Session 38

Max Sheppard

Ocean Engineering Associates, Inc.

Update on Scour & Rock Methodology

Topic Description

Update on Rock Scour Methodology: This presentation covers the current status of research at the University of Florida and the FDOT Materials Laboratory in Gainesville, FL on sediment scour in cohesive sediments and erodable rock. Improvements have been made to the apparatus used for measuring Rate of Erosion as a function of water flow induced Shear Stress. These improvements are discussed along with attempts to establish a correlation between erosion rate and other geotechnical properties of the sediment.

Speaker Biography

Max Sheppard is President of Ocean Engineering Associates, Inc. (OEA, Inc.) and Professor Emeritus in the Civil and Coastal Engineering Department at the University of Florida. His areas of expertise include: bridge scour, coastal hydraulics, sediment transport, coastal structures, and wave loading on coastal and offshore structures.

Session 38

Dave Horhota

FDOT - State Materials Office

Update on Scour & Rock Methodology

Topic Description

Erosion & scour prediction for bridge piers using newly developed lab test methods: RETA (Rotating Erosion Test Apparatus) & SERF (Sediment Erosion Rate Flume).

Speaker Biography

David Horhota currently is the State Geotechnical Materials Engineer at the State Materials Office. He has been with the Florida Department of Transportation for 20 years, all at the State Materials Office, working in the area of geotechnical materials and testing. David received his Doctoral Degree in 1996 from the University of Florida. Both his Masters and Ph.D. were obtained while working with the Department on DOT-sponsored research projects.

Update on Rock and Clay Scour Predictions

D. Max Sheppard
OEA, Inc., University of Florida
David Horhota
FDOT Materials Laboratory

Presentation Outline

- Problem Statement
- Test Apparatus
- Discuss Updates to Both Systems
- Preliminary Results on Attempts to Establish Relationship between Erosion Rate and Other Geotechnical Properties
- Example Test Results
- Summary

Problem Statement

- FHWA Guidelines Require:
  - Erodible rock and clay to be treated as sand for design scour depth calculations
- Erosion Resistance of Erodible Rock and Clay Varies Significantly
- To Date No Correlation Has Been Established Between Rate of Erosion and Other Geotechnical Properties
- Significant Waste of Funds in Over-Design

Development of Apparatus for Measuring Rate of Erosion

- Two Different Apparatus Designed and Constructed for Measuring Rate of Erosion Properties
  - Rotating Erosion Test Apparatus (RETA)
  - Sediment Erosion Rate Flume (SERF)
- Each Apparatus Has Advantages and Disadvantages

RETA

- Advantages
  - Direct measurement of applied torque (average shear stress)
  - Better for testing less erodible rock sediments
- Disadvantages
  - More labor intensive
  - Limited to stiffer sediments
  - Erodes vertical surfaces

SERF

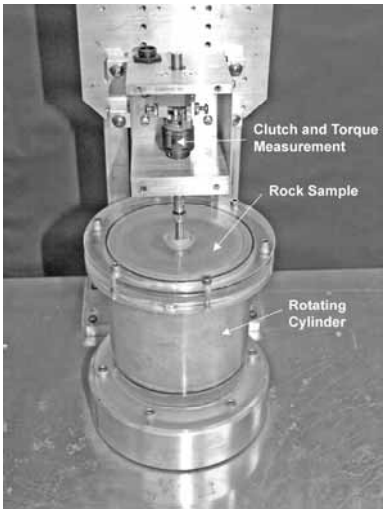
- Advantages
  - Direct measurement of erosion rate
  - Less labor intensive
  - Erodes horizontal surfaces
- Disadvantages
  - Indirect method for shear stress measurement
  - Presently not well suited for long duration tests

RETA

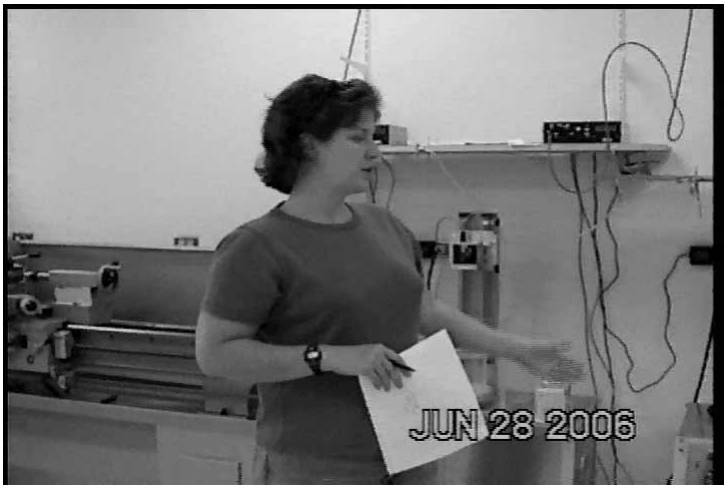
Rotating Erosion Testing Apparatus

RETA Updates

- New Torque Cell Design
- Slip Clutch
- Control System that Maintains Torque or RPM
- Continuous Monitoring
- Evaporation Control
- Multiple Units at FDOT Materials Lab



RETA



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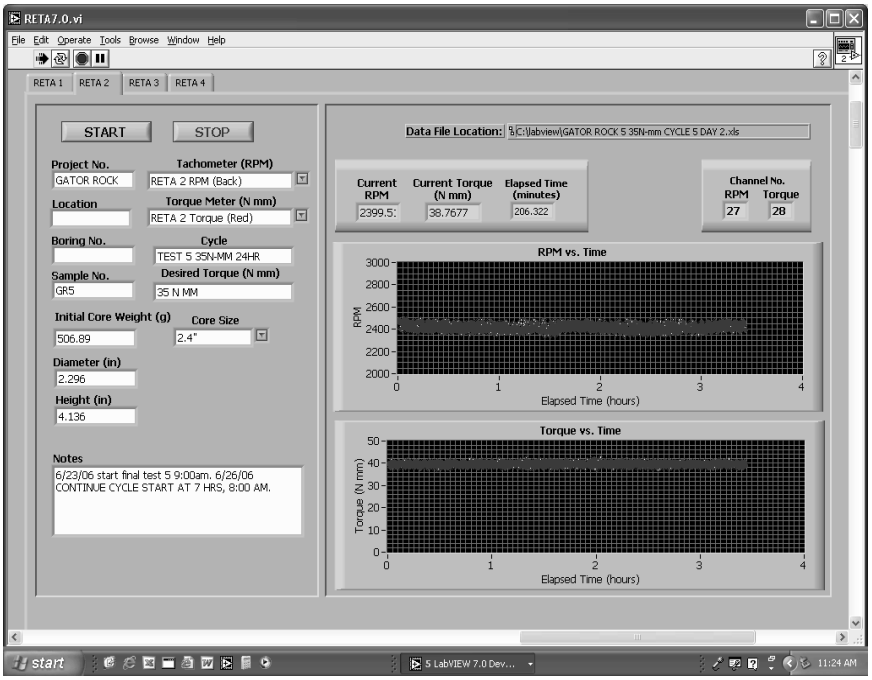
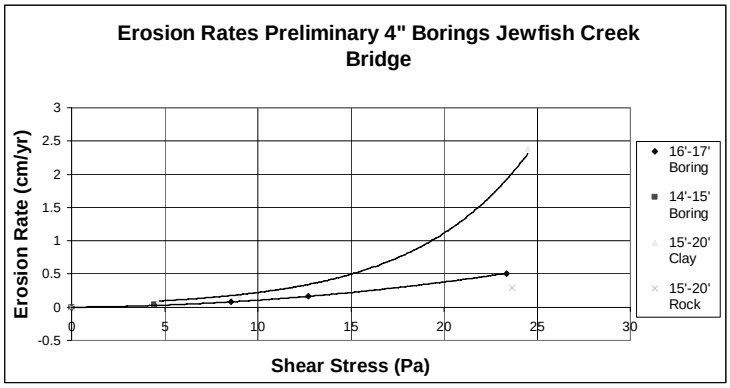


RETA Test Results

- Jewfish Creek Lime Rock Samples



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RETA Test Results

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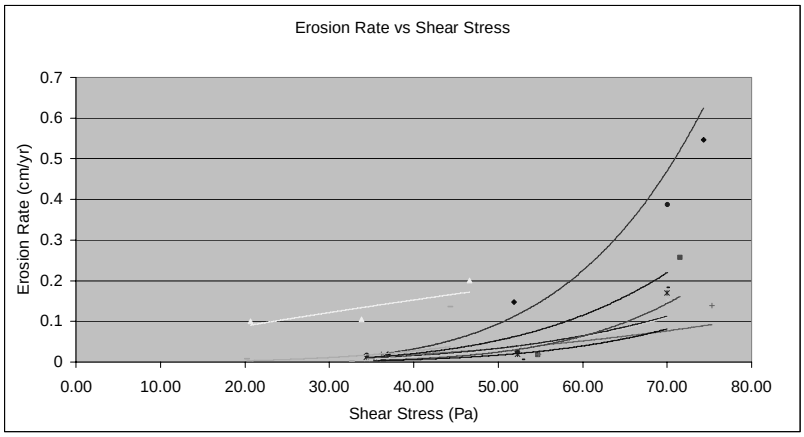

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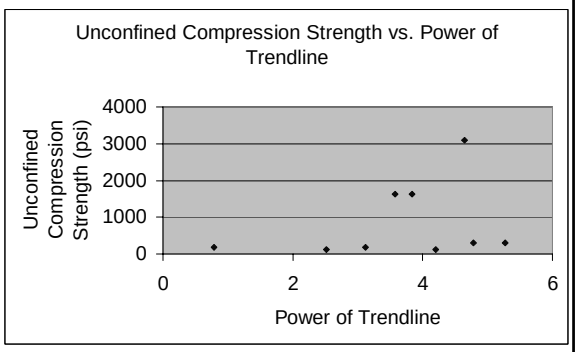
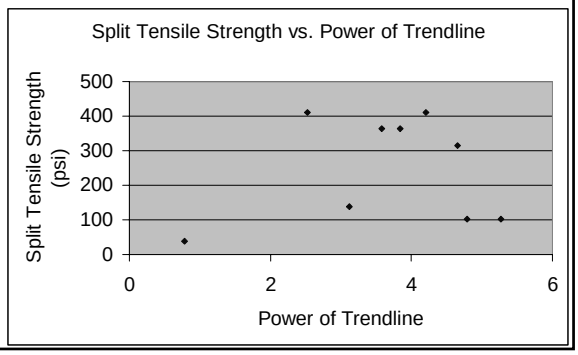
Sample Strength Correlation to Erosion Rate?





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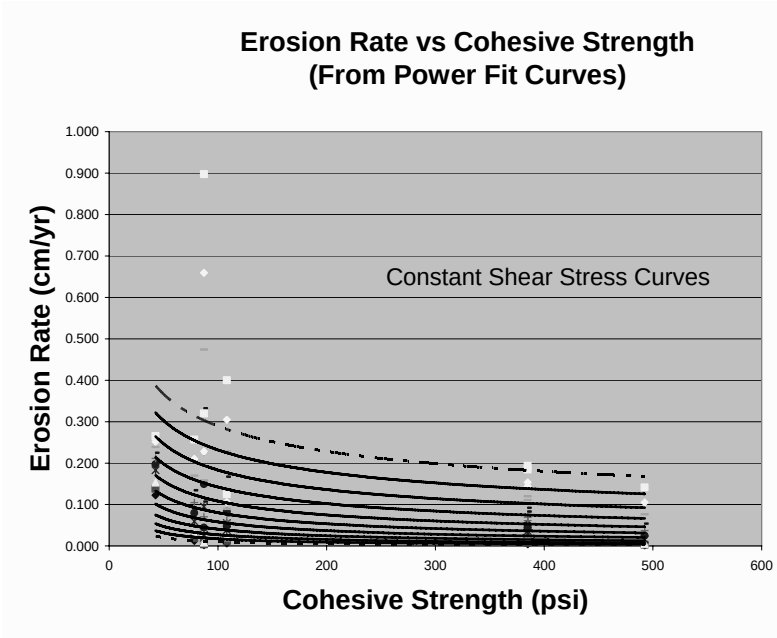

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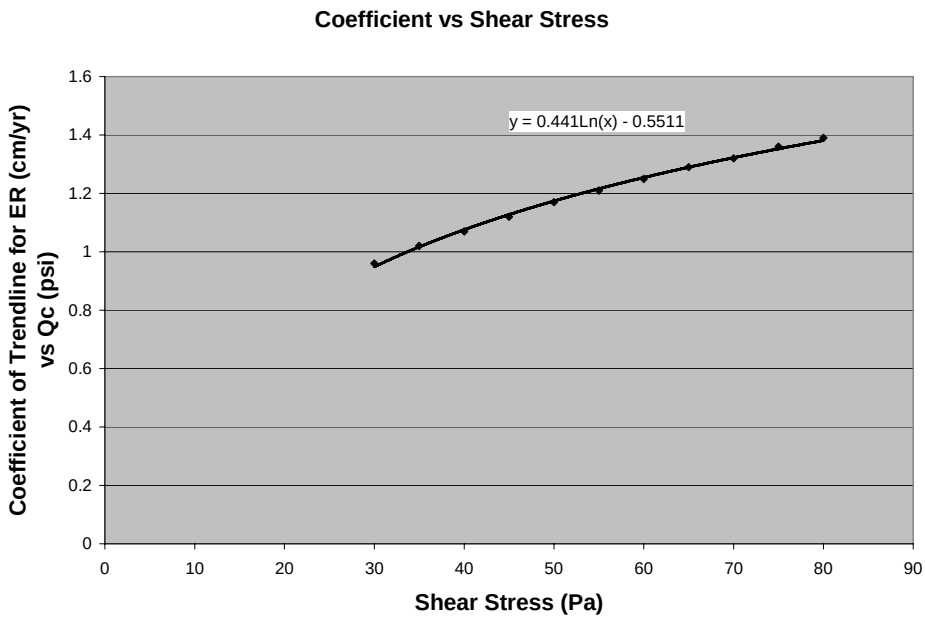

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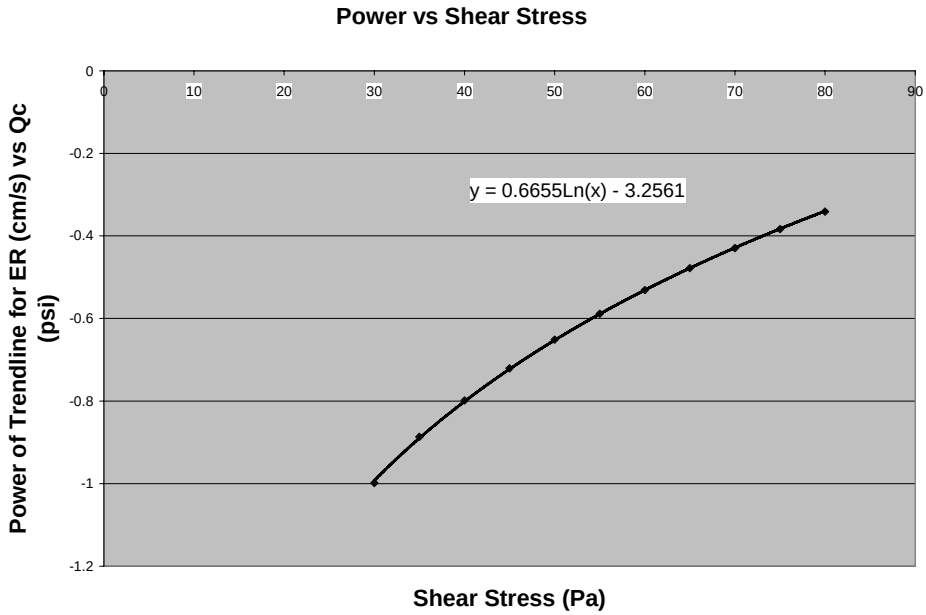

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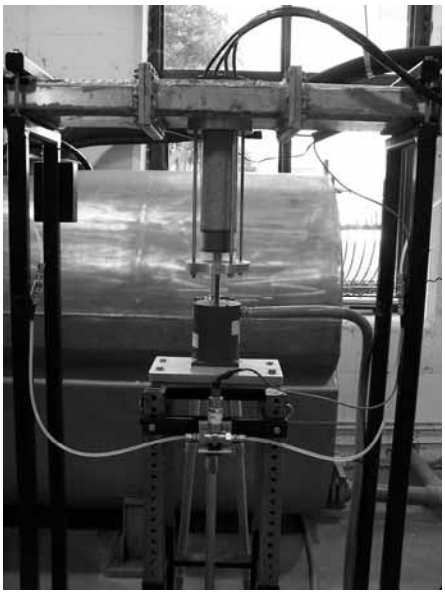
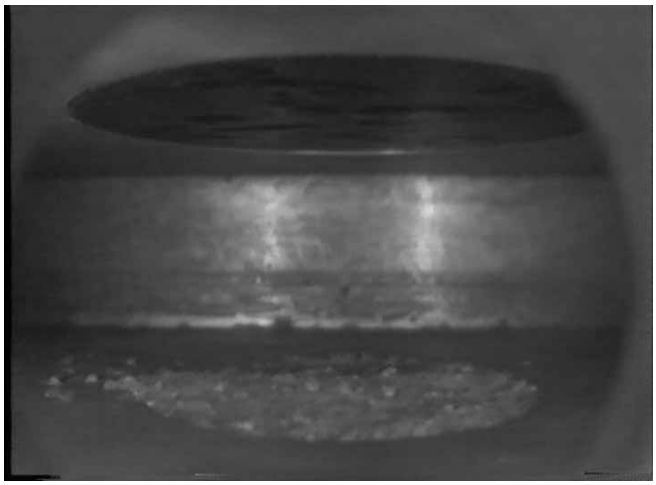
Sediment Erosion Rate Flume



SERF Sand Sample Video



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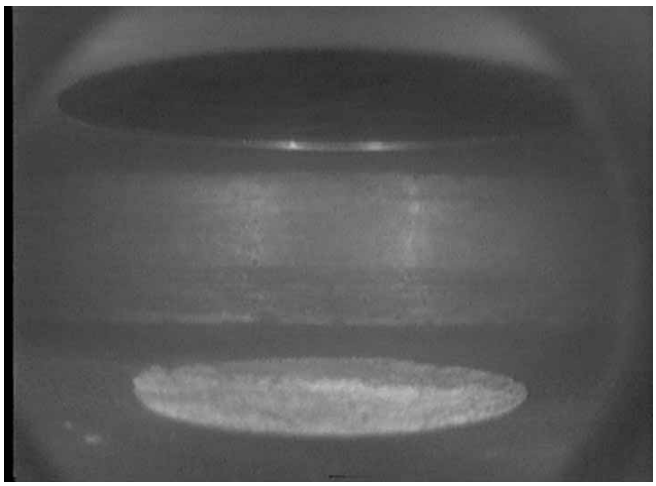
SERF Clay Sample Video



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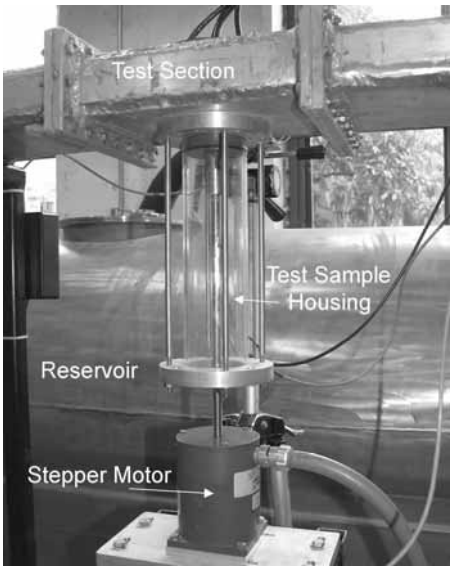
SERF Updates

- Acoustic Signal Return Enhancement
- LabVIEW Data Collection and Analysis
- Additional Differential Pressure Transducer

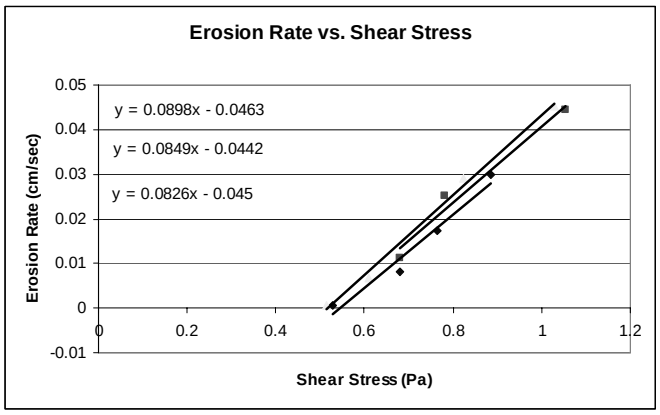


Rock Erosion Test Results

- Jewfish Creek Lime Rock
- Chipola River Rock

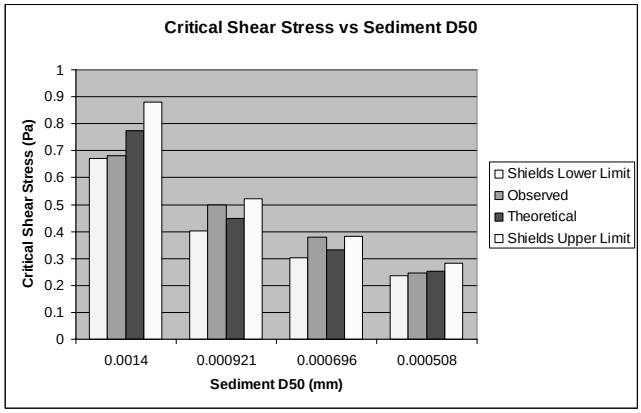
Cohesionless Sand Results

- Repeatability of Tests



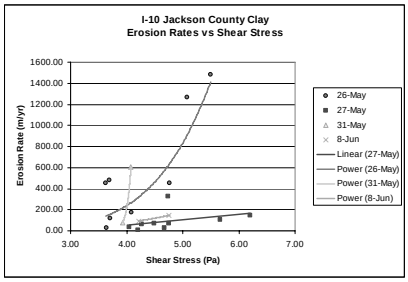
Cohesionless Sand Results

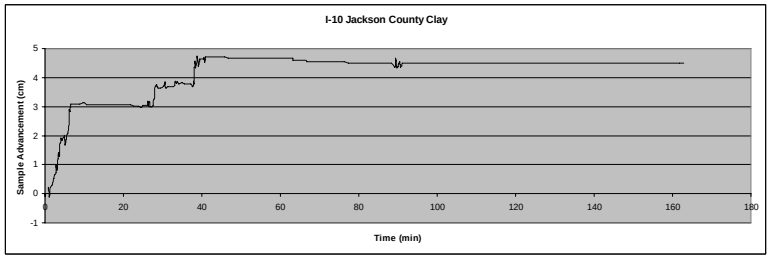
- Critical Shear Tests



Cohesive Clay Results

- I-10 Jackson County "Bubble Bump"
- Expansive Clay Samples
  - Saturation Depth and Erosion Rate





Future Updates and Experiments

- Test a Wide Range of Sediments in RETA and SERF
  - Gator rock, sand stone
  - Wide variety of sediments
- Attempt to Establish Correlation Between Erosion Rate and Other Geotechnical Properties
- Limestone Dissolution Rate Tests
- Improved Shear Stress Measurements in SERF
  - Additional differential pressure transducer
  - Direct shear stress measurement

Summary

- Two Apparatus for Testing Rate of Erosion as a Function of Applied Shear Stress Functional
- Design Improvements and Enhancements Have Been Made
- Presented Example Test Results
- Need for Sediment Samples to Build Database

Need For Sediment Samples

- Clay, Clay-Sand, Other 3” Shelby Tube Samples
- 2.4” and/or 4” Rock Core Samples
- Please Provide Detailed Information
  - Sample Description at Collection
  - Sample (Horizontal and Vertical) Site Location
  - Boring Logs
  - Blow Count
  - Etc.

Questions, Comments

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