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The GeoEngineering Centre

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MASOUMEH SAIYAR, PHD (2011)

RESEARCH SUMMARY

BEHAVIOUR OF BURIED PIPELINES SUBJECT TO NORMAL FAULTING

VARIOUS DUCTILE PIPE MODELS PROVIDED RESULTS EXAMINING EFFECT OF PIPE STIFFNESS

GLASS PIPE MODELS PROVIDED DATA ON ROTATIONS AT BREAKS

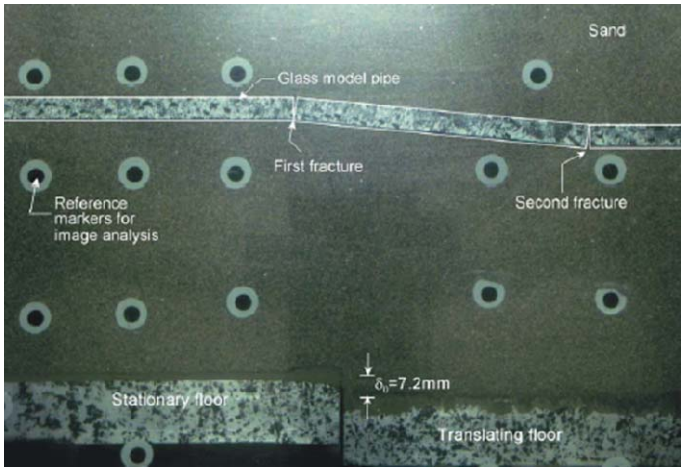
ALUMINUM MODELS WERE ALSO DEVELOPED TO EXPLORE THE BEHAVIOUR OF JOINTED PIPES

NEW FILTERS FOR PARTICLE IMAGE VELOCIMETRY WERE ESTABLISHED

THE DATA WAS USED TO DEVELOP DESIGN CALCULATIONS FOR PEAK MOMENT & SHEAR

THE JOINT ROTATION ESTIMATION PROCEDURE CAN BE USED IN DESIGN OF PIPE REPAIRS

Many circumstances arise where water pipes, sewers, and gas and oil pipelines cross regions of differential ground movement. This may be seasonal (freezing of frost-susceptible soils in the winter, or shrinkage of reactive soils in the summer) or permanent (faults induced during earthquakes). Longitudinal pipe bending results where it passes across ground experiencing differential movements, and this can cause pipe failure.



Glass model of cast iron pipe has similar flexural characteristics and brittle behaviour; here the bending induced by differential floor movement caused fracture.

A series of 1/30th scale (30g) experiments were conducted in a geotechnical centrifuge to investigate the effect of pipe stiffness on the bending moments that develop. Model pipes composed of aluminum, acrylic, polycarbonate and Teflon were used to represent pipe materials from cast iron to polyethylene. Analysis of deformations using Particle Image Velocimetry and calculus provide the distributions of curvature and moment, shear force, and lateral pressures along the pipe. New design methods were then developed to estimate peak moment and shear in the pipe.

HIGHLIGHTS

- 3 articles published to date with more being submitted
- Testing performed using the large beam centrifuge at C-CORE, St John's, Newfoundland
- Now employed as a consultant in Canada

THE LARGE BEAM CENTRIFUGE AT C-CORE

Masoumeh's tests were conducted using the large Geotechnical centrifuge at the Centre for Cold Regions Engineering in St. John's, Newfoundland. This 5.5m beam centrifuge is available through a Multiuser Research Support grant awarded by the Natural Sciences and Engineering Research Council of Canada to Andy Take and a team of scholars from across Canada.

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Masoumeh and the C-CORE Centrifuge