Maximum shear moduli of compressible Chicago Glacial Clay

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Block samples of low OCR Chicago glacial clays

Lurie Center

Ford Design Center
Experimental program

SCPT tests (Ford Center only)

Bender element tests
Lurie and Ford Center

CK₀₀D triaxial tests
Lurie and Ford Center
Drained stress probes

\[ \eta = 0.78 \]

Ave. initial state for stress paths
\[ \sigma_{vc}' = 134 \text{ kPa}, \ p' = 90 \text{ kPa}, \ q = 66 \text{ kPa} \]
Bender Element Results Comparison for $K_0$ Consolidation Phase

$$G_{\text{max}} = 2790.5p^{0.6358} \quad R^2 = 0.9943$$

$$G_{\text{max}} = 4940.1p^{0.5083} \quad R^2 = 0.9834$$

Effective Mean Normal Stress, $p'$ (kPa)

$G_{\text{max}}$ (kPa)

Power (LB3RTE2)

Power (LB2RTC1)

LB2RTC1

LB3RTE2
Secant shear modulus – Lurie Center

![Graph showing secant shear modulus vs. triaxial shear strain.](image)

- **Graph Title:** Secant shear modulus – Lurie Center
- **Y-axis:** Secant Shear Modulus, $G_{sec}$ (MPa)
- **X-axis:** Triaxial Shear Strain, $\varepsilon_{sl}$ (%)
- **Legend:**
  - AL
  - TC1
  - CMS2
  - RTC1
  - AU2
  - RTE2
  - CMSE
  - TE2
- **G_{BE} Range:** Marked on the graph
- **Unloading and Loading Directions:** Indicated on the graph
Secant shear stiffness as a function of recent stress history.

- Lurie Center data
- Ford Center data – continuing evaluation
Comparison with SCPT results

- Horizon where specimens taken at Ford Center has shear wave velocity that varies from 180 to 190 m/s (Thanks to Paul Mayne and GT students)

- After creep interval in TX tests, the propagation velocity of the induced wave is 175 to 190 m/s, indicating that the Gmax values based on SCPT and in lab are the same
Conclusions

• Shear modulus from Bender element tests after consolidation to *in situ* conditions approximately equal to $G_{sec}$ at $\approx 0.001\%$ in drained probes with shear stress decreasing at $\approx$ constant mean normal effective stress.

• Shear modulus from Bender element tests (with an appropriate creep increment) are similar to those from SCPT tests.

• $G_{max}$ from BE = $G_{max}$ SCPT = $G_{0.001}$ from “unloading” drained TX tests.