

# *Effect of Polymer Slurry Stabilization on Drilled Shaft Side Shear Over Time*



*GRIP 2016*

*Presented by: Gray Mullins, PhD, PE*



# Problem Statement (recall)

- ◆ Construction methods affect drilled shaft side shear resistance which is not fully addressed by design.
- ◆ The primary objectives of this study are to quantify the time effects on side shear (if any) from prolonged open excavation where polymer slurry is present and determine what changes would be needed in the specifications.

# Problem Statement

- ◆ Bentonite and polymer slurries work differently (e.g. filter cake / no filter cake).
- ◆ Present specifications for bentonite largely do not apply to polymer.



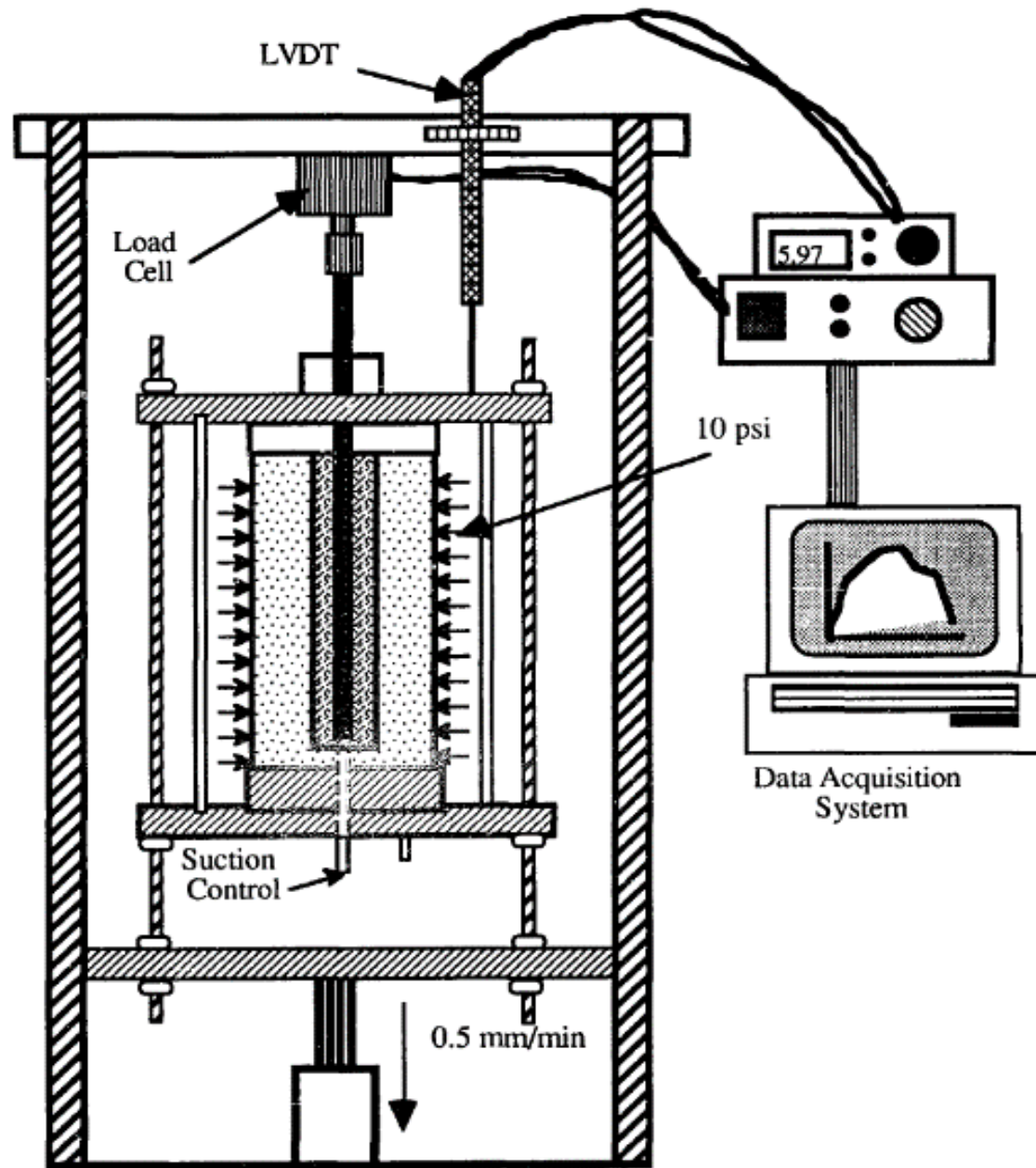
# Current Specification

*FDOT 2014 455-15.11.5 specifications state:*

*Any unclassified excavation work lasting **more than 36 hours** (measured from the beginning of excavation for all methods except the Permanent Casing Method, which begins at the time excavation begins below the casing) before placement of the concrete requires **overreaming the sidewalls** to the depth of softening or **removing** excessive **slurry cake buildup**. Ensure that the minimum depth of overreaming the shaft sidewall is 1/2inches and the maximum depth is 3 inches. . .*

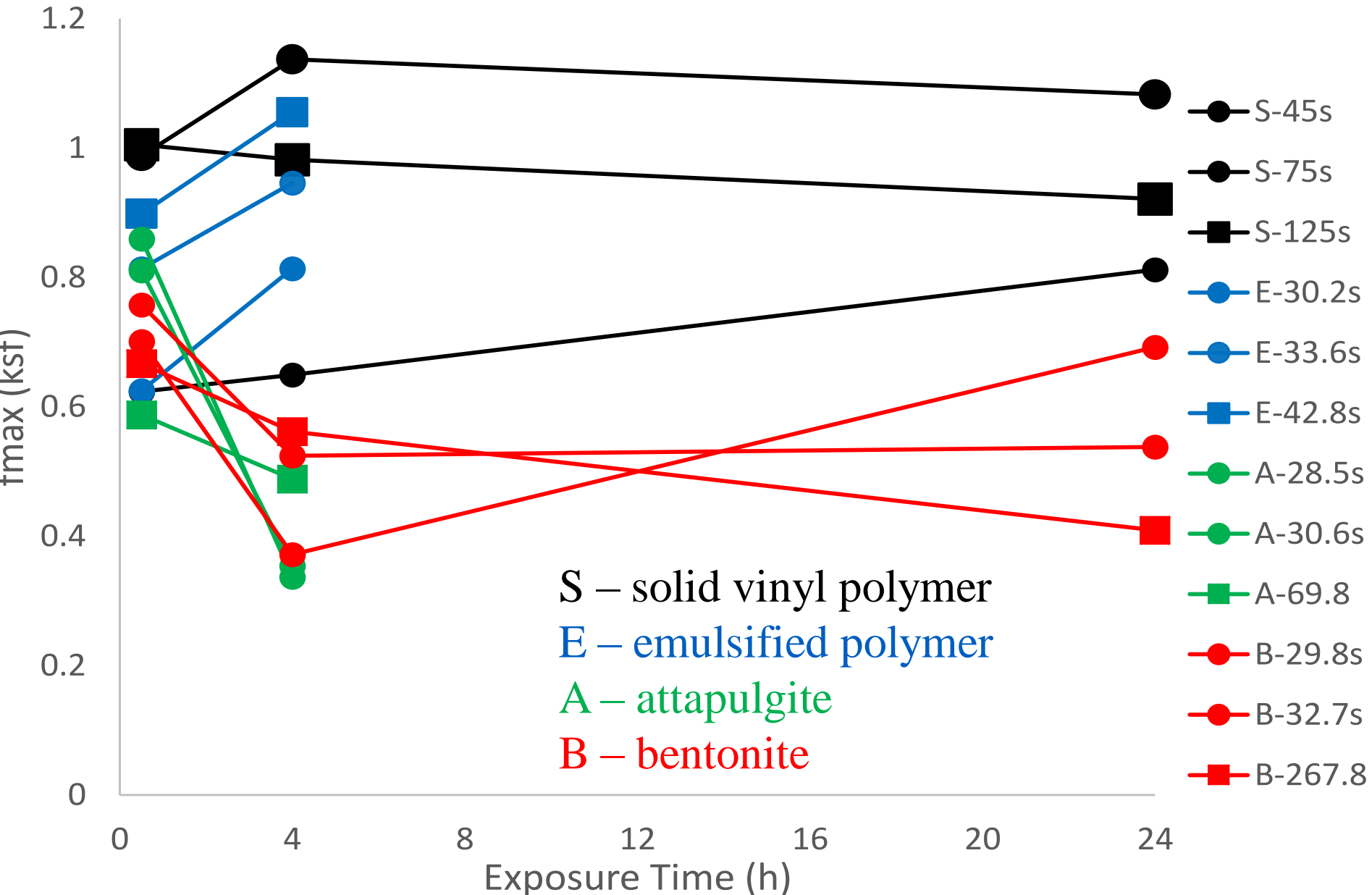
# Effects of Exposure Time on Side Shear

(Majano, 1992, and Majano and O'Neill, 1993)



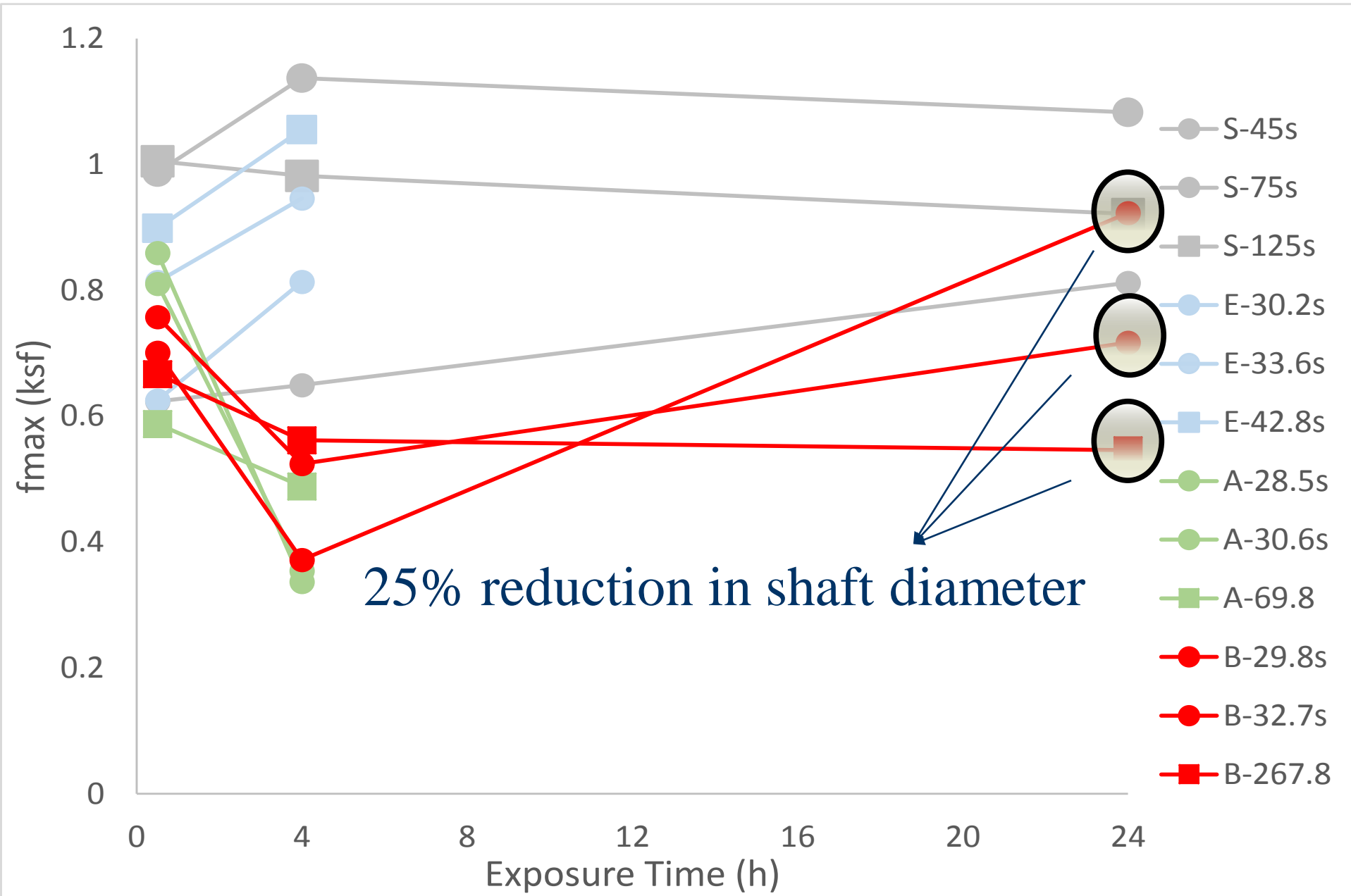
# Effects of Exposure Time on Side Shear

(Majano, 1992, and Majano and O'Neill, 1993)



# Effects of Exposure Time on Side Shear

## Corrected 24h Bentonite





# Effects of Exposure Time on Side Shear

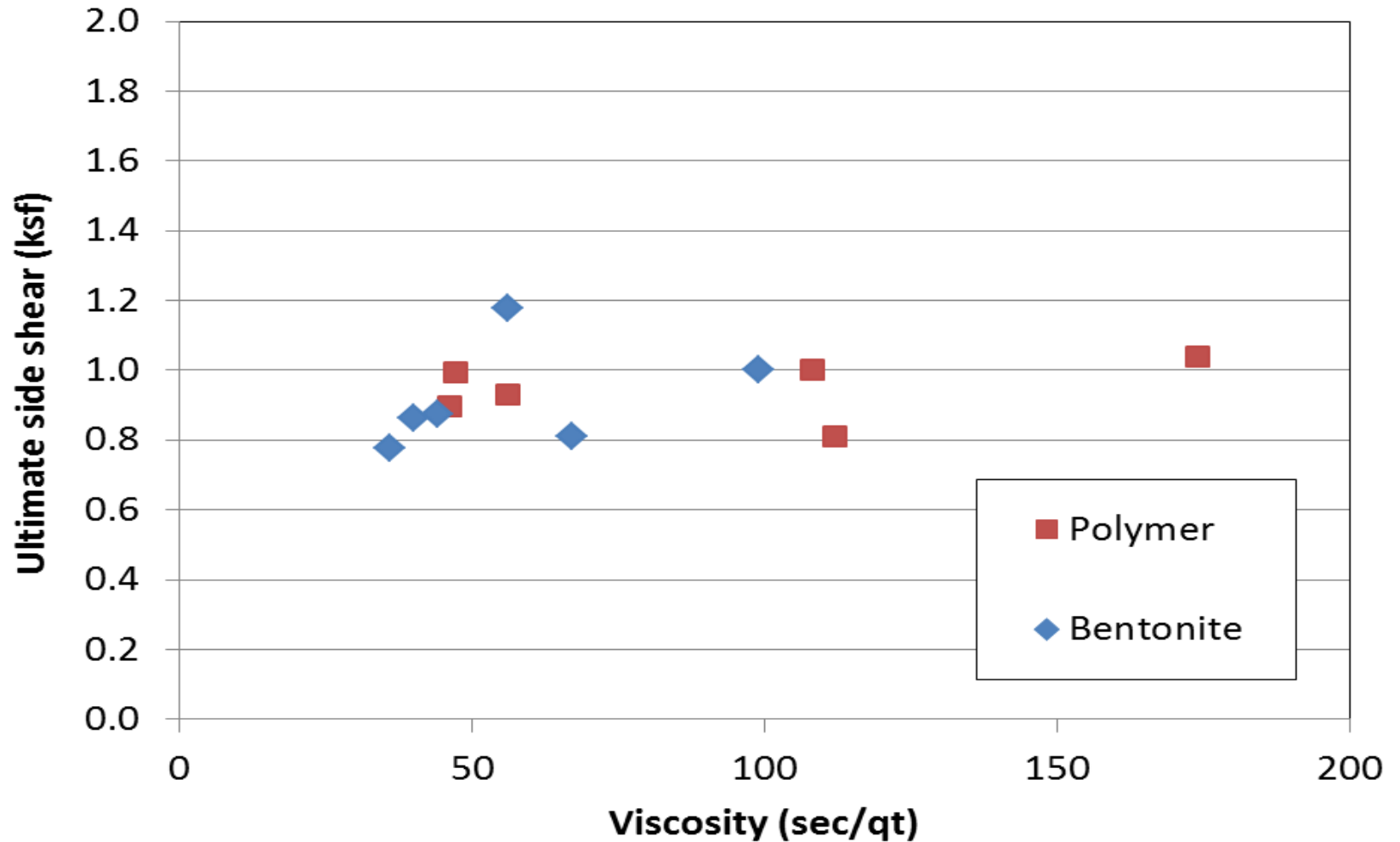
(Majano, 1992, and Majano and O'Neill, 1993)

*“Although the perimeter shear values yield by some slurries showed an improvement in the load transfer with time (e.g. bentonite) it is erroneous to assume that longer exposure times produce better drilled shafts. Visual analysis of the model shafts indicated deterioration in their geometrical dimensions which can be extrapolated to field practice to suggest that the detrimental effect on structural integrity of the foundation.”*

*Majano, 1992*

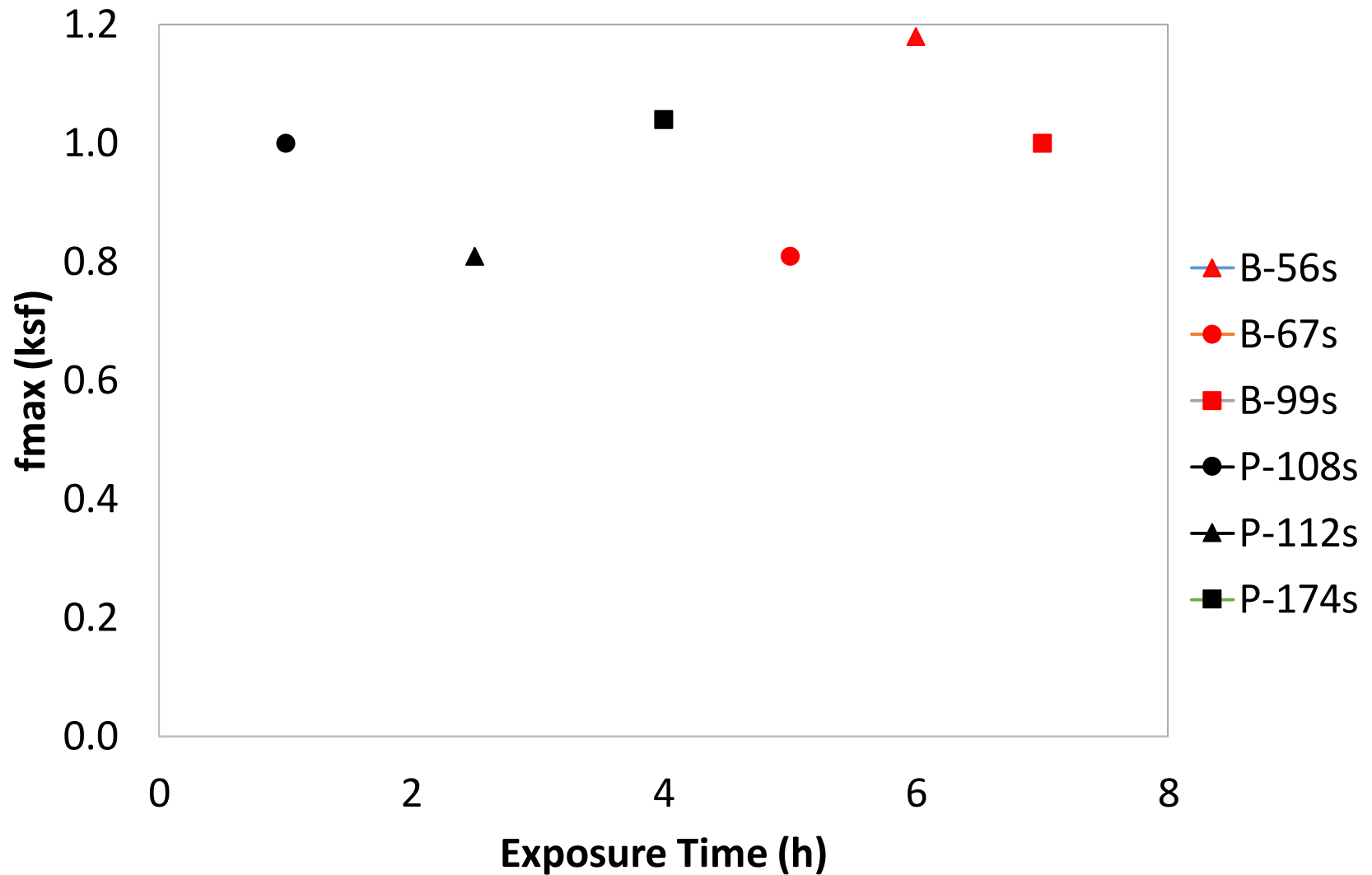
# Past Study

(Upper Viscosity Project 2014)



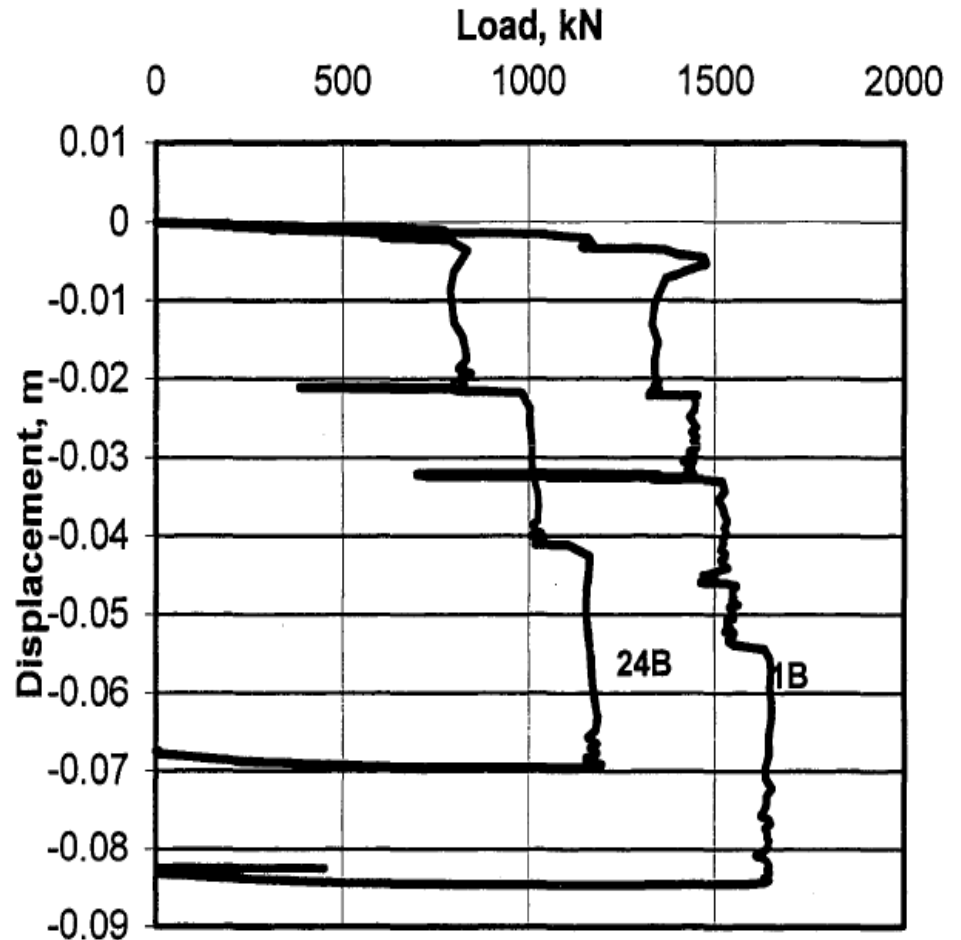
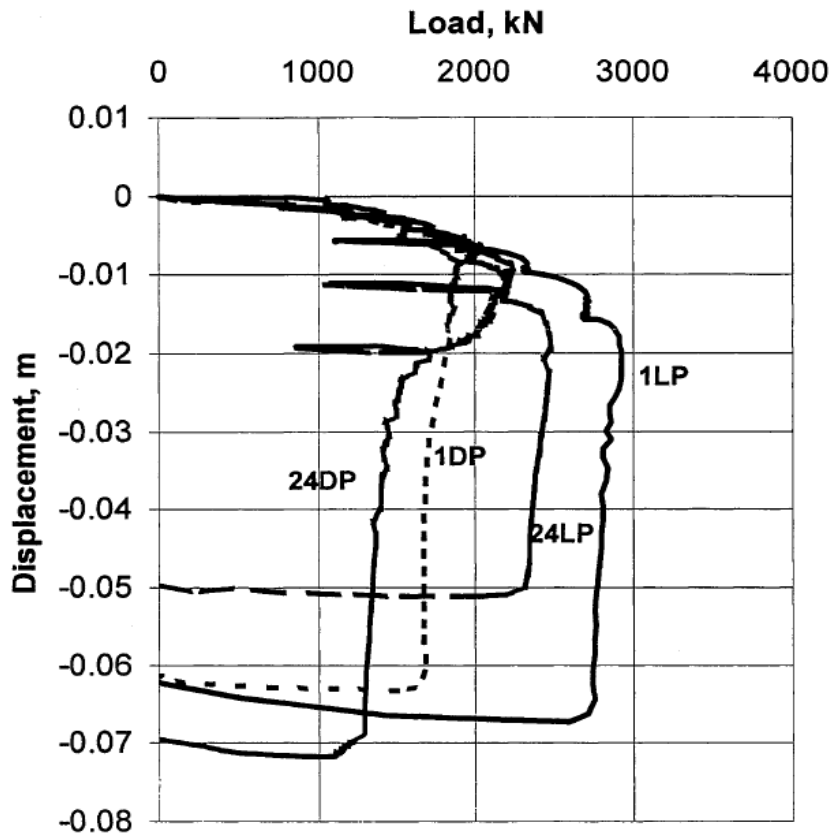
# Past Study

(Upper Viscosity Project 2014)



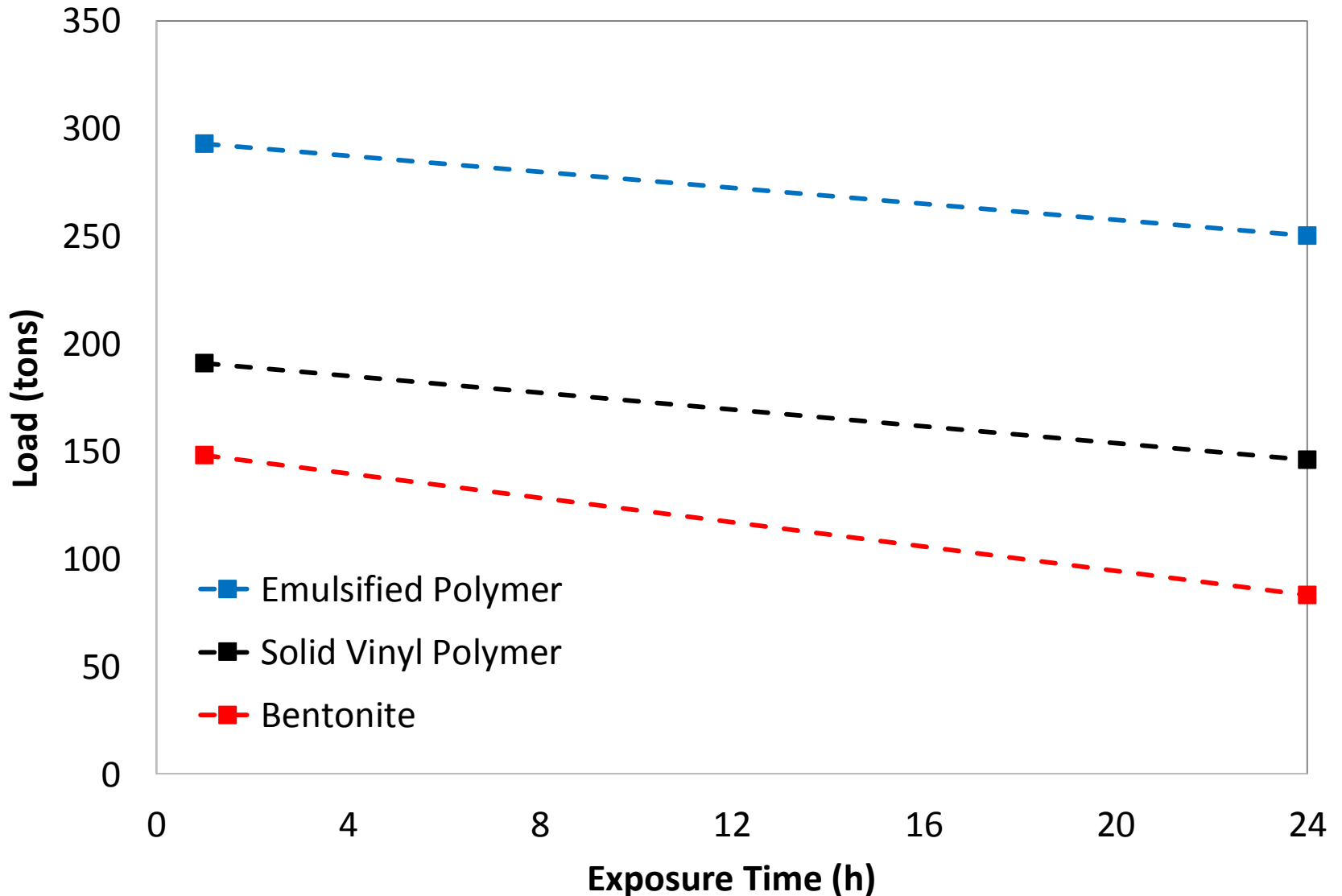
# Time Exposure

Effects of drilling slurries on Side Resistance (Brown, 2002)

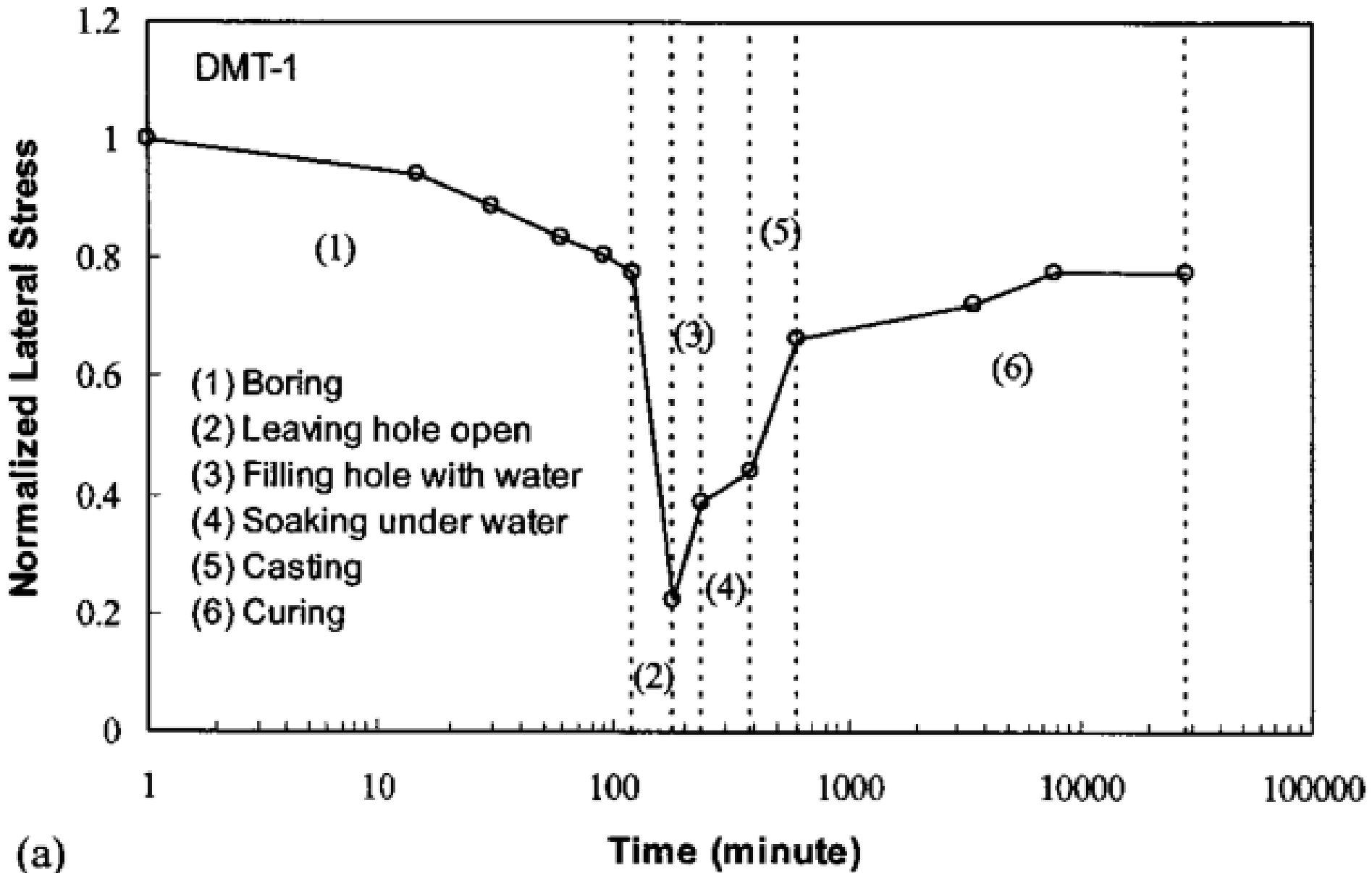


# Time Exposure

(Brown, 2002)



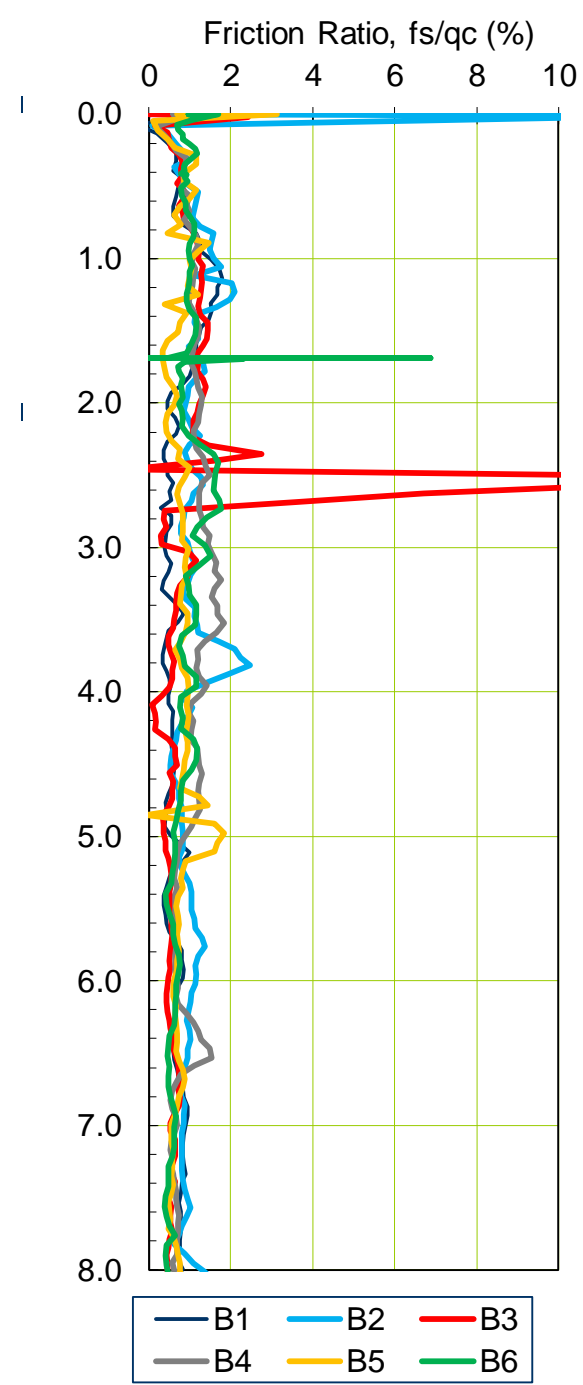
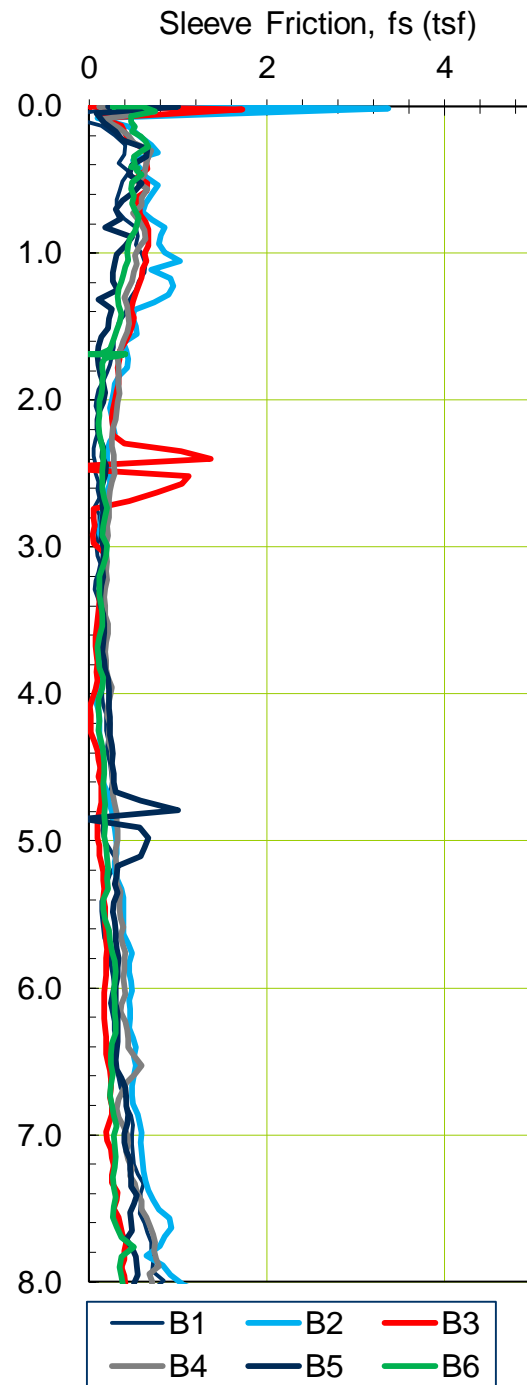
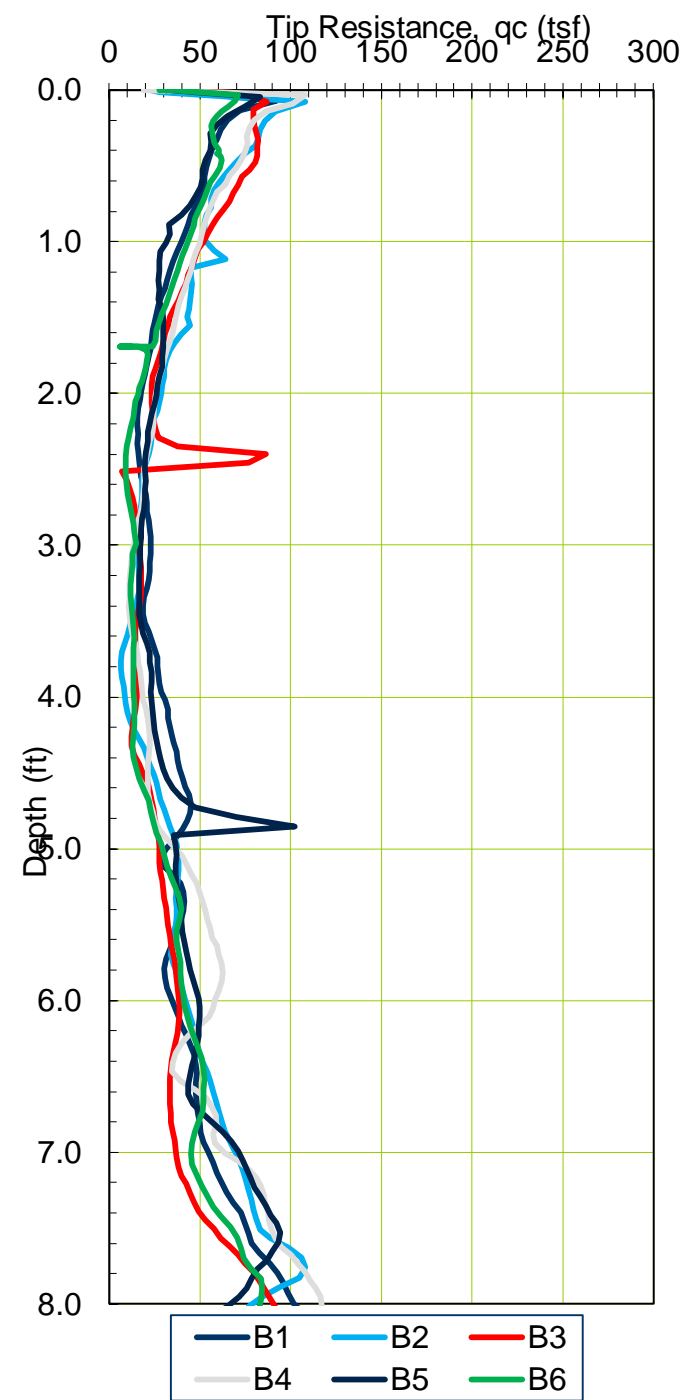
# Stress Relaxation – (Chang and Zhu, 2004)



(a)

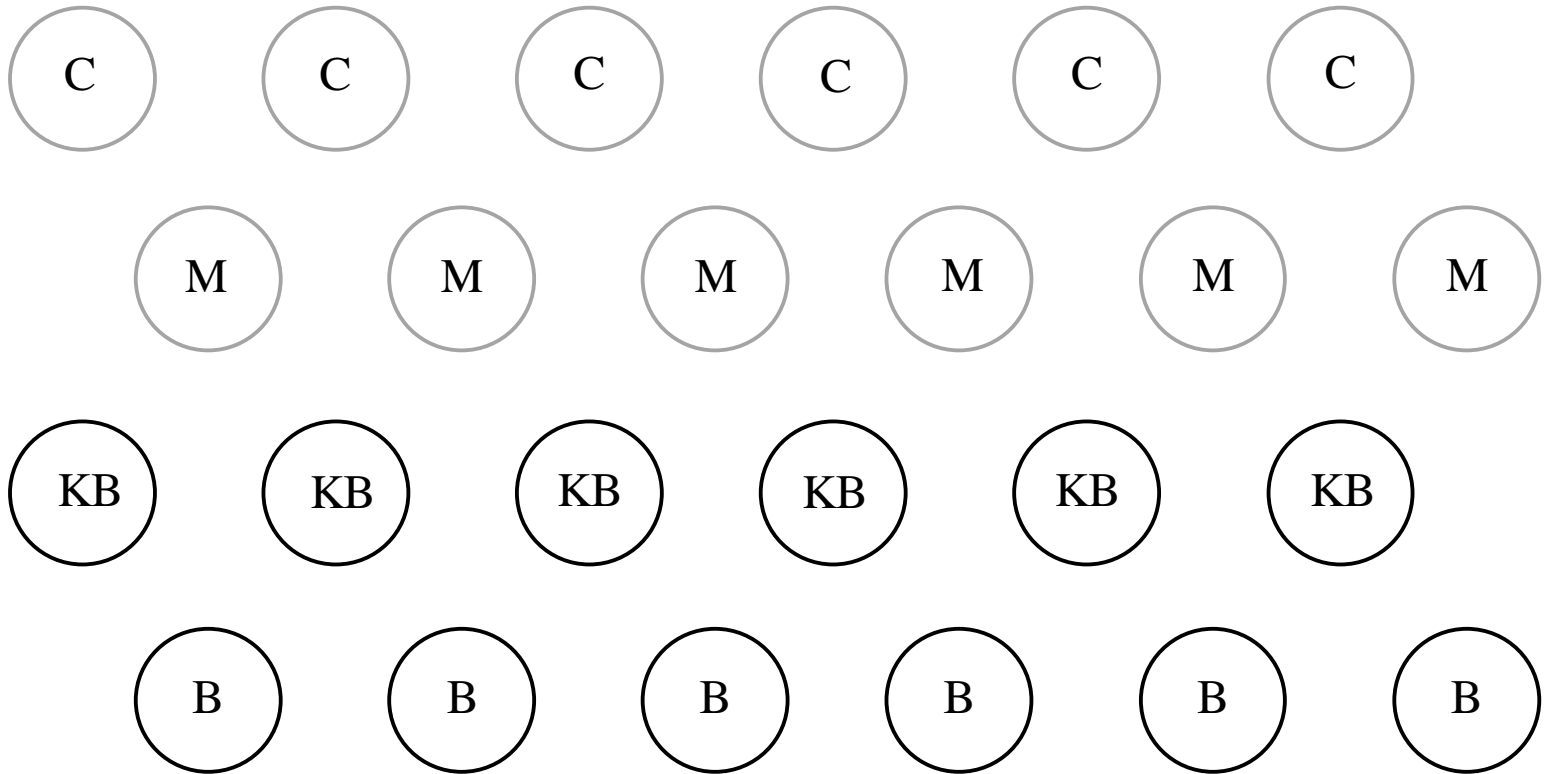
# Small Scale Test Shaft Program

- ◆ ~36 shafts
- ◆ 4in diam. 8ft long
- ◆ Sandy / silty sand
- ◆ 0, 1, 2, 4, 8 and 24h exposure times
- ◆ 3 different polymer type





# Small Scale Test Shaft Program



Not to Scale

# Materials & Equipment







# Excavation





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# Mixing

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# Concreting





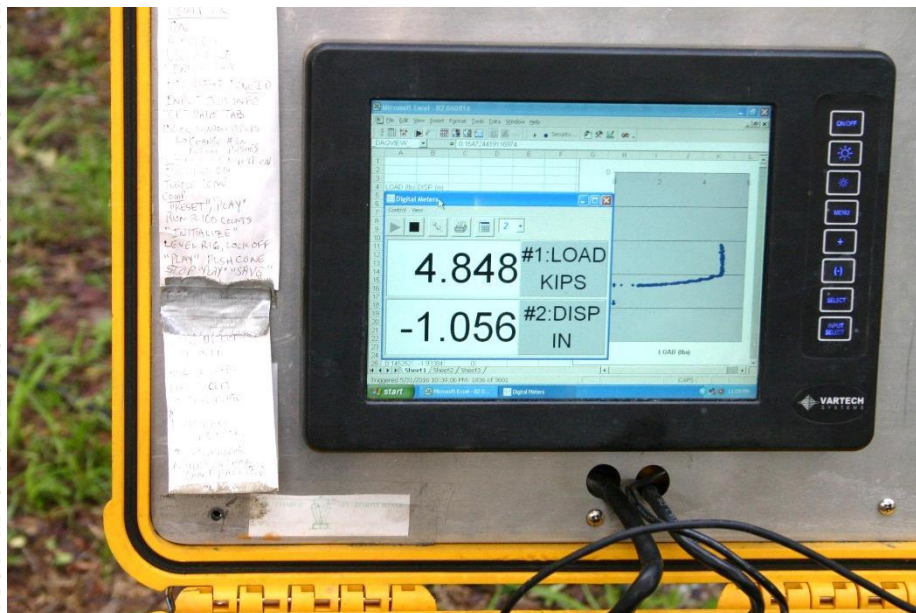






# Static Load Test

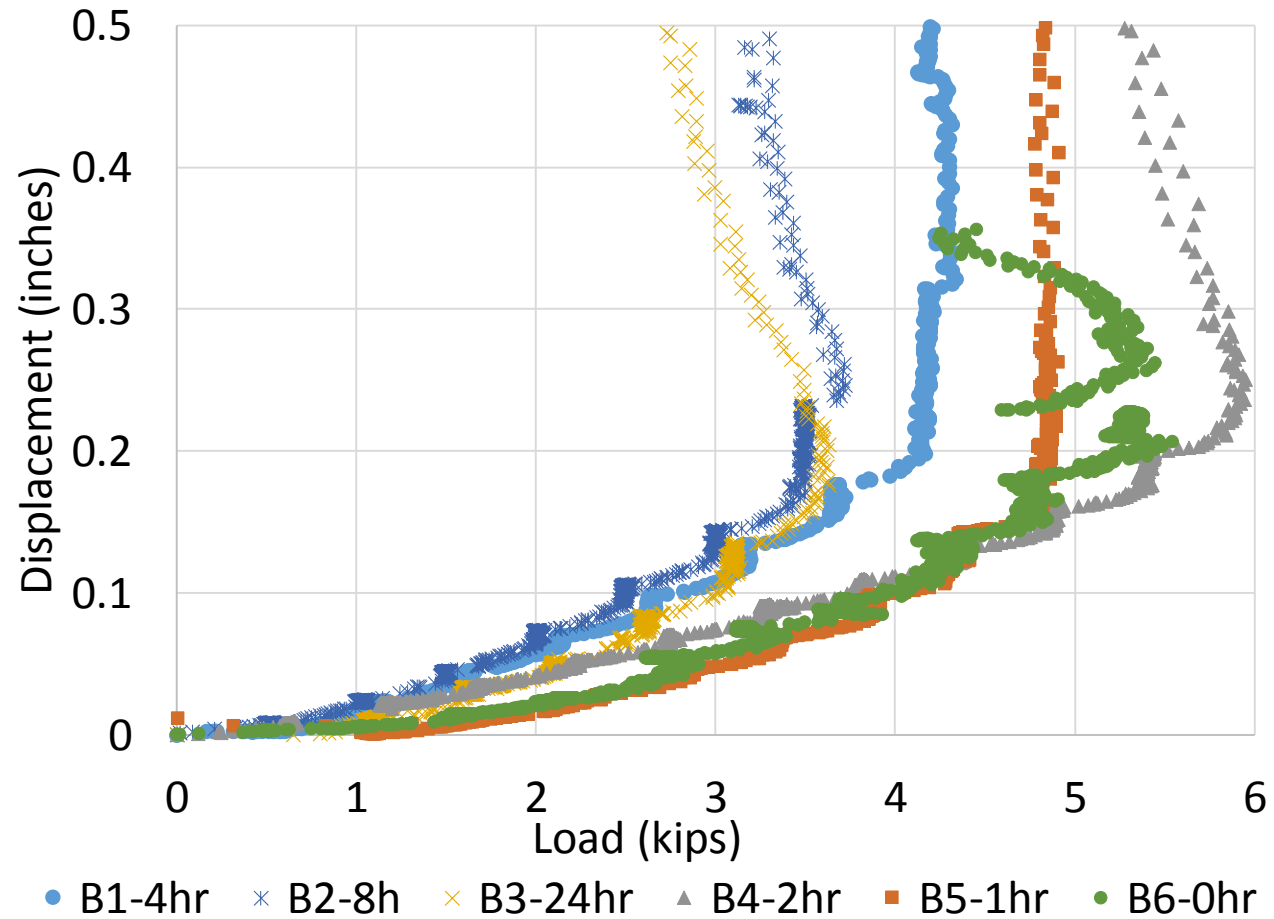
- ◆ Modified Quick Test
- ◆ Load Increments of 500lbs
- ◆ Max. Displacement of 4in



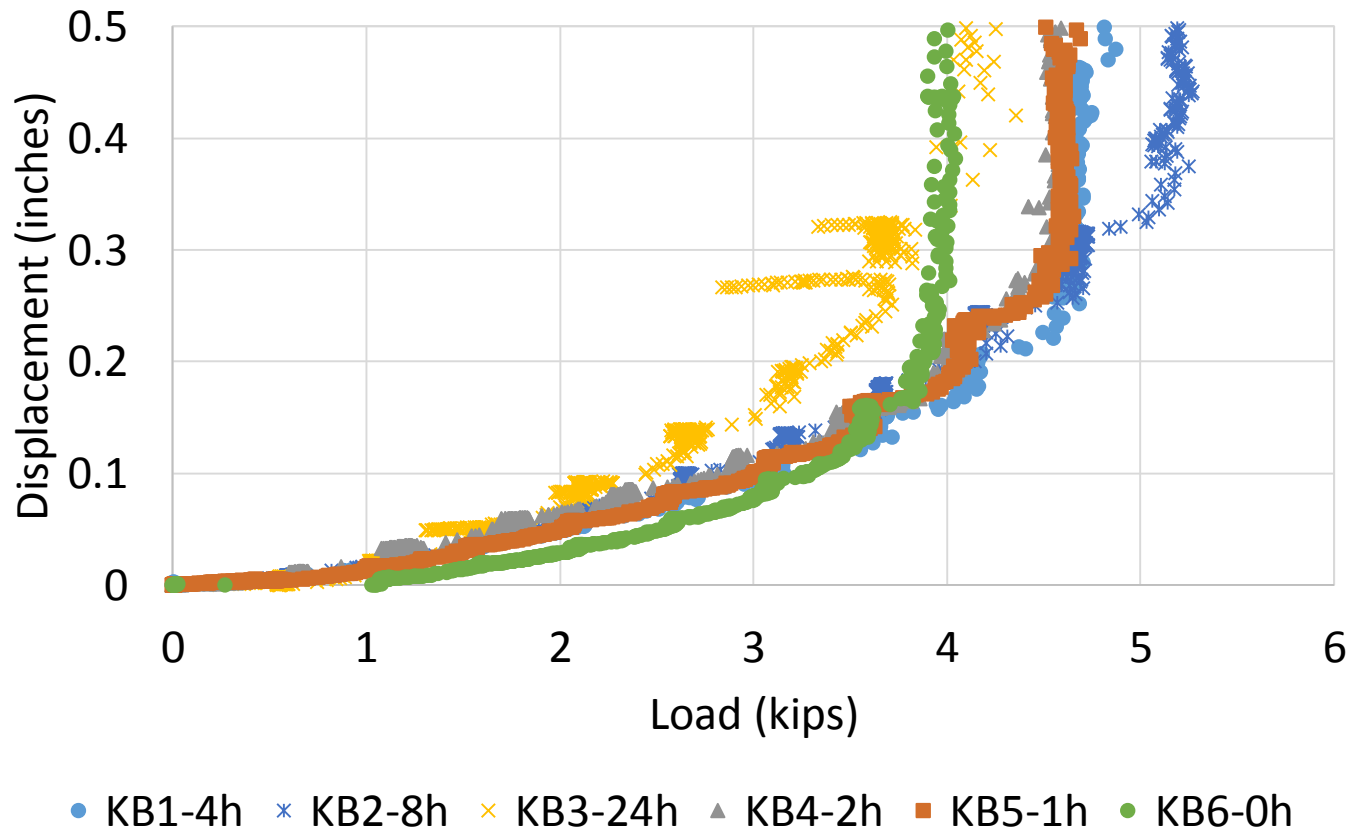
# Load Testing



# Bentonite Load Tests



# Polymer Load Tests



# Shaft Extraction











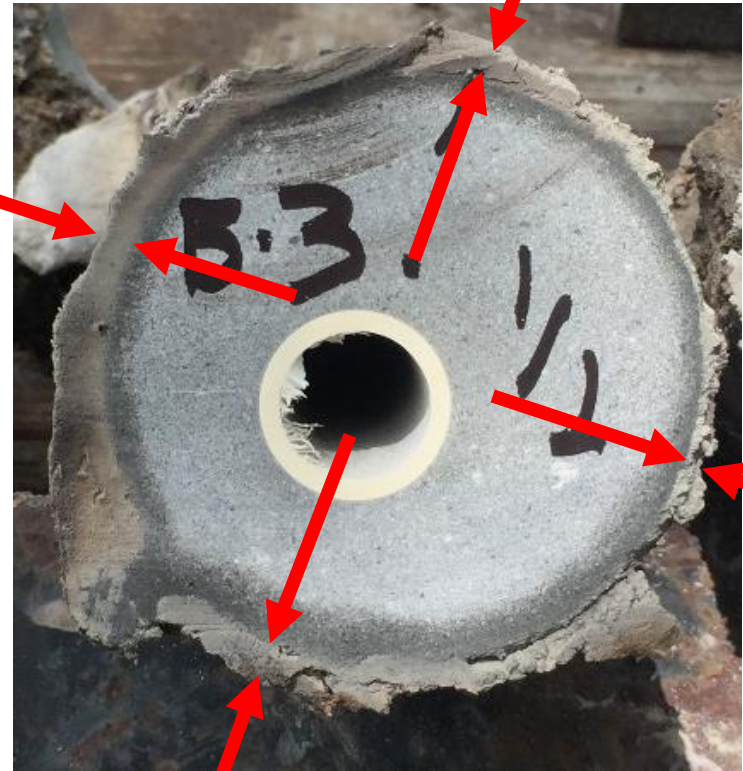
# Cutting & Cross Section



# Bentonite



0h



24h

# KB Polymer



0h



24h

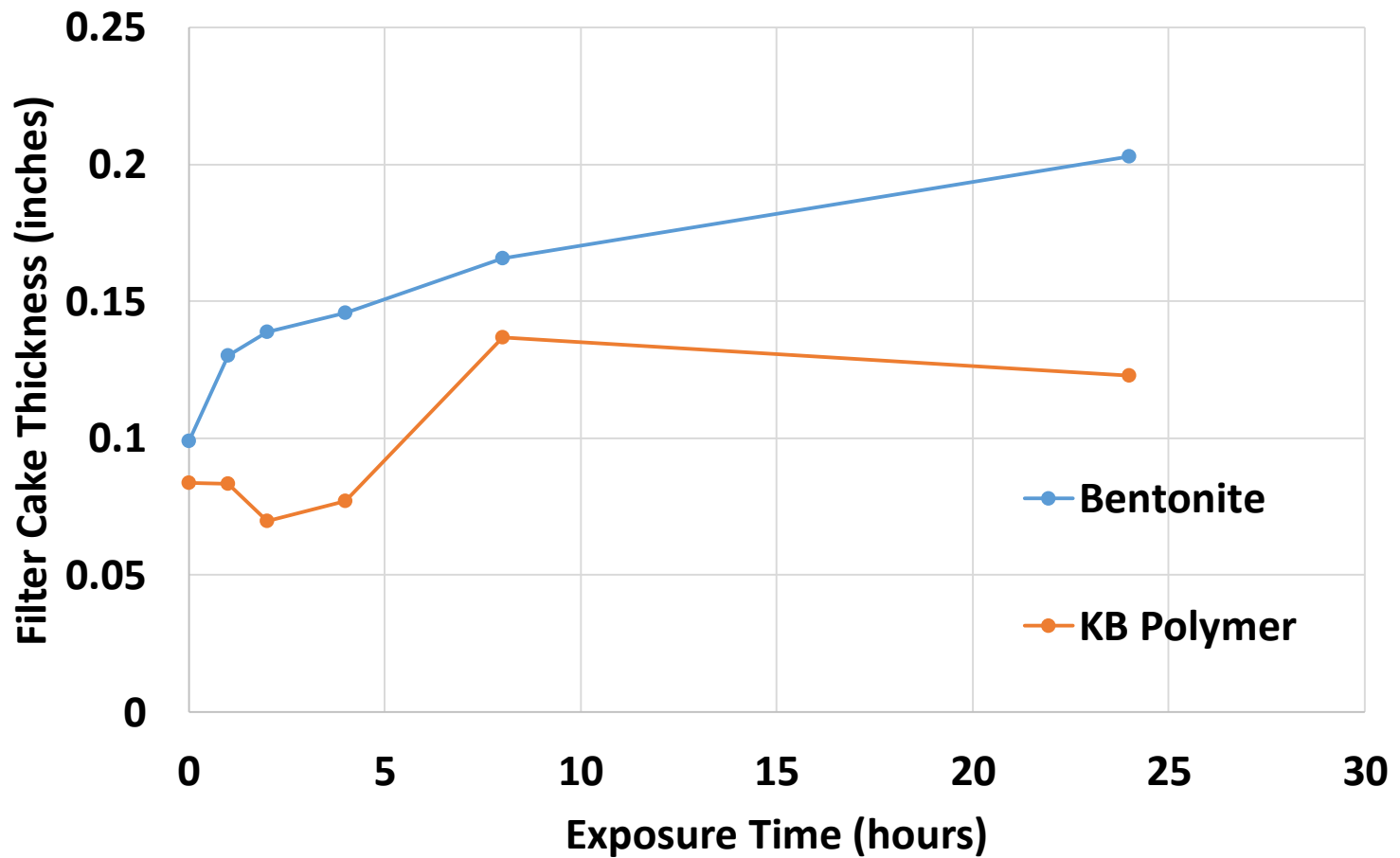


0h

24h

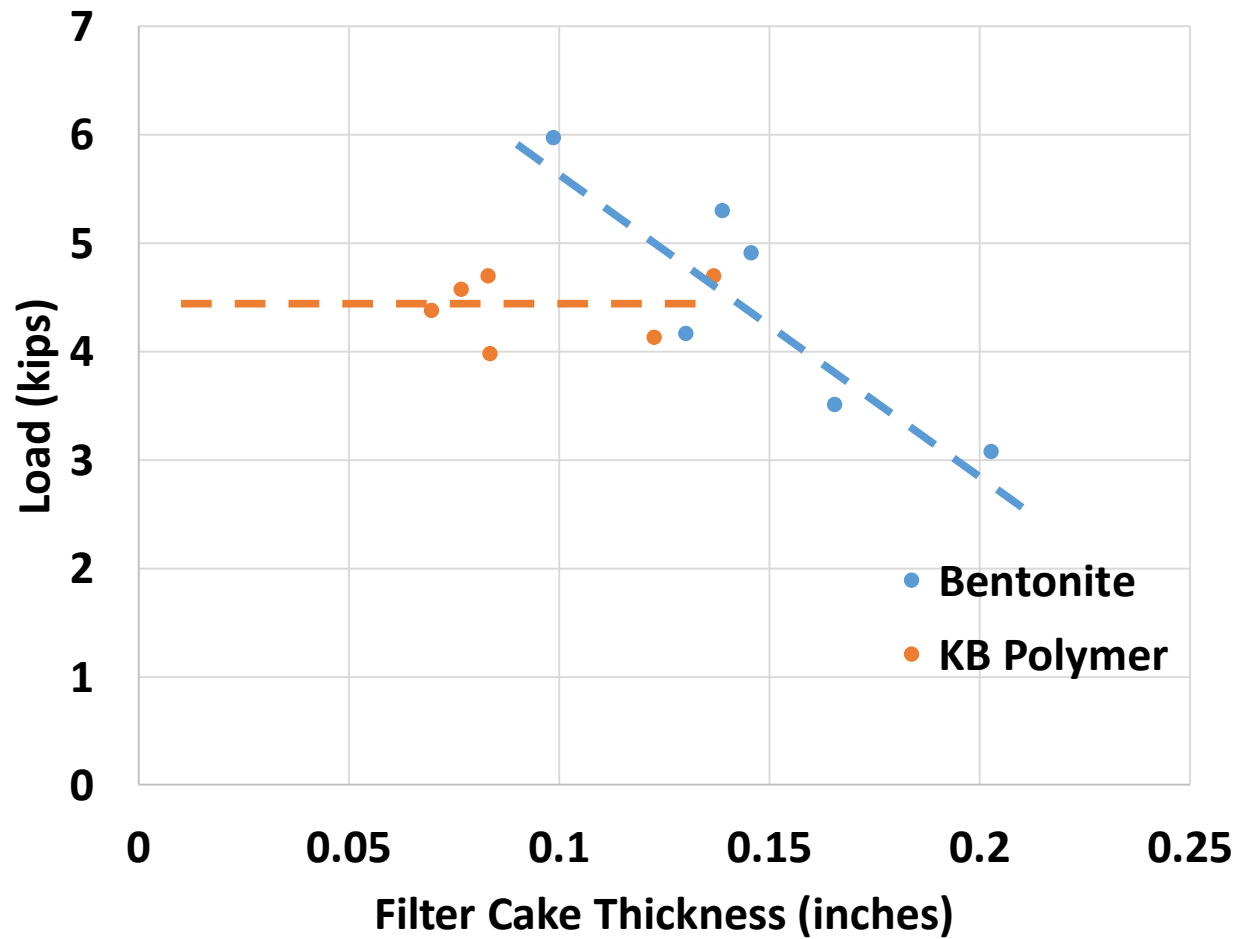


# “Filter Cake”

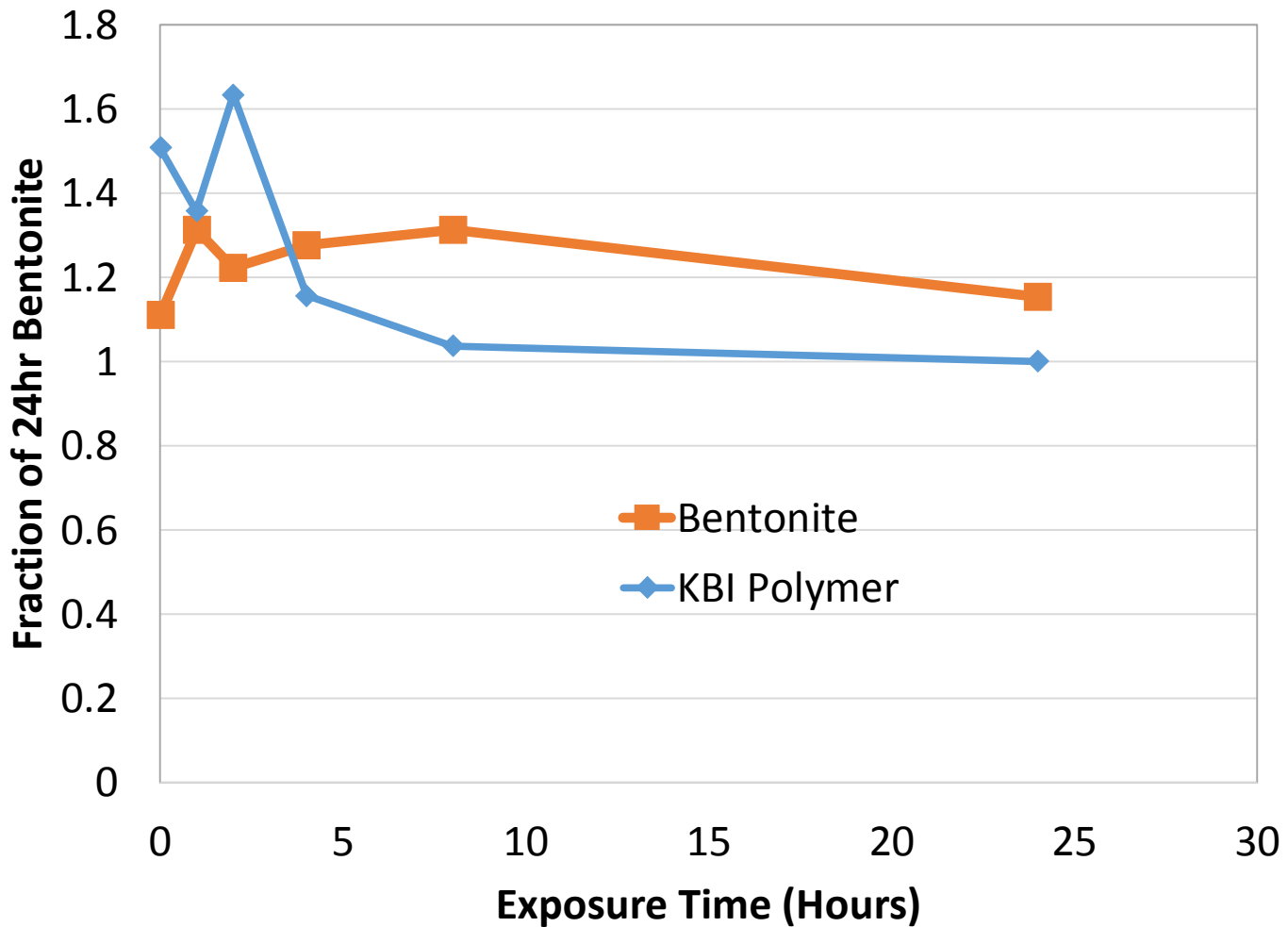




# “Filter Cake”



# Exposure Effects



# Summary

- ◆ Two of four sets of shafts were cast and tested
- ◆ Most bentonite strength reduction occurs within 8hrs
- ◆ Polymer shows no reduction with time (at present)
- ◆ Extended exposures times up to 48hrs will be added to test matrix