



SOLUTIONS FOR THE BUILT WORLD

Fall 2015 Iowa DOT Vibration Seminar

Techniques of Instrument Deployment

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Techniques of Instrument Deployment

- Phenomena to Monitor
 - Vibrations
 - Crack Movements
 - Tilt
 - Structural movement
 - Soil movement
 - Settlement

Techniques of Instrument Deployment - Vibrations

- Seismographs
 - Instantel
 - Minimate Plus
 - Minimate Pro4, Pro6
 - Micromate
 - Geosonics/Vibratech
 - 3000LC
 - 3000-EZ Plus
 - 3000LCP
 - 5500
 - White Industrial Seismology
 - Mini-Seis III
 - Mini-Seis

Techniques of Instrument Deployment - Vibrations

- Instantel
- Minimate Plus
- Minimate Pro4
- Micromate



Techniques of Instrument Deployment - Vibrations

- Geosonics/
Vibratech

- 3000LC

- 3000-EZ Plus

- 3000LCP

- 5500



Techniques of Instrument Deployment - Vibrations

- Attaching Seismometer

- In Ground



Figure 3.4 Installing the Standard Transducer using the Ground Spikes.

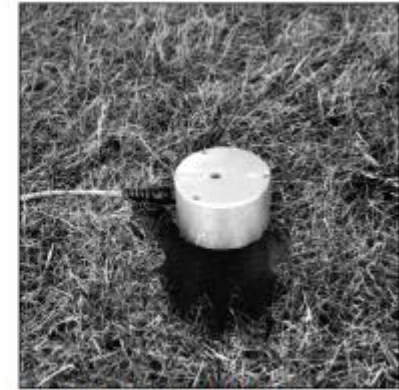


Figure 3.5 Final Installation with Ground Spikes Pushed Fully into the Ground.

- Hard Surface



Figure 3.11 Bolting the Standard Transducer to a Surface.



Figure 3.12 Bolting the Standard Transducer to a Surface using the Leveling Plate.

Sandbagging – For Very Low Velocity Levels Only

Use this method for installations where velocity levels remain very low. The sandbag must be of sufficient size to cover the entire Minimate Plus or standard transducer and lay on the surrounding

Techniques of Instrument Deployment - Vibrations

- Attaching Seismometer
 - Underside of slab
 - Wall



Figure 2 Installing the Standard Transducer on a Ceiling Right Side Up.

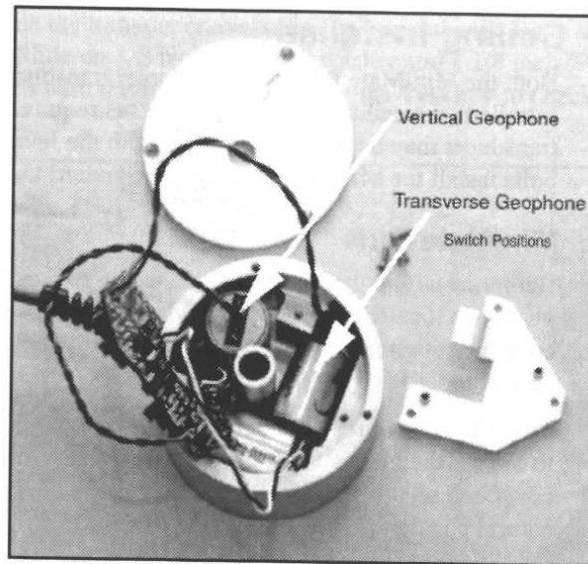


Figure 5.2 For Wall Installations of the Standard Transducer, Switch the Positions of the Transverse and Vertical Geophones.

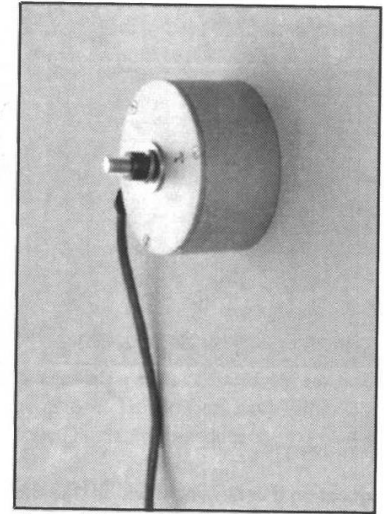


Figure 5.3 Installing the Standard Transducer on a Wall.

Techniques of Instrument Deployment - Vibrations

- Seismograph Installation Preferences
 - In-ground is best reflection of the USBM guidelines
 - Usually basement slab is chosen
 - Avoid boilers, furnaces, sump pumps, dehumidifiers.
 - Keep logging unit out of low water area.

Techniques of Instrument Deployment - Vibrations

- Monitoring Modes
 - Waveform Recording
 - Triggered or manual
 - Fixed length or Auto-record
 - Histogram
 - Logging Interval
 - Store
 - Peak Particle Velocity
 - Frequency
 - Peak Vector Sum = $\text{Sqrt}(L^2 + T^2 + V^2)$
 - Histogram/Combo

Techniques of Instrument Deployment - Vibrations

- Monitoring Modes (continued)
 - Histogram/Combo
 - Continually collect histogram data
 - Trigger to capture waveform event if a threshold is exceeded
 - AutoCallHome (essential)
 - Transmit files to remote server when any event occurs
 - Trigger level exceeded
 - Scheduled upload time
 - Allows server to send alert notifications
 - Results in 2 emails for triggered event

Techniques of Instrument Deployment - Vibrations

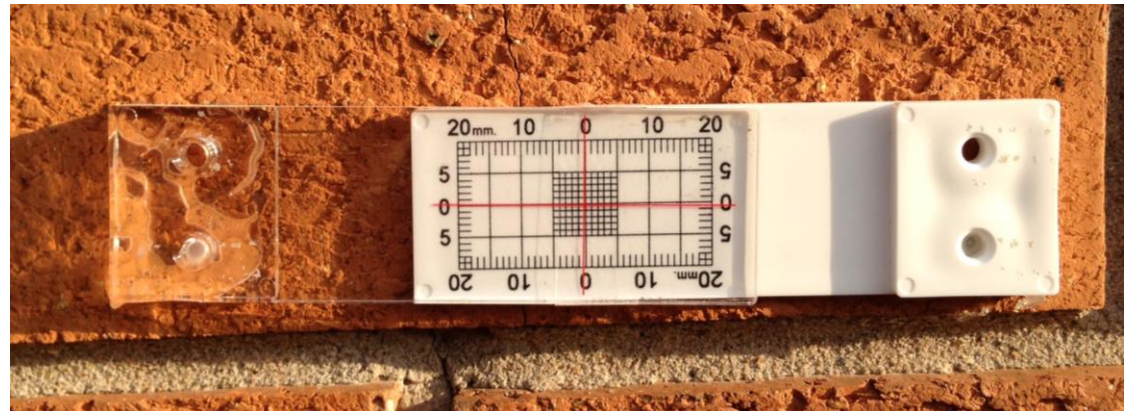
- Communication (Remote Access)
 - Land-line modem
 - Cellular modem
 - Airlink RavenXT
 - Sierra Wireless LS300
 - Serial interface
 - Static IP address for remote access
 - i.e. 166.156.17.70
 - Satellite modem

Techniques of Instrument Deployment - Vibrations

- Communication Issues (Remote Access)
 - Signal strength (RSSI)
 - Basements
 - Rural areas
 - Supplemental antenna
 - Antenna cable extension
 - Signal booster
 - Serial cable extension

Techniques of Instrument Deployment - Cracks

- Measurement Modes
 - Visual observations
 - Crack Gages
 - Tell-Tale Crack Monitors, RST Instruments Ltd.
 - Crack Monitoring Equipment, Geotest Instrument Corp.
 - Avongard Crack Monitor, Avongard Products USA



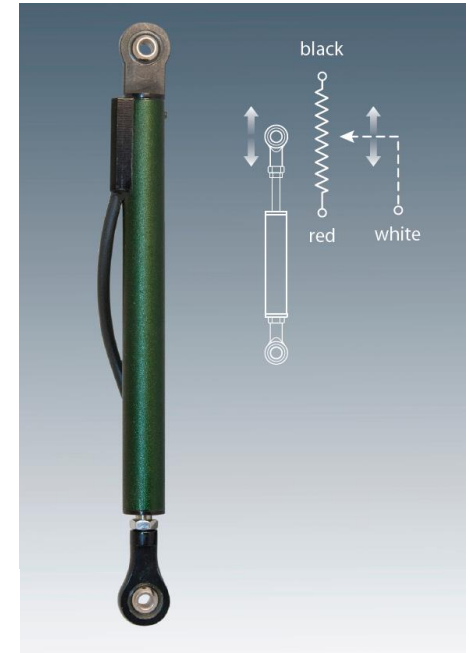
Techniques of Instrument Deployment - Cracks

- Measurement Modes
 - Visual observations
 - Optical Comparator
 - Fowler 7x Lupe



Techniques of Instrument Deployment - Cracks

- Measurement Modes
 - Remote Logging/Monitoring
 - Potentiometer
 - LVDT
 - Mount plunger & core on opposite sides of the crack
 - Requires weatherproofing
 - Continuous power



Techniques of Instrument Deployment - Cracks

- Measurement Modes
 - Remote Logging/Monitoring
 - Requires logging device and remote communications
 - Sensor can be affected by temperature changes.

Techniques of Instrument Deployment - Tilt

- Tilt Monitoring for structural movement
 - Single axis or bi-axial
 - Use with logging device and remote communications for single location
 - Use single tilt meter with several anchored base plates to be read periodically
 - Can be affected by temperature changes
 - May require stabilization period depending on sensor type.
 - Mounting location is an issue
 - Column
 - Slab or beam between columns

Techniques of Instrument Deployment - Tilt

- Tilt Monitoring for structural movement
 - Applied Geomechanics Model 711
 - Jewell Instruments Tuff Tilt 801



Model 711-2 Floor Mount Tiltmeter



Techniques of Instrument Deployment - Tilt

- Tilt Monitoring for Soil Movement
 - Borehole Inclinerometers
 - Would detect lateral soil move before it effects surface-mounted structures
 - Several casings with one inclinometer
 - Requires manual readings at incremental depths
 - Single borehole with several inclinometers anchored at several depths
 - Can be monitored with logger and remote communication

Techniques of Instrument Deployment - Settlement

- Elevation and Lateral Position Surveys
 - Referenced to a stationary benchmark
 - Targets on buildings, pavements
 - Manual optical survey equipment
 - Scribe marks
 - Total Station
 - Prisms mounted on surfaces
 - Can be automated

Techniques of Instrument Deployment - Vibrations

- When AC Power is not available:
 - Solar panel
 - Enclosure with battery



Techniques of Instrument Deployment - Vibrations

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Techniques of Instrument Deployment - Vibrations

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 - Enclosure with battery



Techniques of Instrument Deployment - Vibrations

- When AC Power is not available:
 - Solar panel
 - Gangbox with battery
 - Transducer buried in ground beneath box

