North American Society for Trenchless Technology
2007 No-Dig Conference & Exhibition

San Diego, California
April 15-20, 2007

Paper B-1-01

NUMERICAL & EXPERIMENTAL EXAMINATION OF THE LONG-TERM PERFORMANCE OF A CIPP PRESSURE PIPE LINER

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ABSTRACT: There is a growing interest in the utilization of structural CIPP liner for the rehabilitation of deteriorated gray cast-iron water mains. However, little data is available on the long-term performance of such rehabilitation systems with respect to static and cyclic internal pressures. Numerical and experimental studies were undertaken to develop mathematical relationships between the size and geometry of the hole in the host pipe and the burst pressure of the liner, taking into account both the liner's long-term mechanical characteristic and loading history.

Fifteen specimens were subjected to a long term (5000 hours or 208 days) creep test to measure the get the long-term modulus for the liner material as per ASTM D2990-95. In addition, specimens cut in the hoop and axial directions were subjected to suite of short-term tests to evaluate key material properties. Data collected was used in developing a 3-D finite element model to predict the burst pressure of the liner for a gray cast-iron host pipe in which holes of different diameters were introduced. A mathematical expression was developed in terms of burst pressure versus hole diameter. Perditions from the numerical model were compared with these calculated using ASTM F 2207.

Fully deteriorate lined specimens were subjected to the equivalent 50-year cyclic loading to evaluate the impact of this loading mechanism on the long-term burst pressure of GFRP CIPP liner installed in a host-pipe with different diameter gaps. The relative contribution of fatigue to the deformation of the liner under typical cyclic pressure operating conditions was evaluated.