Discussion

N. J. Withers[1] *(written discussion)*—The conclusions arising from the papers in Part VII of this STP, the panel discussion at the symposium, and this paper have much in common. It is perhaps constructive to list the items that need to be addressed by an offshore vane standard. They are offered to stimulate discussion and are based on Fugro's experience with its offshore vane, which is shown in following conclusions.

Experience has shown that repeatable, accurate vane data can be obtained with the following.

- Well designed equipment which
  (1) is operationally convenient
  (2) meets defined specs for accuracy/resolution
  (3) can be deployed in a controlled manner (penetration rate and thrust measured)
  (4) can be used at speeds of 0.1°/sec to 0.2°/sec for tests and 1.0°/sec for 3 revolutions before remoulded test
  (5) can accommodate blades compatible with various standards/specs.

- (For downhole mode) Adequate heave compensation of drillbit using a hard-tie system.

Standard needs to specify acceptable

- Vane dimensions for ranges of C_u, 0 to 50, 50 to 100, and 100 to 200 kPa
- Vane shape factor ($H/D = 2$)
- Vane blade thickness (area ratio $< 12\%$)
- Method of calibration of torque, rotation, rotation speed
- Internal friction w.r.t. full-scale torque (2% FSO)
- Accuracy, resolution of torque (0.5% FSO), rotation, rotation speed (4% FSO)
- Angular velocity of blade (0.1°/s to 0.2°/s for $D = 50 - 65$ mm)
- Maximum rotation or (tip displacement) during pre-post peak test (100°) remolded test
- Definition of peak torque, post peak torque, remolded torque
- Number of revolutions before remolded test (3)
- Speed revolutions before remolded test (1°/s)
- Maximum time to maximum rotation for undrained conditions throughout
- Depth of test (1.5 m unless hard-tie used in downhole mode)
- Test interval (>0.7m)
- Maximum bit pressures, mud pressures as function of expected soil strength to avoid unacceptable disturbance (these can only be advised).
- Parameters to be measured during deployment
  internal friction (a must)
  thrust (desirable)
  penetration rate (desirable)
  penetration (a must)

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Internal friction should also be measured after each test (downhole mode) or series of tests (seabed mode)

- Waiting times for start of test and for between post-peak and remolded phases (<5 min in both cases)
- Standard for presentation of data
- Guidance for interpretation of data (including limitations, corrections factors, and so forth)