

QUARTERLY REPORT – PUBLIC PAGE

**Validation and Documentation of
Tensile Strain Limit Design Models for Pipelines**

Date of Report: May 30, 2008

Contract No: DTPH56-06-000014

Prepared For: United States Department of Transportation
Pipeline and Hazardous Materials Safety Administration
Office of Pipeline Safety

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For Period Ending: May 30, 2008

Progress to Date

This project, funded by PHMSA, PRCI, and several other industry partners is aimed at developing strain capacity models and documented procedures for establishing tensile strain capacity limits. Industry partners directly participating in the study include BP, Chevron, Duke, El Paso, Enbridge, ExxonMobil, Gassco, Gaz de France, IPSCO, JFE Steel Corporation, Lincoln Electric, Nippon Steel, Pacific Gas & Electric, Petrobras, Saudi Aramco, SoCalGas, TransCanada PipeLines Limited, TAMSA and Williams.

The primary objectives for the research are to:

- obtain high quality test data to identify the dominant parameters governing the tensile strain capacity of pressurized pipes;
- building on previous work, apply test data to assess the accuracy of existing numerical and engineering models, modify the models to improve accuracy and identify requirements for second generation model development;
- prepare a state-of-the-art guidance document to establish tensile strain limits based on existing SBD models; and
- develop second generation tensile strain limit models and strain-based design (SBD) procedures.

These objectives will be achieved through a well planned and executed experimental testing program from small- to medium- and large-scale, and advanced computational modeling that reflects material's micro-scale response and global structure response.

The project is comprised of the following tasks:

1. Initial Analysis and Test Matrix Development
2. Pipe Acquisition and Specimen Fabrication
3. Small-Scale Material Tests
4. Full-Scale Small Diameter Pipe Tension Tests
5. Analysis of Full-Scale Small Diameter Pipe Tension Tests
6. Full-Scale Large Diameter Pipe Tension Tests
7. Medium-Scale Curved Wide Plate Tests
8. Model Verification and Modification
9. Initial Guidance Document Preparation
10. Progress, Planning and Review Meetings
11. Reporting and Final Presentation
12. Program Management
13. Focused Presentation to PHMSA/OPS

To date, 12 full-scale small diameter pipe tension tests have been completed and four medium-scale curved wide plate tension tests on material from similar pipes were carried out. The primary purpose of the pipe tests was to explore the effects of internal pressure on the tensile strain capacity of pipe with circumferential flaws in the pipe body and weld region. The curved wide plate tests were intended to show the degree to which specimen configuration and constraint conditions (i.e. differences between tension loaded pipes and plates) affect strain capacity.

The pipe tests performed to date clearly demonstrated the detrimental effect of internal pressure on the tensile strain capacity. The curved wide plate tests showed that the strain capacity obtained from this test configuration is similar to that obtained for unpressurized pipes.