

TechTalk

Composite Pipe External Load Test



Outline

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- Discussion and conclusion

Please visit flexpipesystems.com for additional information.



Flexpipe conducted a variety of tests on its products to determine their ability to withstand external loading generated by the movement of heavy equipment.

Flexpipe engaged Stress Engineering Services, Inc. (SES) to simulate the test scenarios. SES measured the amount of deflection on pipe samples buried at various depths of 1 foot (30.48 cm) to 3 feet (91.44 cm) generated by the movement of large-scale equipment commonly found at installation sites. The test setup, samples selection and procedure were jointly developed between Flexpipe and SES.

Test procedure and setup

The site in which the testing took place, is similar to customer sites located in Southwest Texas, with regard to soil, rocks, dryness, and other land considerations.

The table below indicates what Flexpipe samples were tested, and what depth they were buried at.

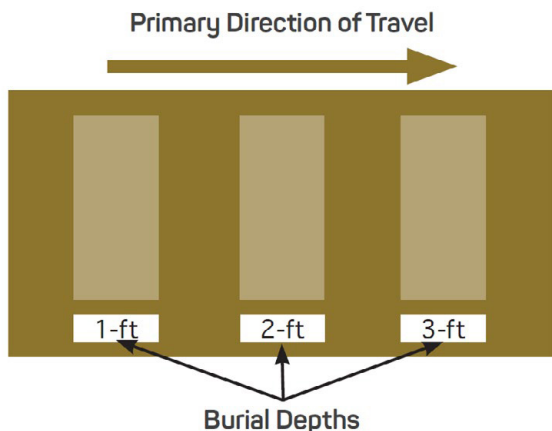
SAMPLE	BURIAL DEPTH (FT./CM)
3" FP 601	1/30.48
3" FP 601	HT 2/60.96
3" FP 601	HT 3/91.44
3" FP 601	HT Surface
3" FP 601	3/91.44
4" FP 601	1/30.48
4" FP 601	SURFACE
2" FP 301	2/60.96

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Test procedure and setup

To measure the amount of deflection caused by the vehicles traveling over unpressurized buried pipe samples, displacement transducers were mounted internally within the pipes and were continuously monitored during the test. The vehicles used for external loading were selected based on weight and common presence on a drilling site. Deflection was then measured both vertically and horizontally. To quantify the weight of the vehicles used for loading, each truck drove over a calibrated scale before crossing the surface and buried pipe sites. Each axle was weighed independently. Due to the length of the samples used in testing, deflection in the pipe was measured at one location and was therefore only loaded by one wheel per axle. The table below shows the weights of the different axles.

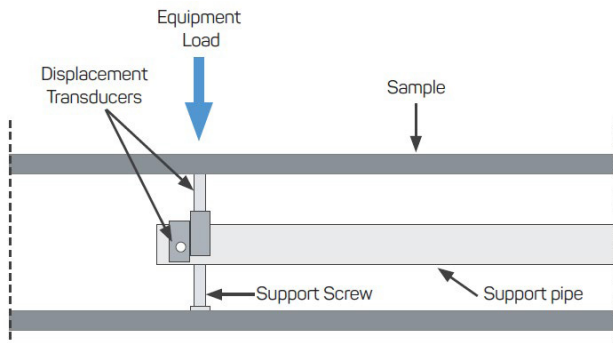
SAMPLE	AXLE	BURIAL DEPTH (FT./CM)
Rubber Toe	1	3,500/1,588
Black-Hoe	2	5,240/2,377
Water Hauling	1	6,180/2,803
Tank Truck	2	7,180/3,257
	3	8,840/4,010
	4	9,220/4,182
	5	11,180/5,071
Coiled Tubing	1	6,840/3,103
Unit Double	2	9,720/4,409
Pumper Truck	3	8,840/4,010
	4	9,560/4,336
	5	11,160/5,062
	6	10,540/4,781
	7	10,920/4,953



A rubber tire back-hoe was used to prepare the trenches at the desired depths and upon placing the pipe samples and leads in the trenches, the back-hoe backfilled the trenches. A smooth drum soil compactor was then used to compact the soil. The pipe was laid in the following manner. The rubber tire back-hoe and roller were used for the initial load tests on the buried Flexpipe samples. Subsequent load tests were conducted using a water hauling tank truck and a coiled tubing unit double pumper truck.

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The samples were positioned in the trenches such that one displacement transducer was oriented vertically and the second was oriented horizontally. Pre-test I.D. and O.D. measurements for these and the remaining samples were measured. These measurements were repeated following testing to observe any permanent changes in the samples.



Results - buried samples

External load testing of the buried samples was performed in two stages. The first stage of testing was completed immediately following burial and involved loading from the rubber tire back-hoe used during excavation and the backfill burial of the pipe samples. As the rubber tire back-hoe moved back and forth across the samples, the measured deflections were recorded. During this test, the equipment traveled towards the 1 foot (30.48 cm) samples crossing the samples buried at 3 feet (91.44 cm) first.

- The maximum recorded vertical displacement during testing with the rubber tire backhoe was less than 1/16" (or 0.13 cm).

The second stage of testing took place one week after the initial rubber tire back-hoe test. During the second stage of testing, the water hauling tank and coiled tubing unit double pumper trucks were used to provide external loading. In each of these conditions, the equipment traveled in the direction, crossing the 1 foot (30.48 cm) samples first. The vertical displacements were recorded for samples buried at soil depths of 3 feet (91.44 cm) and less.

- The greatest displacements observed during the water hauling tank truck rollover was in samples buried at a depth of 3 feet (91.44 cm), which was less than 1/16" (or 0.13 cm; 1.6% displacement)

- The greatest displacements observed during the coiled tubing unit double pumper truck rollover was in samples buried at a depth of 1 foot (30.48 cm), which was less than 3/32" (or 0.21 cm; 2.7% displacement)

Results - surface samples

Surface samples were also subjected to external load testing while recording deflections. External loads for surface samples were produced using the rubber tire back-hoe, the coiled tubing unit double pumper truck, a half-ton truck, and a ¾ ton truck. Quantitative deflection measurements were recorded during all above ground tests with the exception of the coiled tubing unit double pumper truck rollover. This was due to an anticipated deflection of greater than ½" (or 1.27 cm) and likely the destruction of the displacement transducers. In each of these rollovers, deflections were such that the maximum transducer displacements of ½" (or 1.27 cm) were recorded. While using the rubber tire back-hoe, the displacement transducers also suffered permanent damage.

Discussion and conclusion

In each buried sample, the displacement that occurred during the series of tests was less than 5% of the pipe external diameter, which is a typical amount of deflection which results in no deterioration in performance of Flexpipe products. The surface samples were more significantly deflected. Running over surface piping is not recommended by Flexpipe. In conclusion, these tests have demonstrated that Flexpipe products have the ability to maintain structural integrity under heavy loads at a depth of 1 foot (30.48 cm) and greater. For recommendations regarding running traffic over buried Flexpipe pipelines, please discuss the details of your particular application with Flexpipe Engineering. Further testing is ongoing with additional surface samples exposed to loads from light trucks.