IV. SUMMARY

This report has introduced the results of axial compression, axial tensile, bending and underground tests of Steel Pipe for crossing Fault (SPF), which were conducted at Cornell University in the United States as performance tests of SPF.

In the axial compression test, even though the test pipeline was deformed to about twice the allowable value of inner contact displacement, deformation concentrated only on the wave-shaped section. Complex deformation behavior did not occur, and there were no cracks or leaks.

In the axial tensile test, deformation started in the wave-shaped section, and when the allowable deformation (50 mm) was exceeded, creases (buckling) occurred in the axial direction. However, as the straight pipe part began to elongate under increasing deformation, no cracks or water leakage occurred.

In the bending test, a four-point bending test was performed to an allowable bending angle (inner surface contact angle) of 18° and further to 36.6°, which is about twice the allowable bending angle. No complicated deformation was observed and no cracks or leaks were found.

In the underground experiment, simulated fault displacement of 610 mm was applied to a test pipeline at a fault angle of 50°. In the experimental results, the pipe was deformed to 42°, which was about 4 times the set allowable value of the inner contact angle (9°), but deformation was limited to only the wave-shaped sections, and cracks and leaks were not observed.

From all the test results, no cracks or leakage occurred, even when deformation of several times the allowable axial displacement and bending angle were applied, because the wave-shaped sections were designed with sufficient safety against the set tolerance. Thus, it is considered possible to absorb deformation due to fault displacement, even if unexpected deformation occurs, without failure of the pipeline.

Moreover, in a FEM analysis conducted under the same conditions as the tests, the experimental values and analytical values coincided with very high precision. Therefore, it can be concluded that reproducibility is high even under conditions such as different diameter and pipe thickness.

We hope that this method will be considered one effective option for countermeasures for pipelines crossing faults, and will lead to the construction of earthquake-resistant water pipelines in the United States.

REFERENCE

[1] WSP077-2012 “Steel Pipe for Crossing Fault”, Japan Water Steel Pipe Association, 2012.