LANDSLIDE AND ROCKERY WALL MONITORING SYSTEM FOR RESIDENTIAL AREA

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OVERVIEW

- Landslides
  - Nature of failures
- Rockery Walls
  - What is a rockery wall?
  - Why rockery wall can present a potential risk?
- Case Study
  - Nature of the hazards
  - Repair of the slope
  - Monitoring movement of wall
- What are the optimal monitoring solutions for the case study?
  - Monitoring the slope after the repair
  - Monitoring the rockery wall
  - Data Acquisition

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LANDSLIDES

- Nature of failures:
  - Soil saturation
  - Slope angle
  - Surcharge
  - Ground water

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WHAT IS A ROCKERY WALL?

- Difficult design
  - Not standardized
- Construction relies on installers' skill
- No reinforcement
- Can fail due to soil movement behind the wall

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HAZARDS OF A ROCKERY WALL

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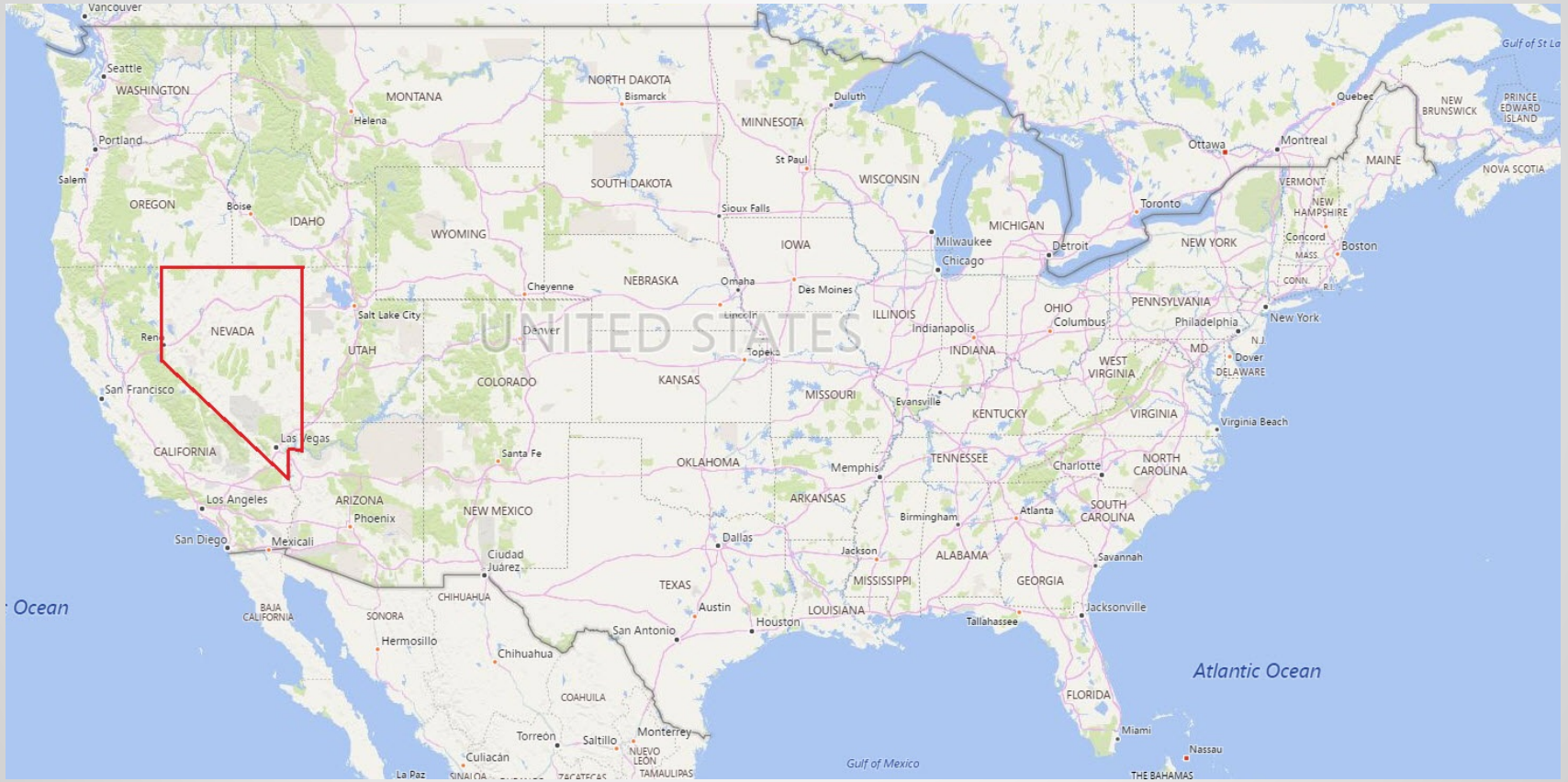
CASE STUDY : RESIDENTIAL AREA IN NEVADA



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NATURE OF THE HAZARDS – LANDSLIDE

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NATURE OF THE HAZARDS – ROCKERY WALL

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REPAIR OF THE SLOPE

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SOLUTION - MONITORING

Monitoring the slope

Monitoring the boulders

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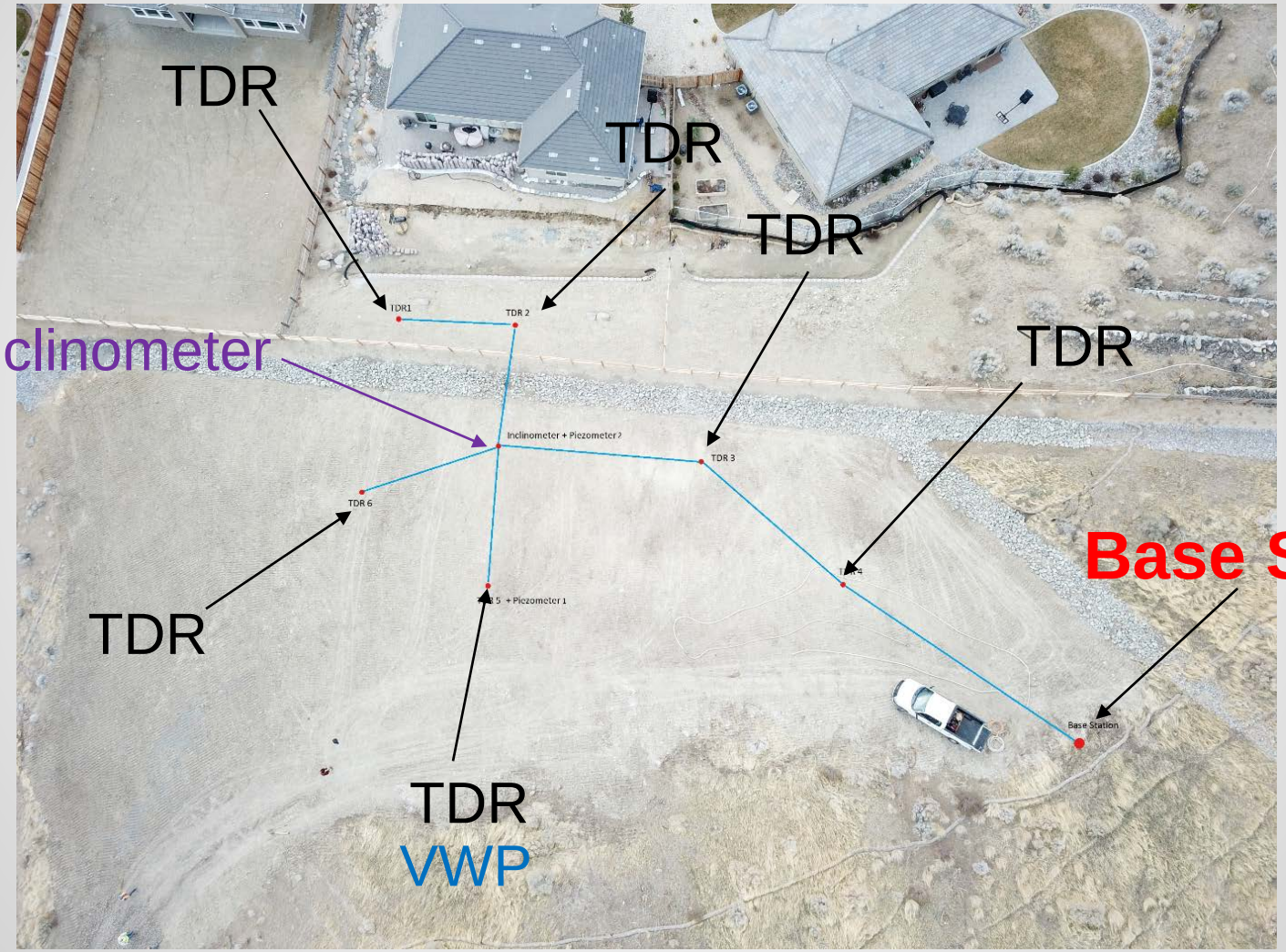
SLOPE INSTRUMENT LAYOUT



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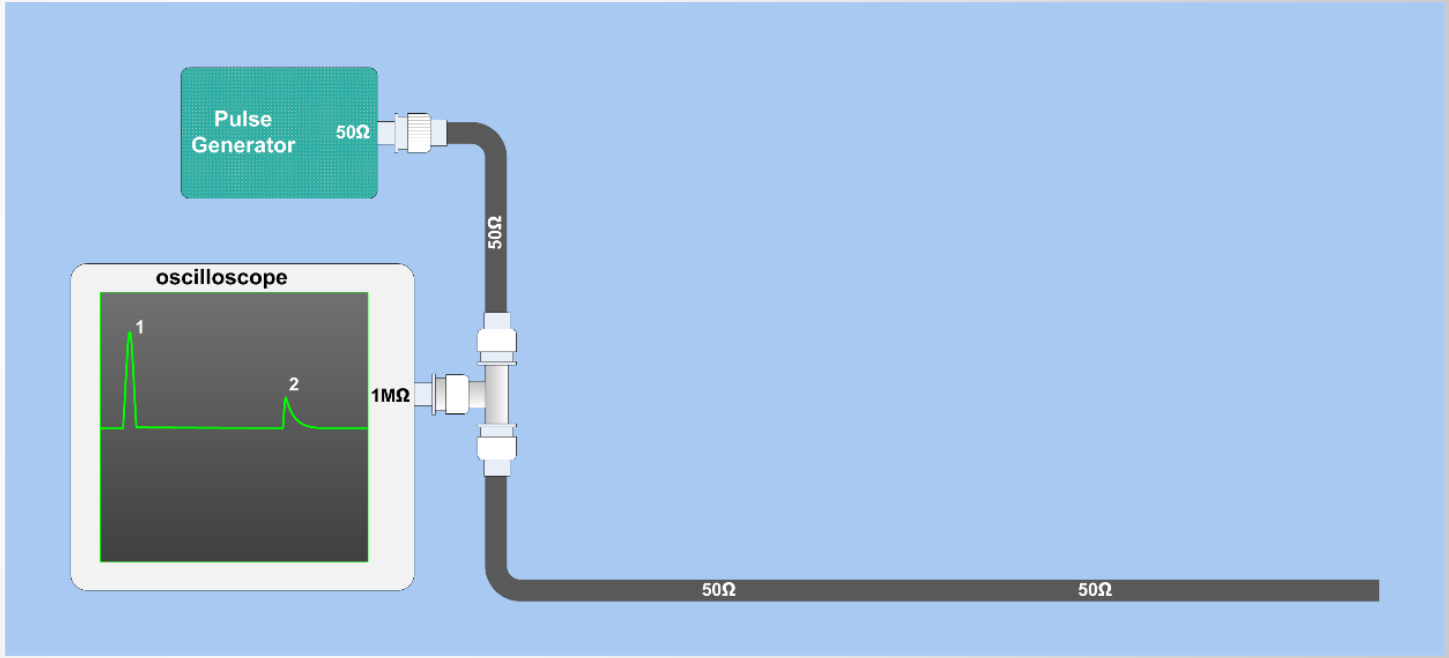
TIME-DOMAIN REFLECTOMETRY (TDR) : HOW IT WORKS

- Works like radar
- Reflectometer transmits short rise-time pulse
- Pulse is transmitted along the cable
  - Cable has a characteristic *velocity of propagation* (Vp).
  - Vp is known as a percentage of the speed of light.
- Pulse if reflected and the travel time determined
  - Length of the sensor cable can be calculated



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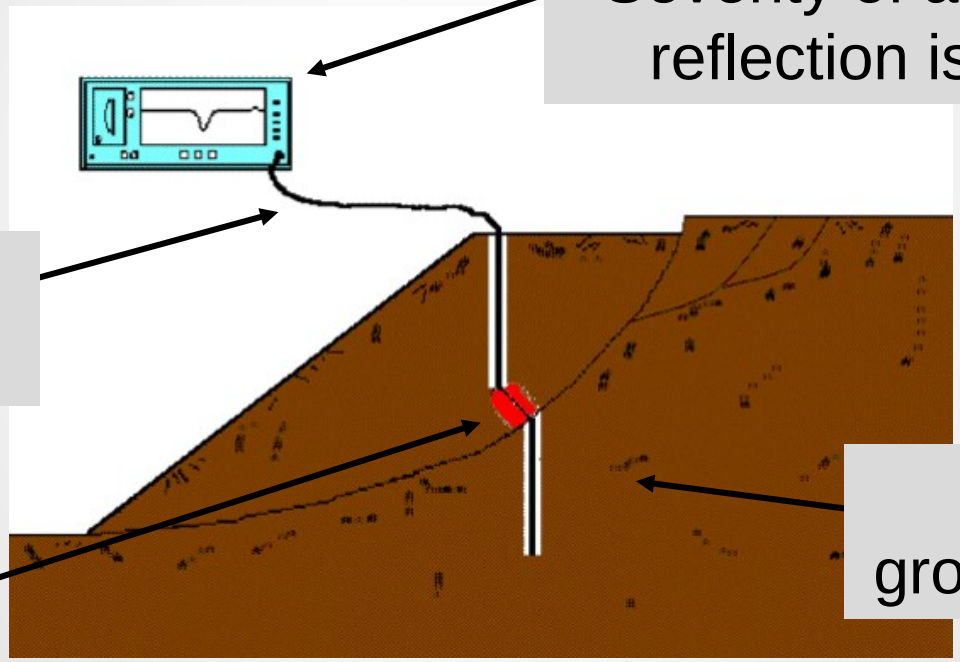
TIME-DOMAIN REFLECTOMETRY

Severity of and distance to reflection is determined



Electrical pulse sent down cable

Pulse reflected at crimps and breaks

Coaxial cable grouted into borehole

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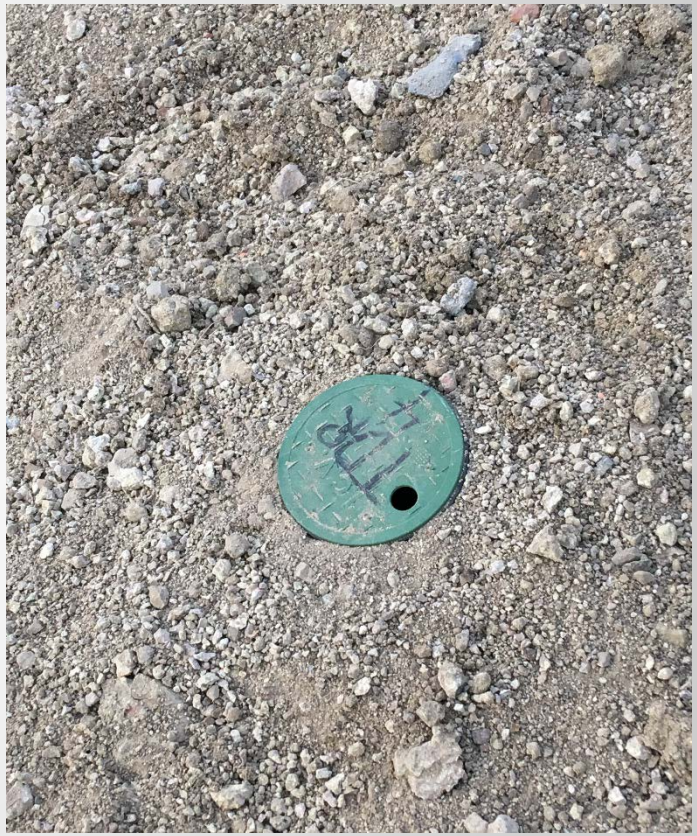
MONITORING THE SLOPE AFTER REPAIR : TIME-DOMAIN REFLECTOMETRY



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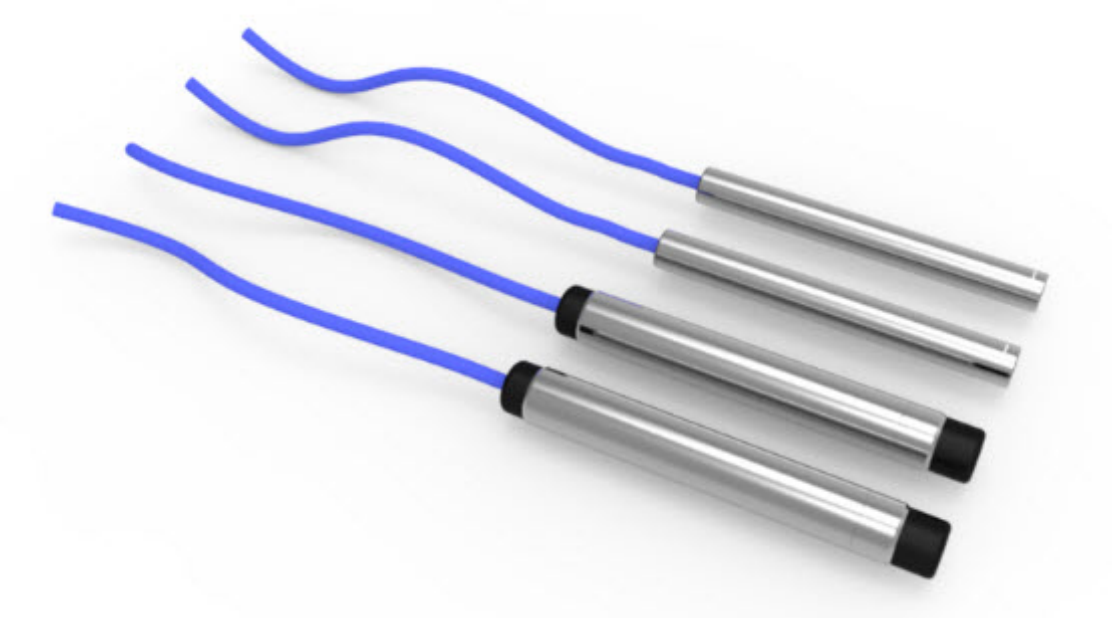
VIBRATING WIRE PIEZOMETER



- Monitors pore-water pressure in soil
- Water pressure changes the tension in the wire

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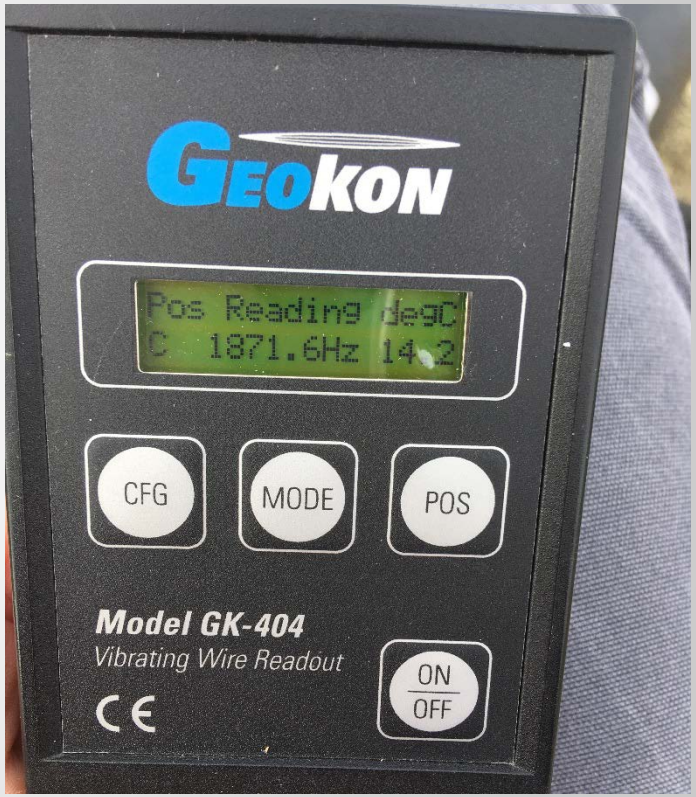
MONITORING THE SLOPE AFTER REPAIR : VIBRATING WIRE PIEZOMETER



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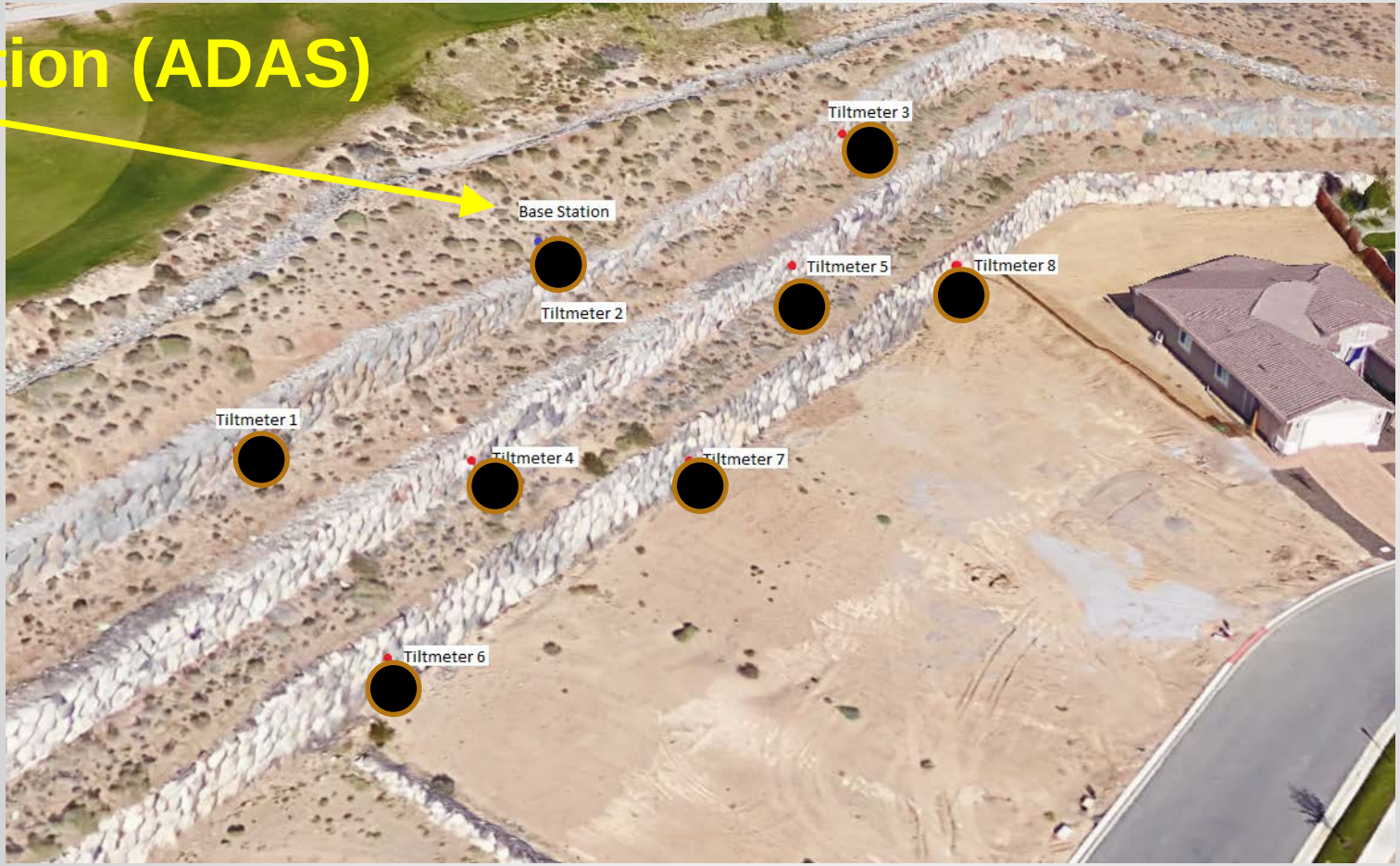
ROCKERY WALL INSTRUMENTATION LAYOUT



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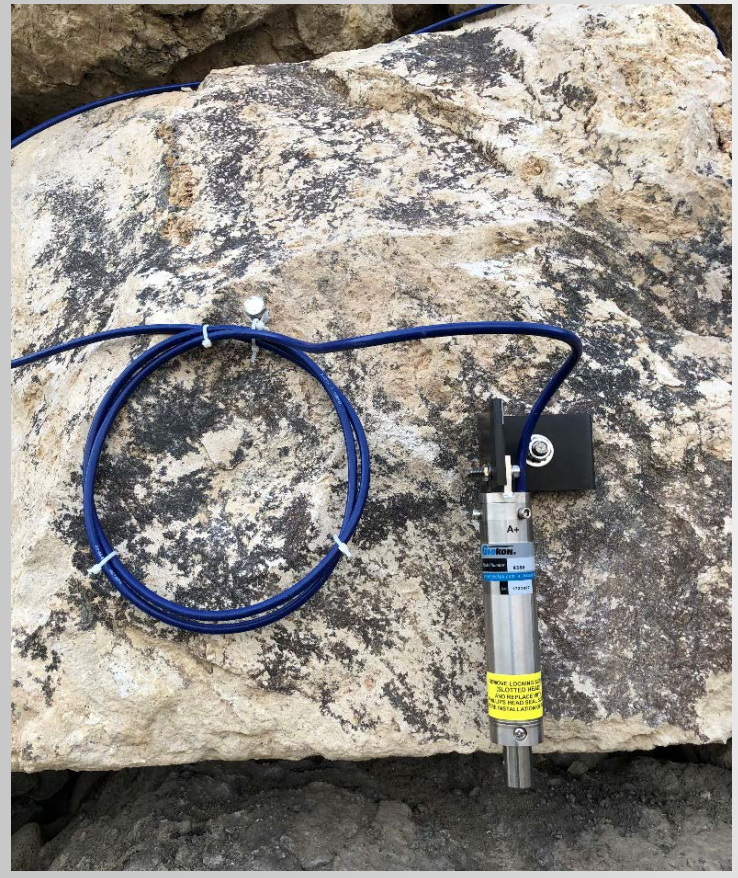
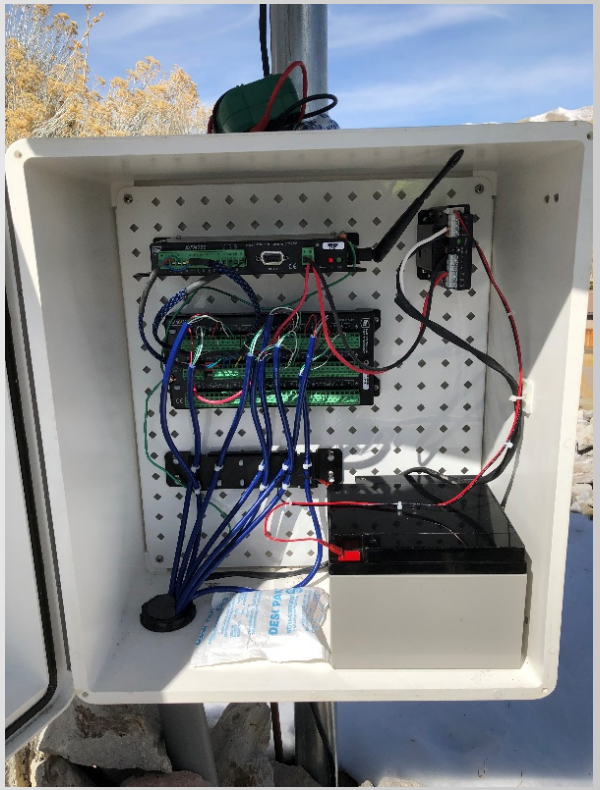
MONITORING OF THE ROCKERY WALL : VIBRATING WIRE TILTMETER



- 8 Uniaxial tiltmeters on 3 different levels
- All connected to a vibrating wire analyzer



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AUTOMATED DATA ACQUISITION SYSTEM

- Instruments connected to a datalogger
- Datalogger collects data
- Real-Time monitoring
  - Email alerts sent via modem

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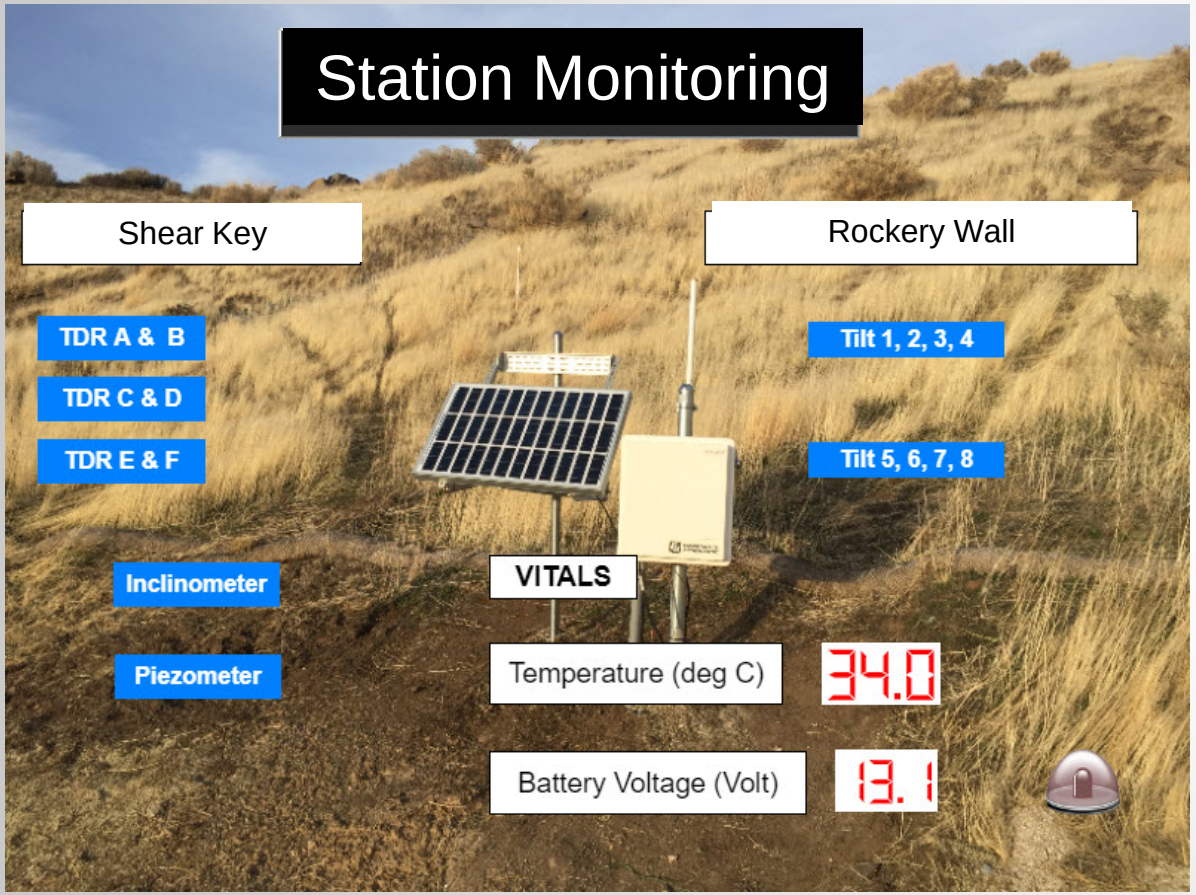
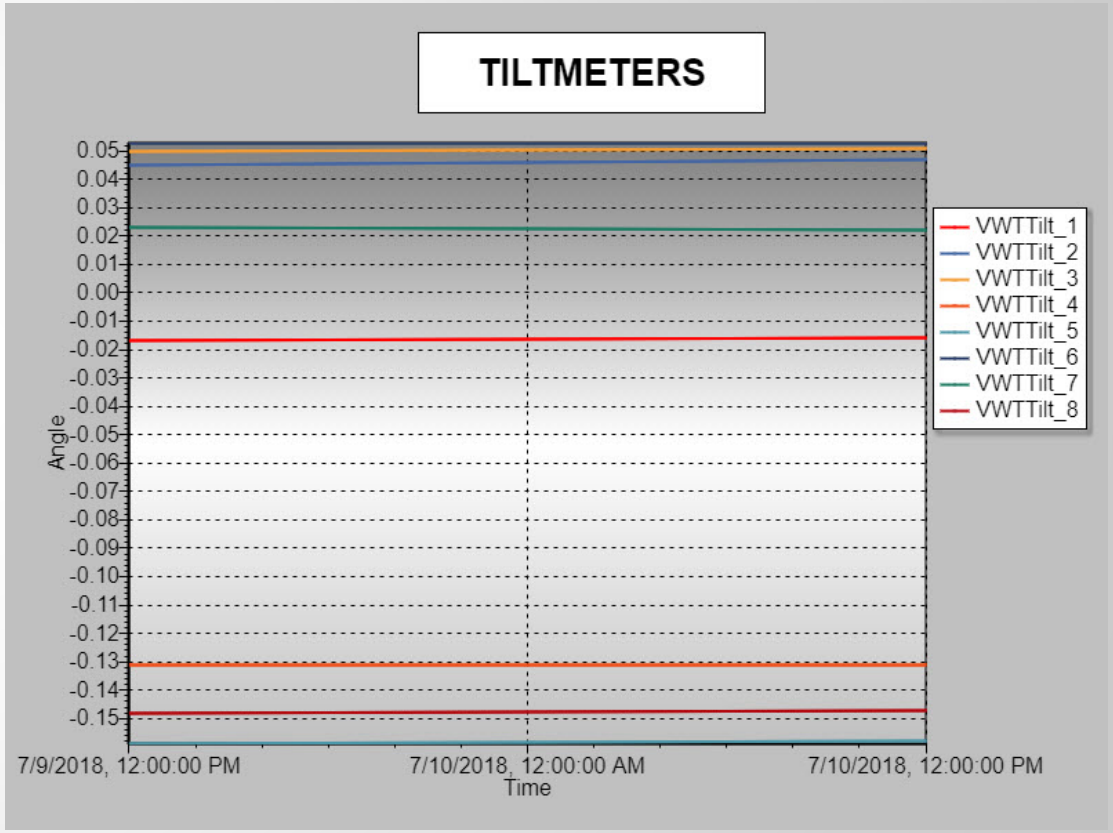
WEB-PAGE INTERFACE





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CONCLUSIONS

- Post-construction monitoring is essential
- Monitoring can determine if a problem actually exists
- Wide variety of instrumentation is available
- Automated instrumentation is cost-effective
  - Can be reused after stabilization is assured
  - Relatively inexpensive
  - Allows real-time data acquisition to spot trends

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