

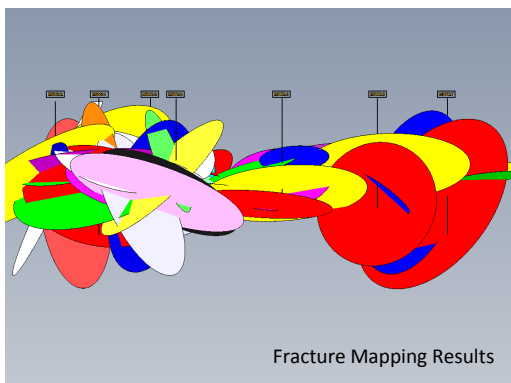
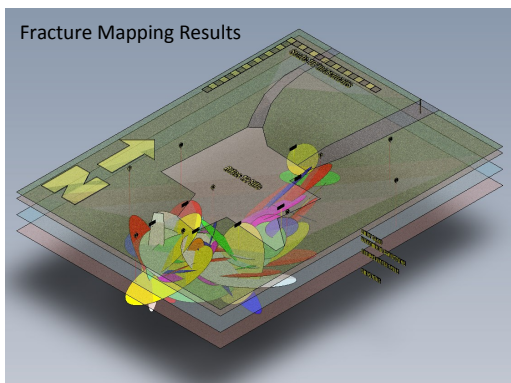
Case Study: Tiltmeter Mapping of Amendment Fractures Emplaced in Sandstone Bedrock for In Situ Remediation

OVERVIEW

Site: A former Air Force Missile Site in Colorado

Subsurface Material: Sandstone Bedrock

Target Treatment and Fracturing Zone: 35 to 65 ft depth



- OBJECTIVES & CHALLENGES**
- Conduct 3D tiltmeter mapping for amendment fractures emplaced into bedrock
 - Determine the treatment area resulting from the amendment emplacement
 - Mapping required for fractures propagating under the missile facility infrastructure

- FIELD PROGRAM**
- Up to 12 surface mounted tiltmeters were used to detect the micro-movements of the ground surface during fracturing
 - Mapping was conducted at 7 boreholes and for approximately 52 fractures

- TECHNICAL EVALUATION**
- The mapping results determined:
- the fractures provided coverage of approximately 60,000 ft²
 - the amendment was successfully distributed across the target interval of impacted bedrock sediments, including under the missile facility (see figures)
 - the extensive network of fractures provided significant contact with the TCE impacts