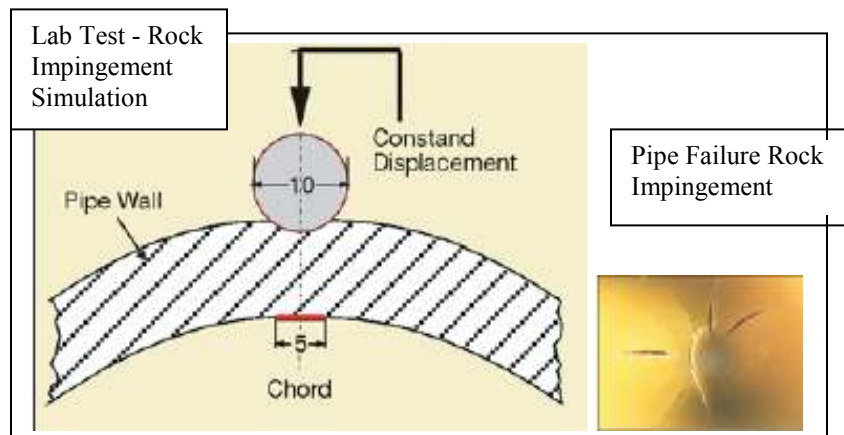
BACKGROUND

In the past, there was no formal way to evaluate rock impingement and its effect on PE pipe service life. Today there are methods available to simulate point loads and quantify the long-term effects on PE pipe. The test methods developed are considered to be conservative and generally apply to a worst case scenario. Although testing was performed in Europe to certify PE 100 pipe, to date there have been no tests on U.S. resins 0to

determine the long-term effects and service life of PE pipe when subjected to rock impingement.

Past experience shows that buried polyethylene pipe can sometimes be damaged by point or linear loads that are acting in addition to the design loads (e.g. internal pressure, earth and traffic load). Linear loads can be produced by wood used as supports below the pipe during installation and not removed after backfilling. Tests have shown that a reduction in service can result from external point or linear loads on pipes. For this reason, codes and standards require that point and linear loads on the external wall of the pipe be avoided during installation. Codes require that the trench base be free of stones and rocks, thereby eliminating failures that could be caused by rock impingement.

Polyethylene resins are continuously being developed with the aim of increasing



creep rupture strength. This increase can be seen in creep rupture curves of various standards between 1976 and 2000. In reality, many of the modern resins have creep rupture values significantly higher than the minimum requirements. This raises the question whether the creep rupture strength of current resins has reached a state of development where a failure with additional point loads should not be expected during pipeline service life.

TECHNICAL APPROACH

The proposal is the first step in evaluating modern PE materials to determine if these new resins exhibit sufficient strength to resist creep rupture and rock impingement. The PE pipe materials will be selected by NYSEARCH funding companies and shipped to Jana Laboratories for the required tests. Slow crack growth resistance of high performance PE Pipe will be characterized under simulated rock impingement conditions. Two pipe sizes having high and medium density materials and different

design ratios will be tested to determine if there is a measurable effect due to wall thickness. While the Rate Process Method (RPM) testing and analysis approach has been demonstrated to correlate well with field service performance of PE piping materials, it is known that the high performance PE materials have such excellent slow crack growth characteristics that the failures needed to utilize this methodology are not expected to occur in a short time frame in the laboratory. Therefore, testing will be conducted using Popelar Shift Functions to predict a minimum expected lifetime. The testing will be conducted in Jana Laboratories, an accredited testing facility.

PROJECT STATUS

The PE pipe materials, sizes and Dimension Ratios have been identified and acquired. All materials for testing have been shipped to Jana Labs. Jana is currently preparing test specimens and finalizing the test parameters that will

be used in this one year effort.

Highlights

- Most gas companies today require clean fill during PE installations.
- Modern PE pipe has a high resistance to slow crack growth.
- Testing in Europe has concluded that most PE materials today no longer require special backfill materials.
- Most utilities can save significant dollars annually by using existing soils.

FOR ADDITIONAL INFORMATION

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Typical Rock Impingement Test Jig Showing Internal Pipe Deformation