

# Get Deterministic (not probabilistic) Pipeline Integrity Assessment with ATC's Innovative Nondestructive SSM Technology

## Pipeline Services

ATC's SSM systems are being successfully used in field inspections in the USA, Europe, and Asia.



## Advanced NDE Techniques for Measuring Tensile and Fracture Properties

ATC's patented In-Situ Stress-Strain Microprobe™ (SSM) System measures the yield strength, stress-strain curve, ductility, and fracture toughness of oil and gas pipelines, including their welds and heat-affected-zones, using its fast, localized, and nondestructive Automated Ball Indentation (ABI) technique.

Integration of ABI-measured key mechanical properties with crack/defect measurements (using conventional UT or eddy-current techniques) allows deterministic structural integrity assessment (DSIA) superior to any probabilistic risk analysis method.

## Benefits of the DSIA include:

(1) Meet increased energy demands utilizing your existing pipeline assets by safely up-rating the transmission pressure of your oil and gas pipelines;

(2) Nondestructively measure tensile properties of pipelines without documentation using Automated Ball Indentation;

(3) Verify grade certifications for new or existing pipelines, and for repair sections that usually have no documentation because of their small quantity;

(4) Measure the actual tensile and fracture properties of welds in new construction and repairs nondestructively and quickly on site;

(5) Eliminate expensive pipeline accidents and their environmental damage;

(6) Comply with new regulations for safe operation and produce effective pipeline integrity managements plans;

(7) Complement your conventional NDE inspections (using in-line smart pigs or off-line instruments) with ATC's innovative nondestructive measurements of key mechanical properties to obtain robust fracture mechanics analysis and to apply Level III of Fitness-For-Service (API RP-579).

• Read our report to the US DOT/OPS and its review of the innovative SSM technology for pipeline industry on our website: [www.atc-ssm.com](http://www.atc-ssm.com)

• ATC is the only source for the SSM technology and certified field testing services.

**Improve safety and increase your operating profit by taking advantage of ATC's SSM technology and certified testing personnel.**



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# PIPELINE INTEGRITY ASSESSMENT

## NONDESTRUCTIVE MEASUREMENT OF TENSILE AND FRACTURE PROPERTIES



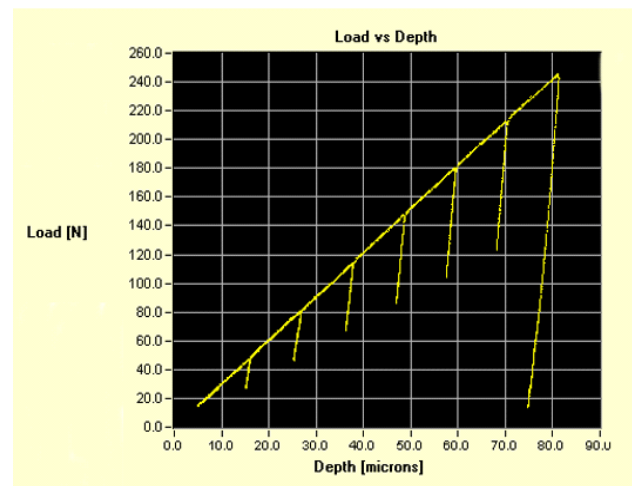
The testing head of the SSM system is temporarily attached to the pipeline using electric-magnets.

### ABI Test

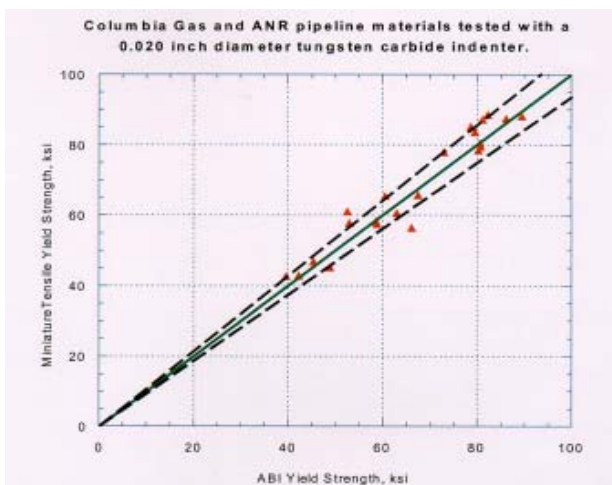
During an ABI test, progressive indentation is made in a single polished test location. The indentation load and depth data are continuously measured and used to calculate the incremental strain and stress values (based on elasticity and plasticity theories). The fracture toughness value is calculated from the indentation deformation energy and the critical fracture stress.

The nondestructive, portable SSM-M1000™ is designed for testing components and structures in the field. It utilizes an Automated Ball Indentation (ABI) test technique to measure key mechanical properties. See a complete list of references and video demo on our website [www.atc-ssm.com](http://www.atc-ssm.com).

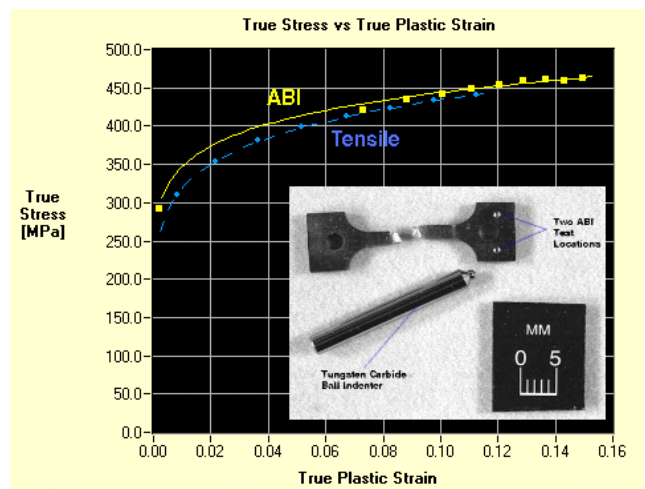
### SAMPLE ABI TEST RESULTS



(a) Data from an ABI test performed, using the magnetic mounts and the battery pack, on X42 steel pipe using a 0.51-mm (0.020-inch) diameter tungsten carbide indenter.



Comparison between the yield strength from ABI [using a 0.51-mm (0.020-inch) diameter indenter] and miniature tensile tests. The dashed lines are the  $\pm 5\%$  variation from perfect agreement.



(b) Comparison between the true-stress/true-plastic-strain curve from the ABI data shown in (a) with the curve from a miniature tensile specimen manufactured from the same pipe.

### References:

- (1) "Nondestructive Determination of Yield Strength and Stress-Strain Curves of In-Service Transmission Pipelines Using Innovative Stress-Strain Microprobe™ Technology." Final Report to U.S. Dept. of Transportation, Office of Pipeline Safety, Sept. 1999.
- (2) "In-Service Nondestructive Measurements of Stress-Strain Curves and Fracture Toughness of Oil and Gas Pipelines: Examples of Fitness-for-Purpose Applications." Proceedings of the 5th International Conference on Pipeline Rehabilitation and Maintenance 2002, Bahrain, Jan. 2002.