


Subsidence Monitoring



Monitoring Planned Subsidence

- 1. Monitoring surface movements
- 2. Monitoring subsurface movements

Surveying Surface Subsidence

- Survey line layout and monument spacing
- Monument design
- Accuracy of surveying

DEQ Exhibit 19

Surveying Surface Subsidence Survey line layout

- Lines should cover both transverse and longitudinal directions
- Lines should extend beyond any potential angle of draw
- If possible extend line across chain pillar and monitor through pass of both panels
- Space at 5 percent of depth

COMPREHENSIVE MONITORING PLAN

○ Monitor
△ System Triangle

FIGURE 1

Monitoring for angle of draw

Monitoring for maximum subsidence

Monitoring to produce post subsidence contours

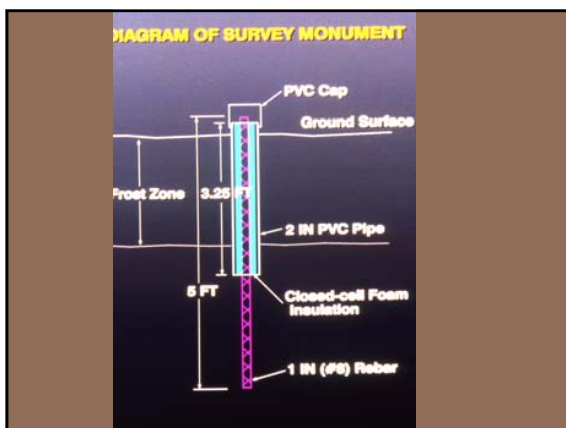
21. If no means to measure the maximum subsidence, a few points near the center of the panel would supply the required data (see below).

22. If a grid of the subsidence contours over a panel is needed, a pattern of monitors over the entire monitoring area would be required (see below).

23. If a measure of the overall strain is required, then lines of closely spaced points or areas of points are needed as

Monument design

- Life of monitoring 2 weeks or 2 years?
- If long term, monuments should be designed to negate the impacts of natural ground fluctuations and frost heave

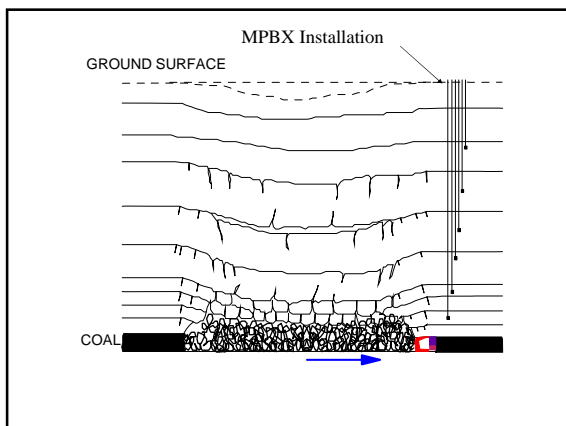


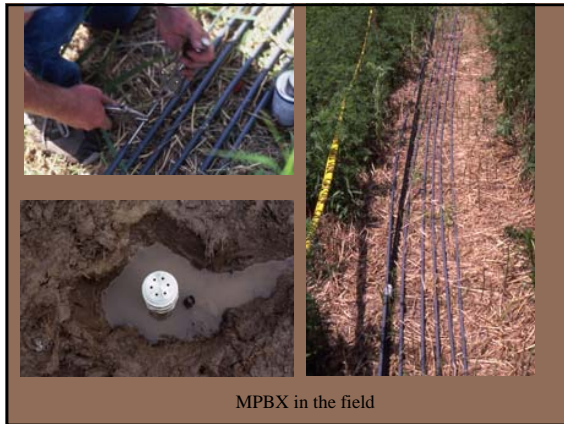




Subsurface Instrumentation

- MPBX (multi point borehole extensometer)
- Inclinator
- TDR (Time Domain Reflexometer)
- Sondex





Inclinometer

- Device to determine the change in inclination down a borehole

Time Domain reflectometry

- Cable tester adapted to ground movement detection application



