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LARGE SCALE EXPERIMENTS OF BURIED STEEL PIPELINES WITH ELBOWS SUBJECTED TO PERMANENT GROUND DEFORMATION

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Earthquake-induced Permanent Ground Deformation (PGD) can affect significantly underground gas or water pipelines. This paper describes large-scale experiments to investigate the effect of PGD on buried steel pipelines with elbows, and to validate and calibrate Finite Element (FE) modeling. There is good agreement between both the magnitude and distribution of measured strains and deformation and those modeled with FE analyses. The analytical models are able to simulate real performance in a reliable way for dry sand, and for partially saturated sand with an adequate correction factor. Using the analytical model, recommendations are proposed for enhancing the earthquake-resistance of buried pipelines with elbows subjected to PGD.

Key Words: pipeline, elbow, earthquake, gas utility, experiment, FEM, ground deformation, liquefaction, landslide, lifeline, soil-pipe interaction, sand, water content

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