

**Louisiana  
TIMED  
Program**  
TIMED IS NOW!

**Audubon  
BRIDGE CONSTRUCTORS**

**PARSONS**

**FLATIRON**

**GRANITE**

**Tip-Grouted  
Drilled Shaft  
Foundations  
for the  
Audubon  
Bridge**

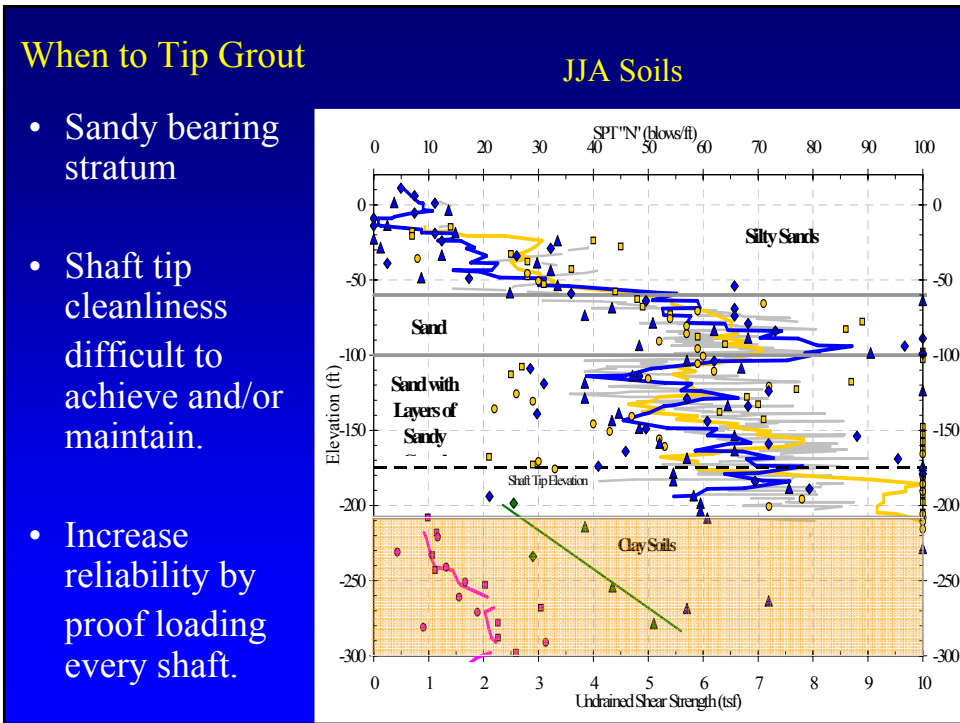
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[www.danbrownandassociates.com](http://www.danbrownandassociates.com)

**John James Audubon Bridge**

- SR10 over the Mississippi River
- 1,583 ft Cable Stayed Span (Longest in N. America)
- Design-Build Project

*Dan Brown & Associates*



## Benefits of Tip Grouting

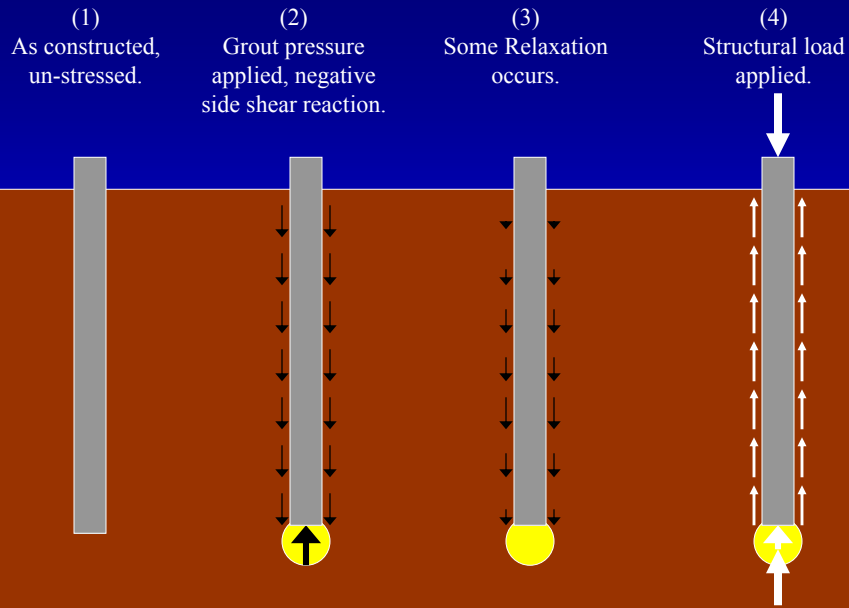
- Increases the ultimate tip capacity.
- Tip component able to contribute to the “useful” capacity (i.e., within tolerable displacements).
- Provides a proof load of capacity for every grouted shafts on the site.







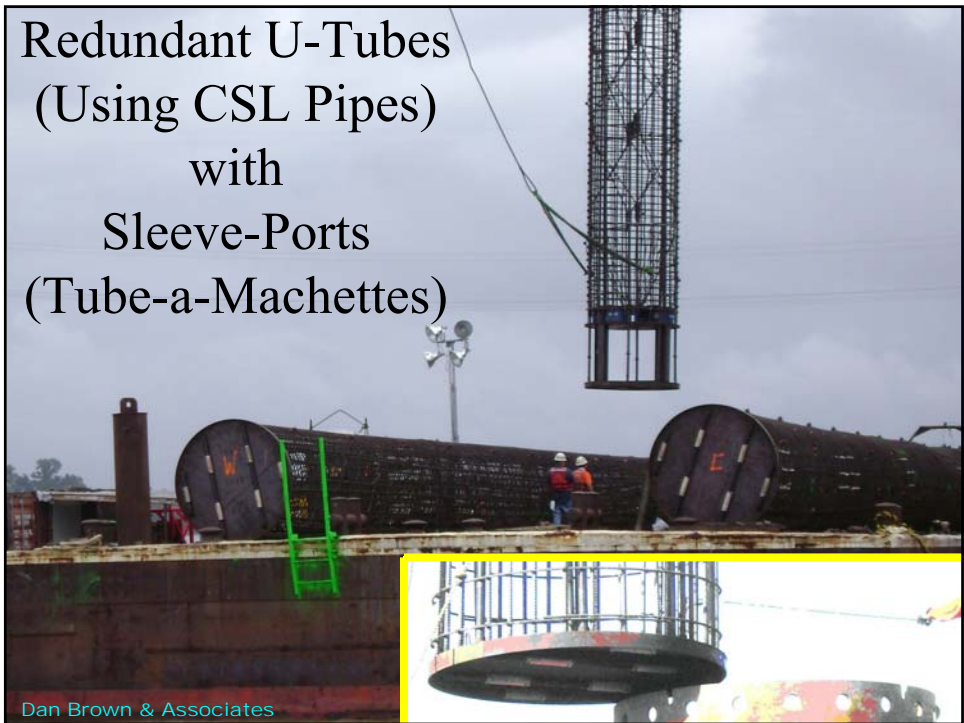
# The Tip Grouting Process

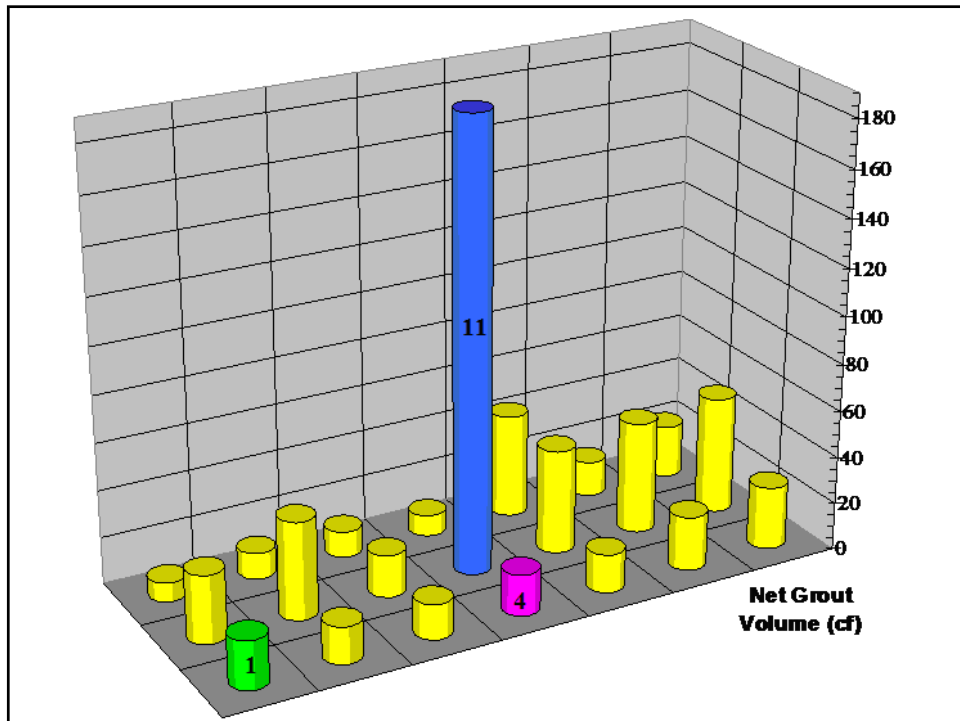
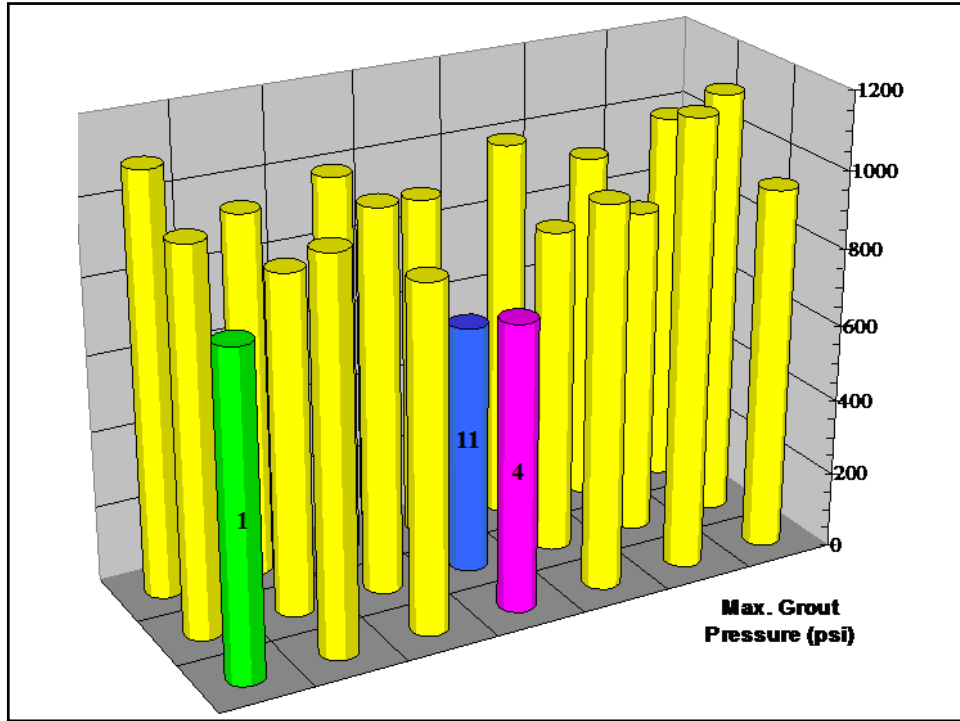


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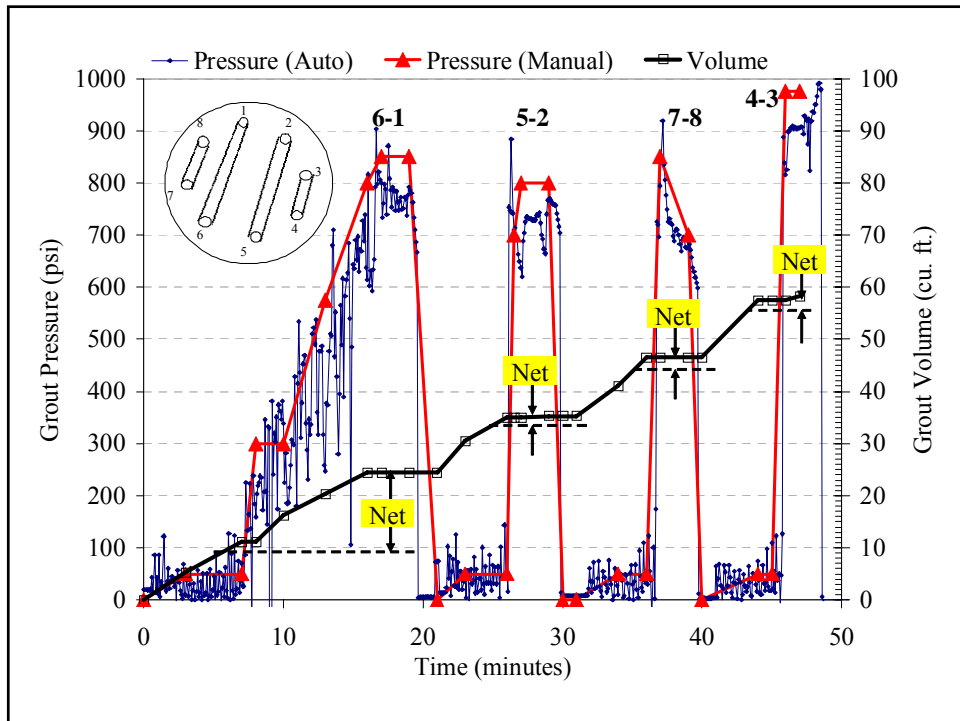
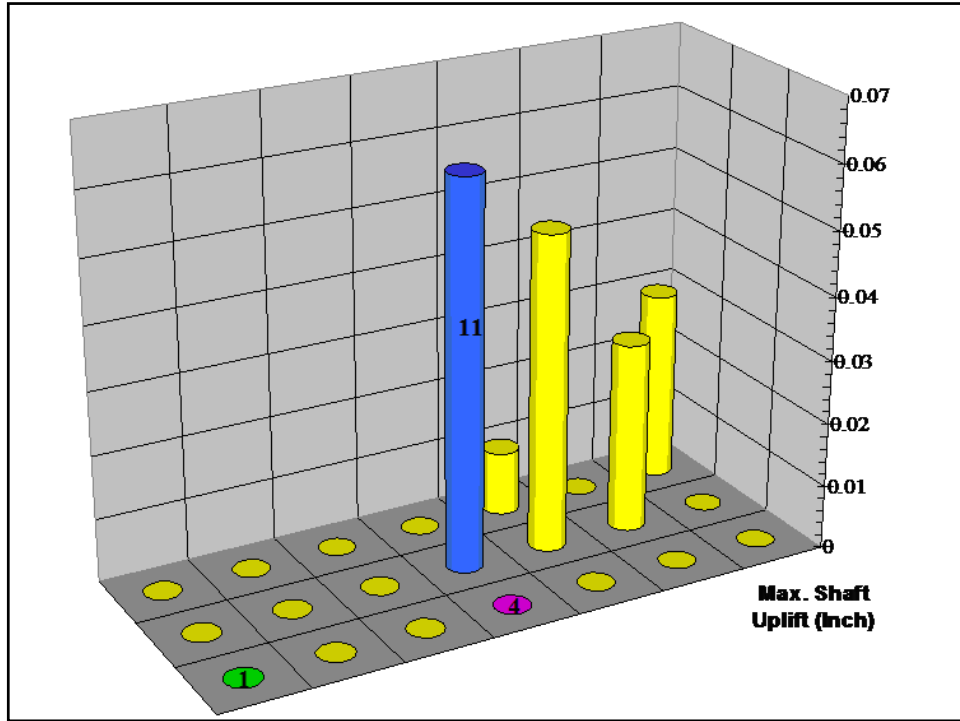


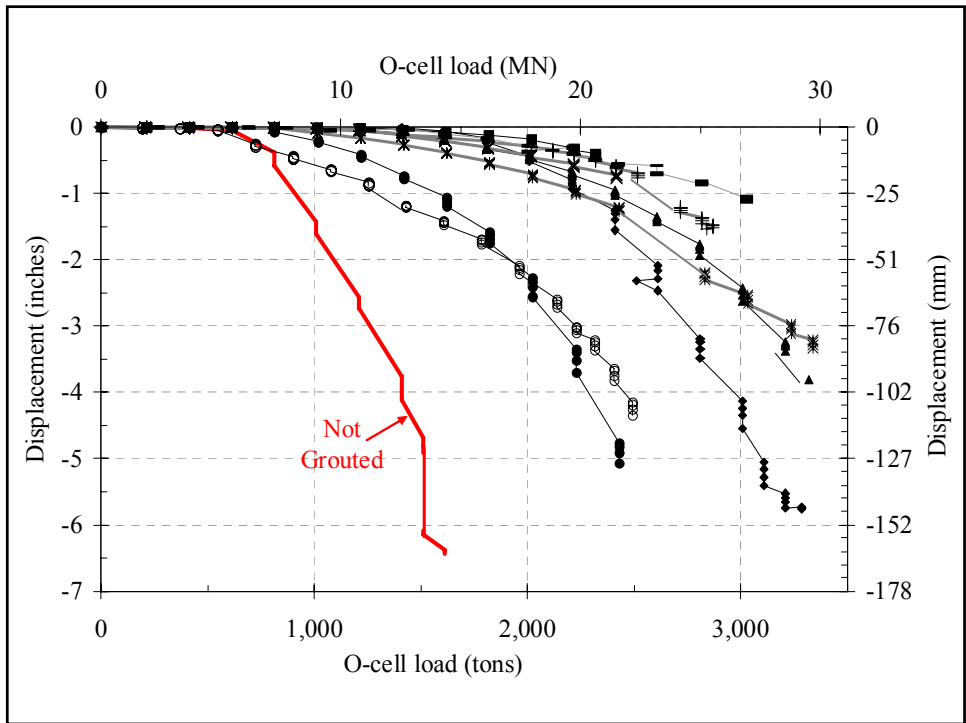
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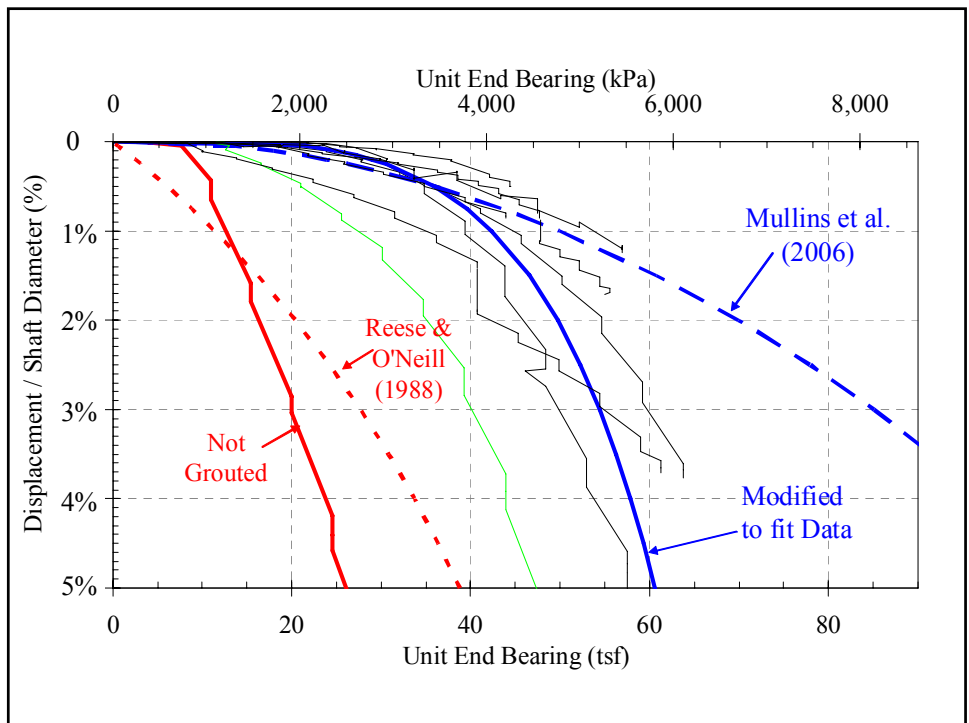
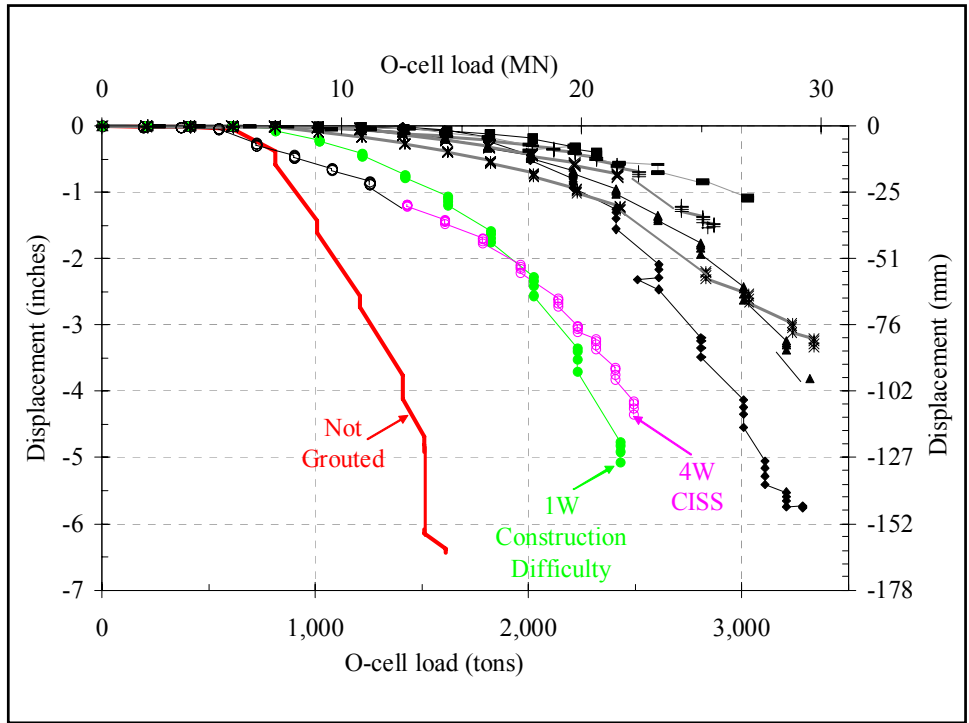


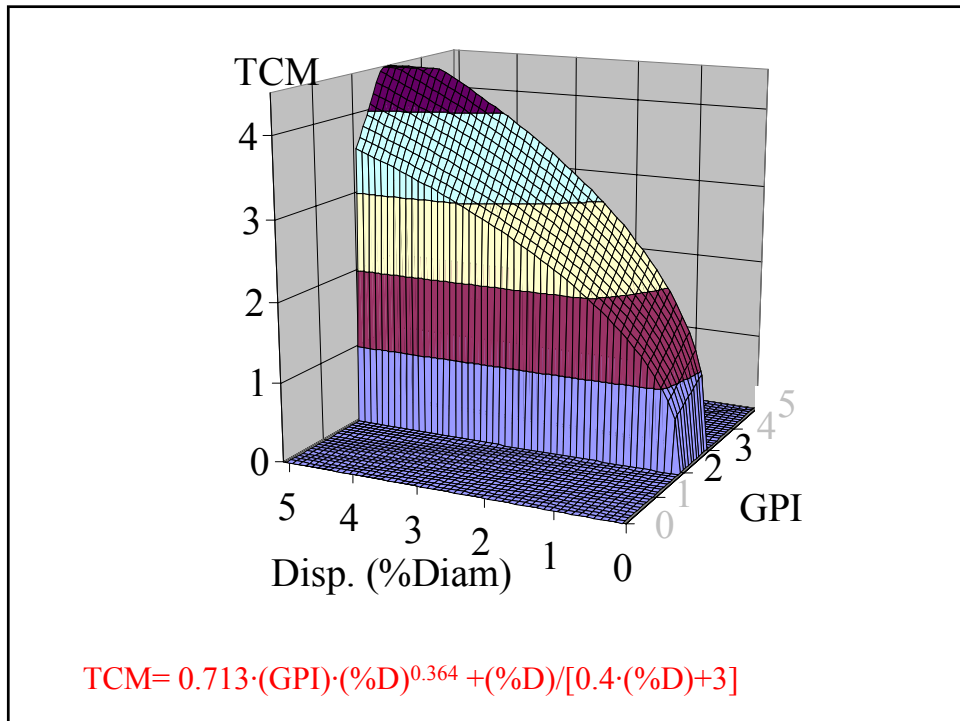
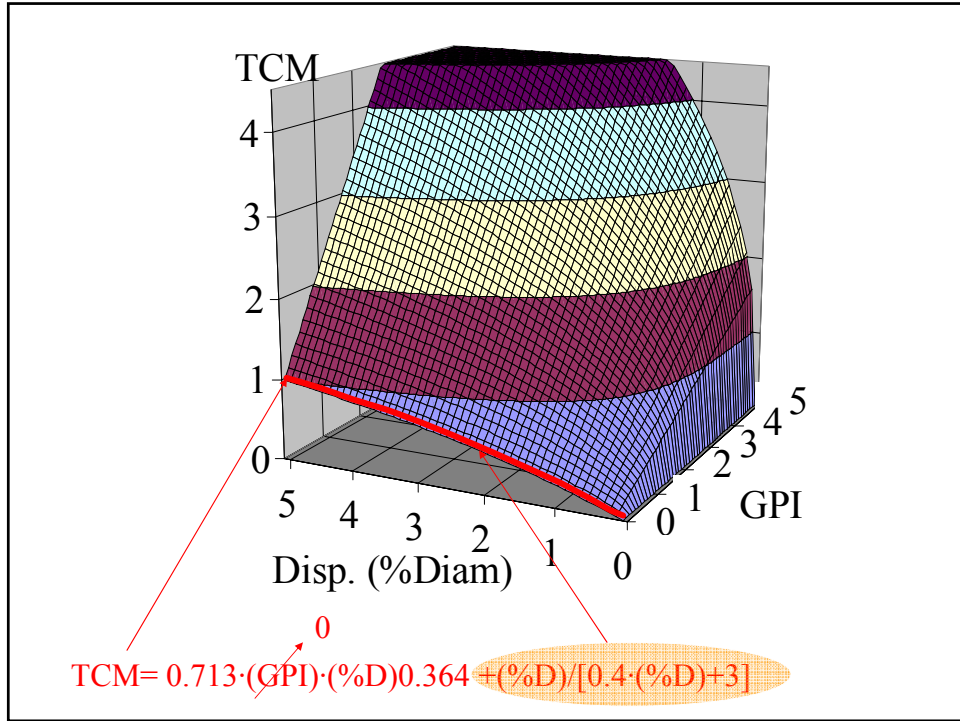


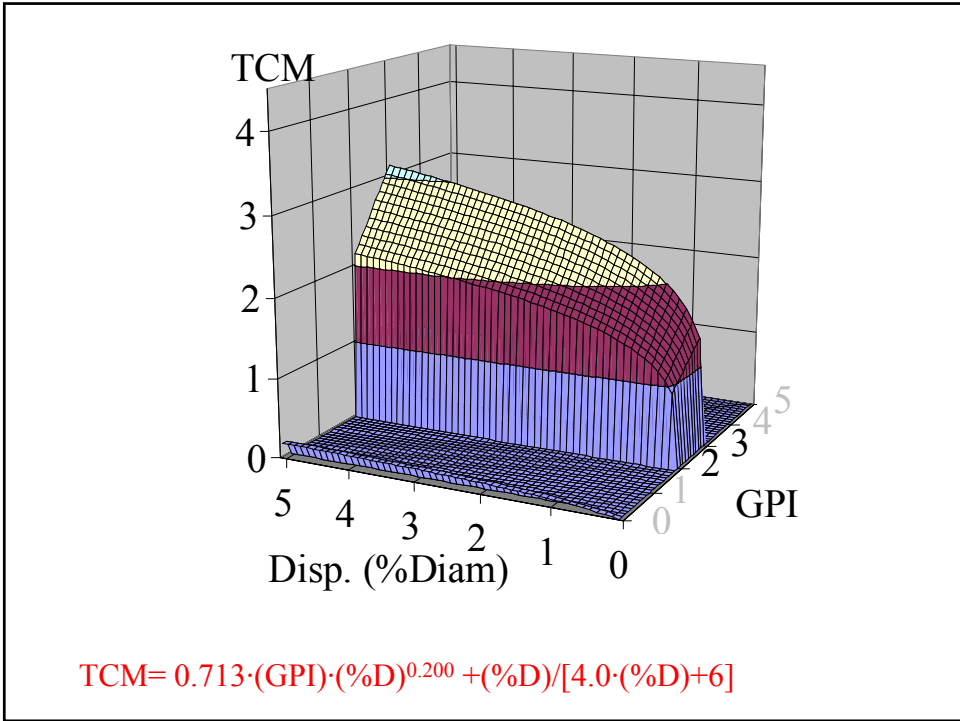












Mullins, Winters, Dapp (2006):

$$TCM = 0.713 \cdot (GPI) \cdot (%D)^{0.364} + (%D) / [0.4 \cdot (%D) + 3]$$

Modified to fit JJA Data:

$$TCM = 0.713 \cdot (GPI) \cdot (%D)^{0.200} + (%D) / [4.0 \cdot (%D) + 6]$$

- TCM = Tip Capacity Multiplier
- GPI = Grout Press./Ungrouted Unit Base Resist. at 5% Disp.
- %D = Displacement Expressed as % of Diameter

Mullins, Winters, Dapp (2006):

$$TCM = 0.713 \cdot (GPI) \cdot (\%D)^{0.364} + (\%D) / [0.4 \cdot (\%D) + 3]$$

Modified to fit JJA Data:

$$TCM = 0.713 \cdot (GPI) \cdot (\%D)^{0.200} + (\%D) / [4.0 \cdot (\%D) + 6]$$

Not Intended to Replace Mullins et al (2006)

Consider Modified Parameters for Use When:

- Large Diameter, Deep Shafts
- High Grout Pressures (in excess of  $\approx 700$  psi)
- Large Grout Pressure Index (GPI  $\approx 2.0$  to 3.0)

## Summary

- Increased the End Bearing Resistance
  - Greater Ultimate Resistance
  - End Bearing Develops within service limit displacement
- Allows for Greater Reliability
  - Proof Loading every production shaft  
(Effect Enhanced with Gravel Pack)
  - Allows for use of lower SF's (Higher  $\Phi$ )
- Identify Unforeseen Construction and/or Soil Problems, and Provide the Means of Remediation.



Thank You

Dan Brown & Associates