

# Echo)))

ENVIRONMENTAL & GEOTECHNICAL SERVICES LTD.

## SUBSURFACE PROFILING SERVICES

### GEOTECHNICAL APPLICATIONS



#### Design parameters

- Shear moduli
- Bedrock profiling
- Soils lithology/continuity



#### GeoHazard Identification

- Void detection
- Project risk reduction

#### EARTH DAMS AND LEVEES

- Investigate Shear moduli and underlying soil structure
- Direct fluid detection by combining P-wave & S-wave reflection sections in a single pass
- Deliver high resolution continuous profiles with no surface disturbance or intrusive drilling along the earth dams
- Jointly conduct MASW and Shear moduli from SH reflection data 10-50m below base of dam
- Optimize CPT and drilling tests if required

#### TRANSPORT CORRIDORS

- Investigate deeper soil structures and hazards where public transportation systems are being built over old forgotten infrastructure
- Ideally suited to work on paved or gravel roads - no "planting" of geophones
- Continuously sample the subsurface between known drill holes or other discrete data points
- SH reflection technology characterizes the shear velocities of the underlying material, identifies voids, low shear strength materials and buried channels to depths of 100+ meters

#### GEOTECHNICAL ENGINEERING DESIGN

- Identify voids or areas of weak soil strength prior to construction to mitigate risk of significant disastrous consequences during and after construction
- Reduce the number of drill or penetration tests required and optimize their placement
- MASW, Shear reflections sections along continuous profiles with no surface disturbance & timely results



# SEE BENEATH THE SURFACE

# Echo)))

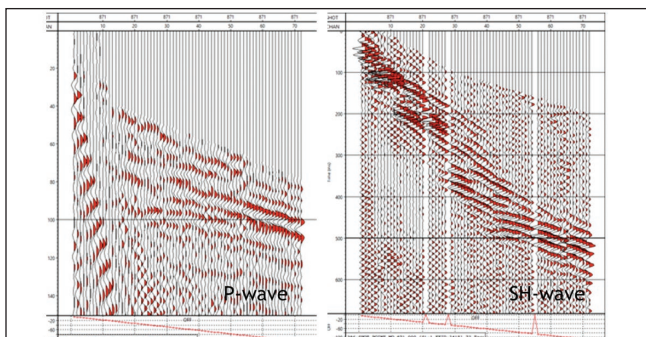
ENVIRONMENTAL & GEOTECHNICAL SERVICES LTD.

## Fast, efficient subsurface, Shear moduli profiling

Echo Geotechnical delivers continuous, high resolution, multi-attribute subsurface profiles, reducing risk and optimizing opportunities for our clients. We collect, process and interpret Shear moduli from SH reflection, MASW and compressional (P-wave) data in a single pass providing our clients with higher resolution images that are decision-ready for their geotechnical, mining or water resource applications.

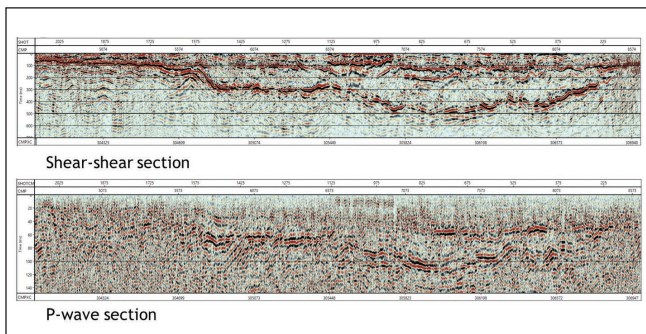
At Echo Geotechnical, we know our clients need as much data as possible before they drill, dig or load their sites. Our equipment is non-intrusive, quick and accurate. Discrete drill holes and cone penetration tests (CPT) leave significant gaps in knowledge especially given the complexity of the subsurface and the cost of undetected hazards.

## WHAT WE DO



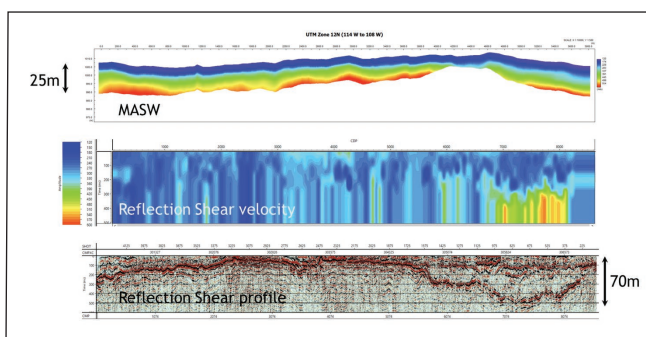
### ACQUISITION

- Cost efficient Vibroseis energy source and streamer with 72 3C receivers using minimal crew
- Includes MASW acquisition, SH and P-wave in single pass
- Non-intrusive - ideal for urban settings or dams and levees
- Large number of channels recorded for full section - shallow to deep



### PROCESSING

- Full wave processing - SH and P-wave from same data
- High resolution imaging in low velocity soils up to 200 meters
- Shear modulus estimates along continuous profiles delivered for engineering analysis



### INTERPRETATION

- Quickly identify subsurface features such as tunnels, fluids, low shear strength materials and buried channels
- Stratigraphic and structural profiles validated with available well and CPT data
- Integrate well data with profiles to create 3D visualization