

## MÜGE BALKAYA, PHD (2010)

### RESEARCH SUMMARY

**PROJECT ON JOINTED PIPE RESPONSE TO NON-UNIFORM BEDDING**

**CALCULATIONS OF PIPE STRESSES NEAR VOIDS UNDER THE PIPE INVERT**

**MODELING OF GASKET-BELL AND GASKET-SPIGOT INTERACTION**

**3D FEA USING ABAQUS EXAMINING BOTH PIPE ASSEMBLY AND BURIAL**

**ANALYSIS COMPARED WITH PIPE MEASUREMENTS DURING INSERTION & BENDING TESTS**

**A MAJOR CONTRIBUTION TOWARDS JOINT MODELING AND DESIGN**

### HIGHLIGHTS

- New models for pipe assembly published in the Transportation Research Record
- Analysis techniques are contributing to development of joint design methods for AASHTO
- Can be extended to develop rational methods for design of gasket geometry

### FINITE ELEMENT MODELING OF JOINTED WATER PIPES

While many studies have been conducted to examine the behaviour of pipe segments between joints, pipe failures often result because of leakage and other issues at the joints themselves. Gasketed bell and spigot joints, for example, seek to provide easily constructed connections between pipe segments that also release longitudinal bending moments. Excessive moments resulting from variations in ground support (in particular, sections of the pipe invert that do not have bedding support) may cause damage. The complex interactions at the joint include gasket-bell and gasket-spigot contacts that can influence the ability of the joint to resist leakage under internal (or external) pressure.

This study commenced with three dimensional modeling of gasketed bell and spigot joints in PVC water pipes, then proceeded to examine the manner in which joint characteristics influence longitudinal bending and stress increases in buried PVC and cast iron pipes with nonuniform ground support. Issues investigated include the possibility that erosion voids formed at leaking joints might lead to pipe failure (particularly in aged cast iron pipe systems).

The project developed computer modeling techniques that are being in further projects

to develop design methods for culvert joints for AASHTO (the American Association of State Highway and Transportation Officials).

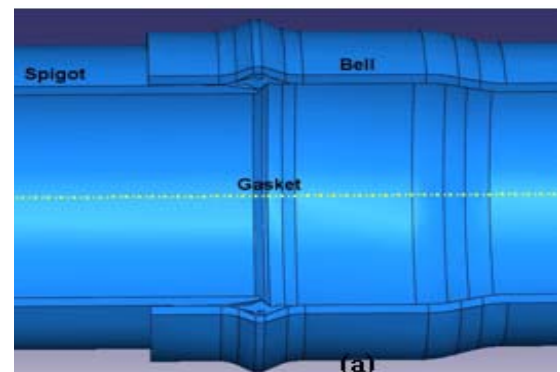
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Three dimensional modeling of bell, spigot and gasket using ABAQUS



### VISITING STUDENTSHIP AT

Dr Balkaya spent two years working at Queen's University as a visiting student from the Istanbul Technical University, supported by a Turkish Government post-graduate scholarship. Her studies at Queen's included attendance at the GeoEngineering Seminar series, presentation of her work to other students working on geotechnical computer analysis, laboratory work to collect data for assessment of her computer models, and extensive use of ABAQUS on the massively parallel computer at Queen's (HPCVL).

### QUEEN'S UNIVERSITY



Müge with Professors SAĞLAMER and MOORE, Istanbul, March 2010