

Feasibility of a Large Excavation at the Homestake Mine

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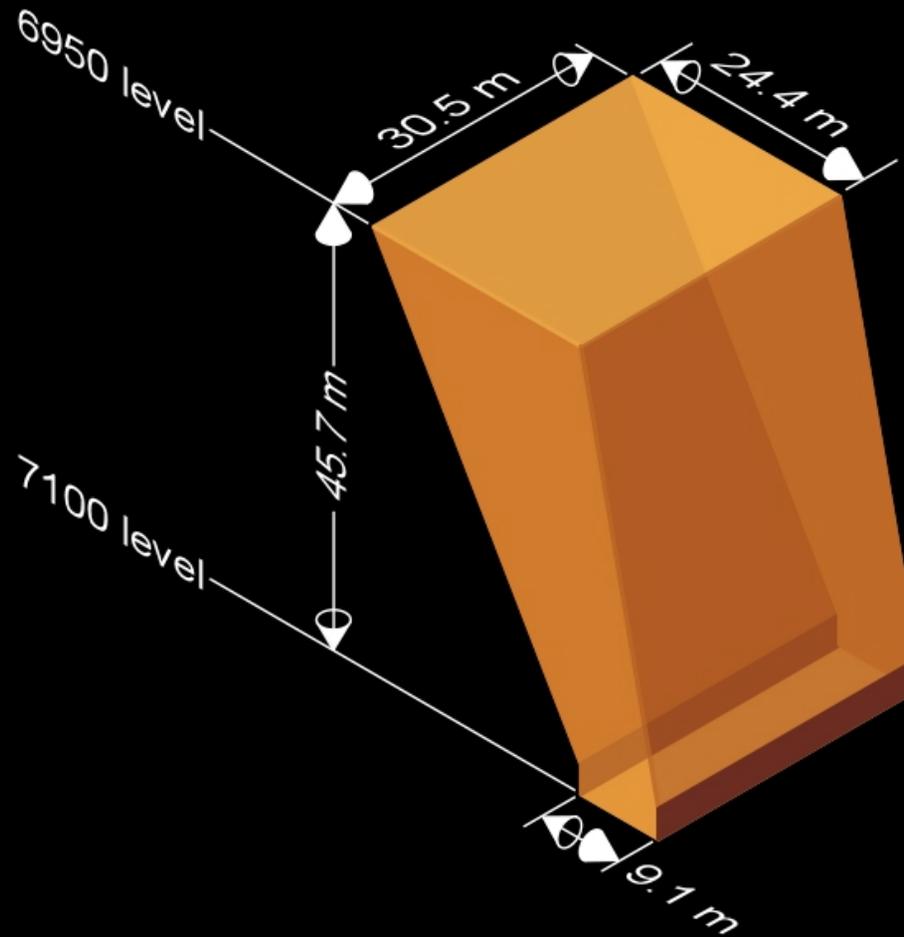
Methodology

- **Case History**
- **3d numeric modeling**
- **Empirical charts from tunneling**

General Assumptions

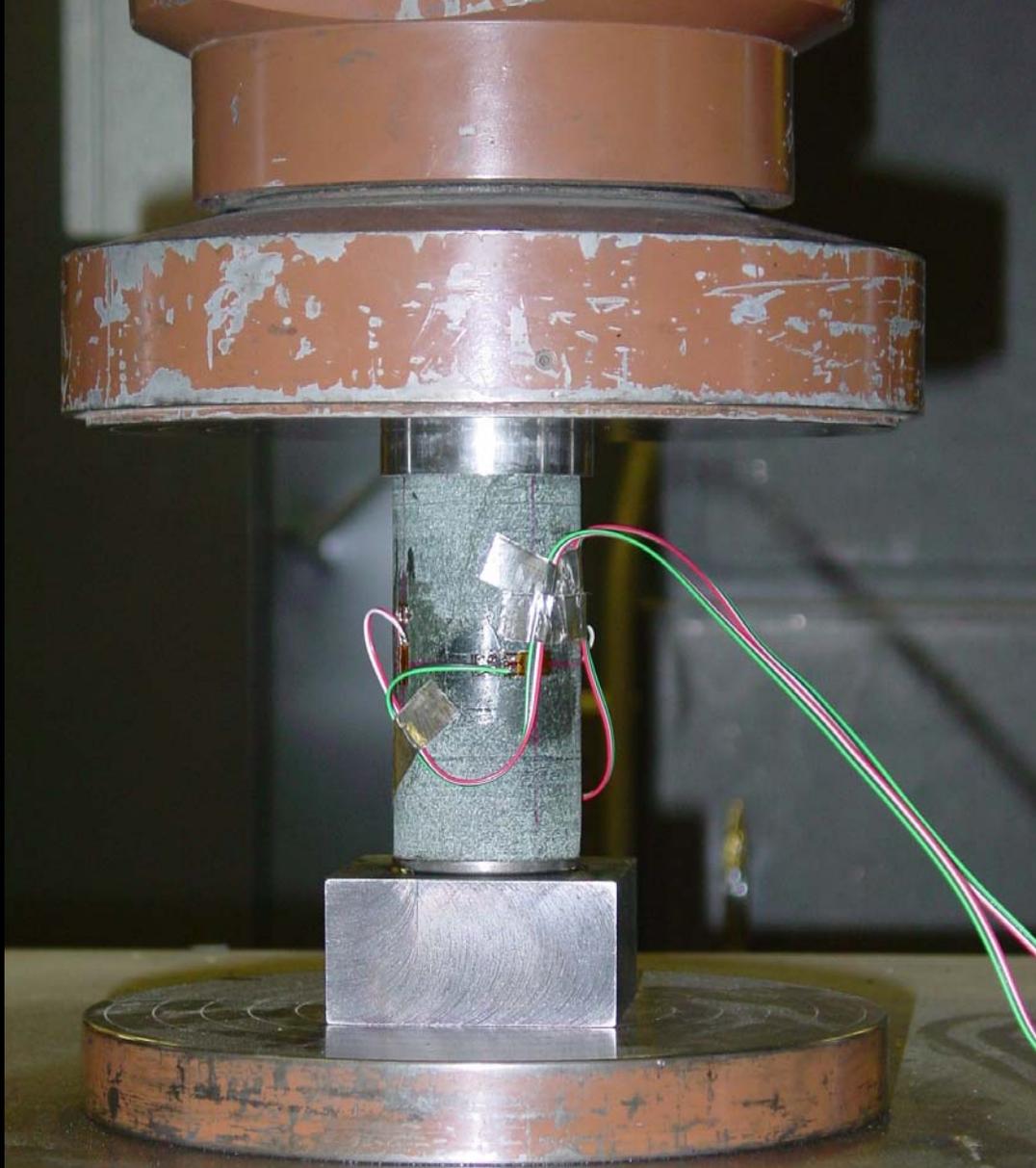
- Room constructed in Yates Formation
- Cylindrical room with arched roof
- Roof span = 50 meters
- Constructed between 6950 – 7100 levels

Homestake Panel 3 – VCR Study

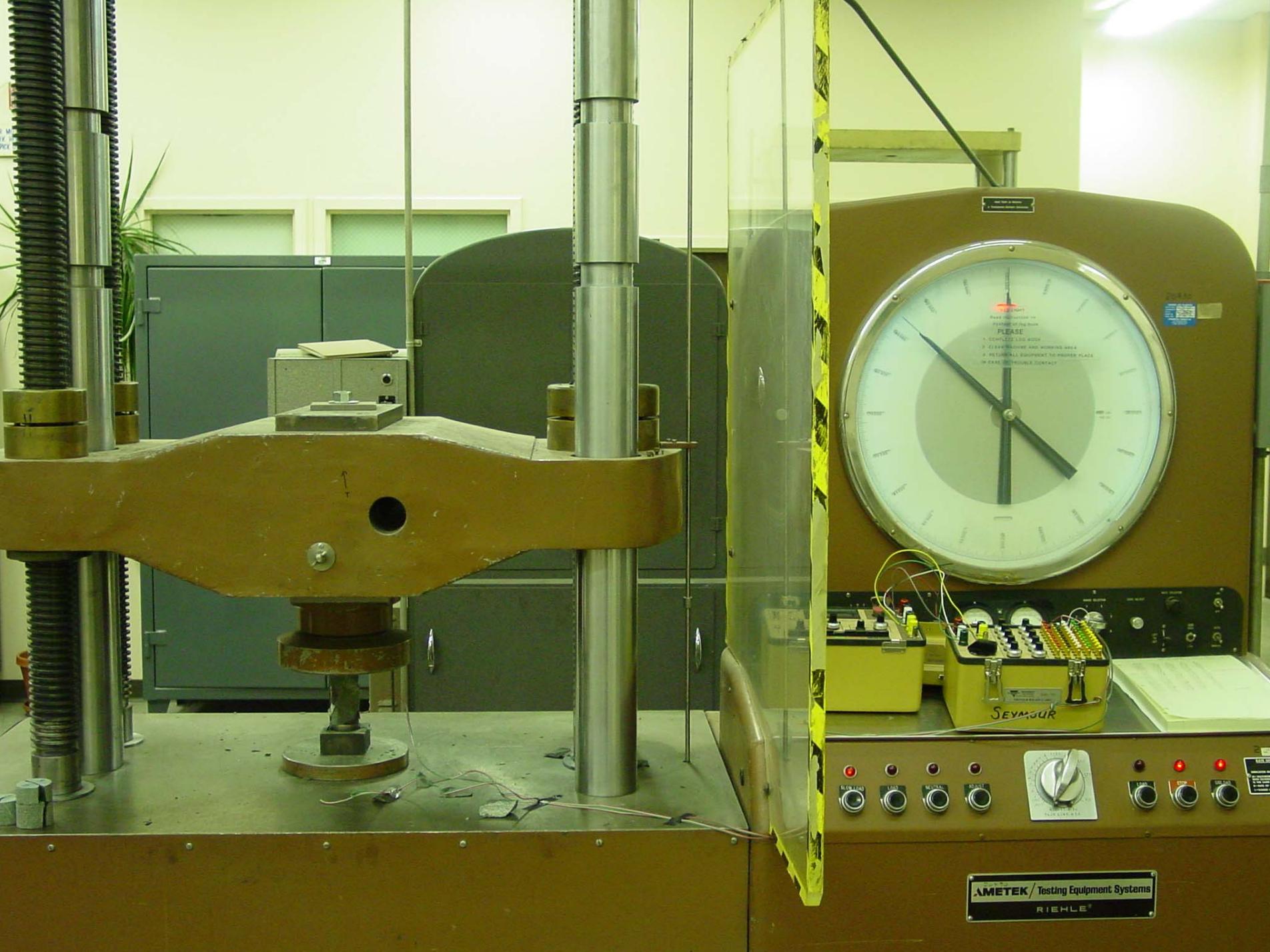


After Pariseau, Duan and Schmuck





WARNING!
in Progress
Sample under
Load
BACK test



SEYMOUR

NEW LEAD LEAD NEUTRAL RESERVE

100V 200V 500V

AMETEK / Testing Equipment Systems
RIEHLE®



YATES LABORATORY PROPERTIES

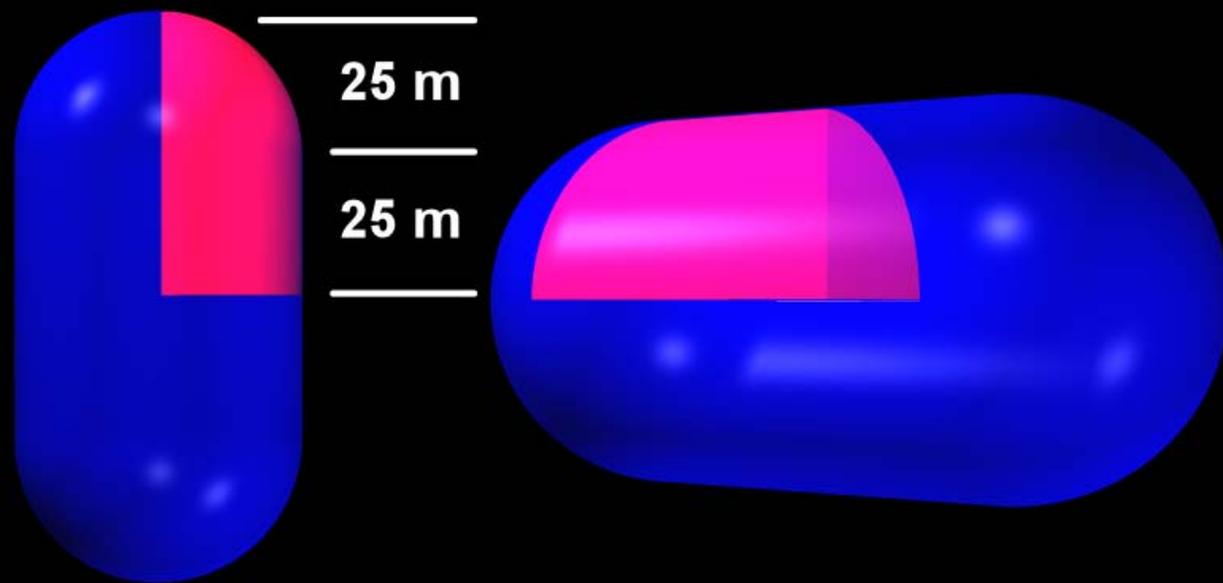
- $E = 14,500,000$ psi
- Tensile Strength = 1890 psi
- UCS = 28,800 psi!

MATERIAL PROPERTY REDUCTION

- Modulus reduced 25%
- Strengths reduced 50%
- Cohesion = 30 deg.

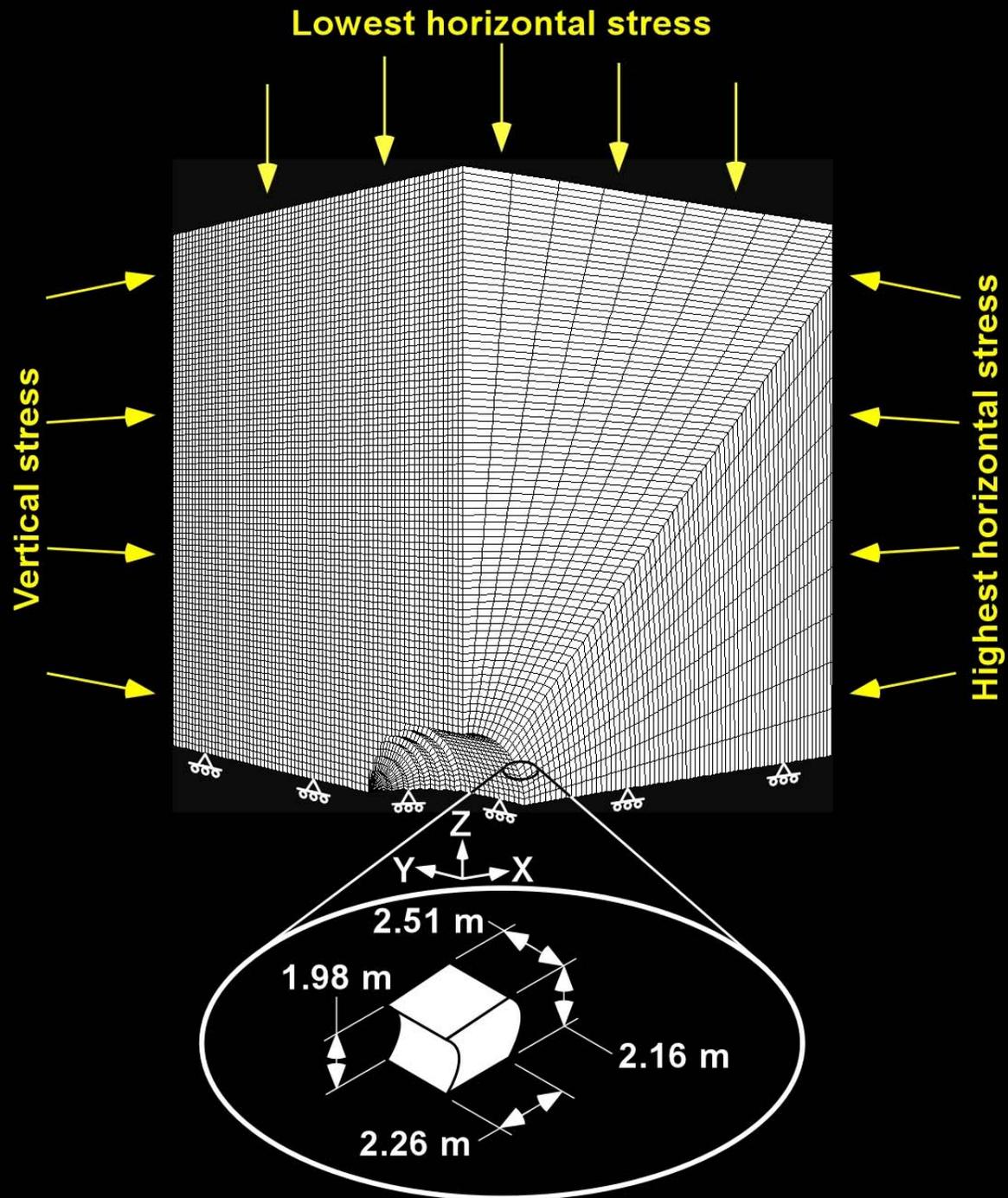
YATES MATERIAL PROPERTIES USED IN MODEL

- $E = 3,625,000$ psi
- Tensile Strength = 945 psi
- Friction Angle = 30 Deg
- UCS = 14,400 psi!



Model Assumptions

- **Homogeneous material**
- **Isotropic properties**
- **Poorman/Homestake in situ stress field**
- **Mohr-Coulomb failure criterion**

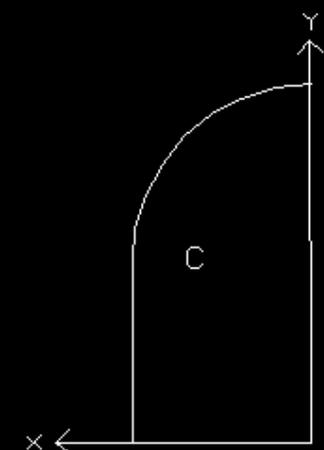
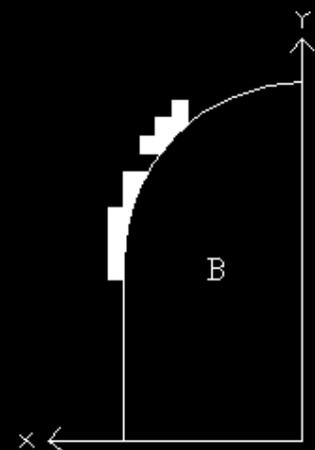
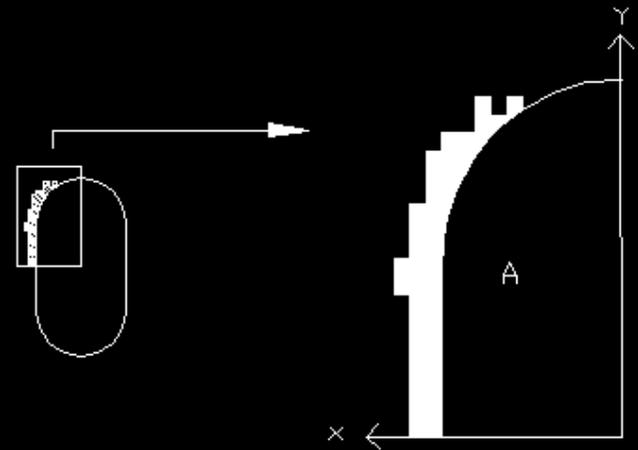


Plastic Zones in Poorman and Yates Rock

COHESION = 12.2 MPa
(1770 psi)

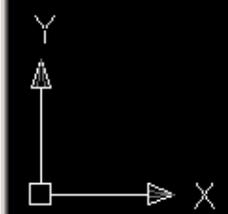
COHESION = 18.3 MPa
(2650 psi)

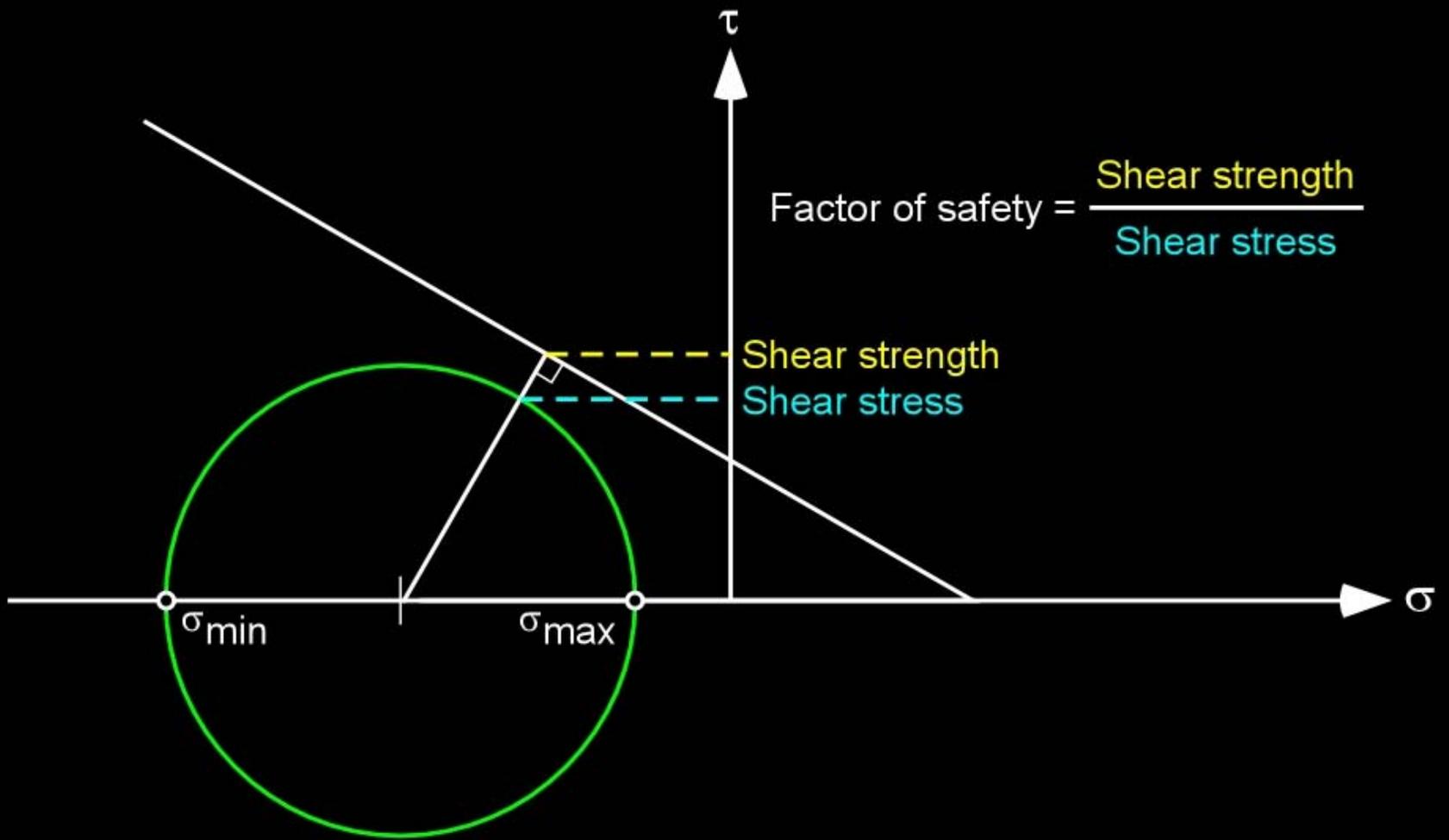
COHESION = 24.4 MPa
(3540 psi)



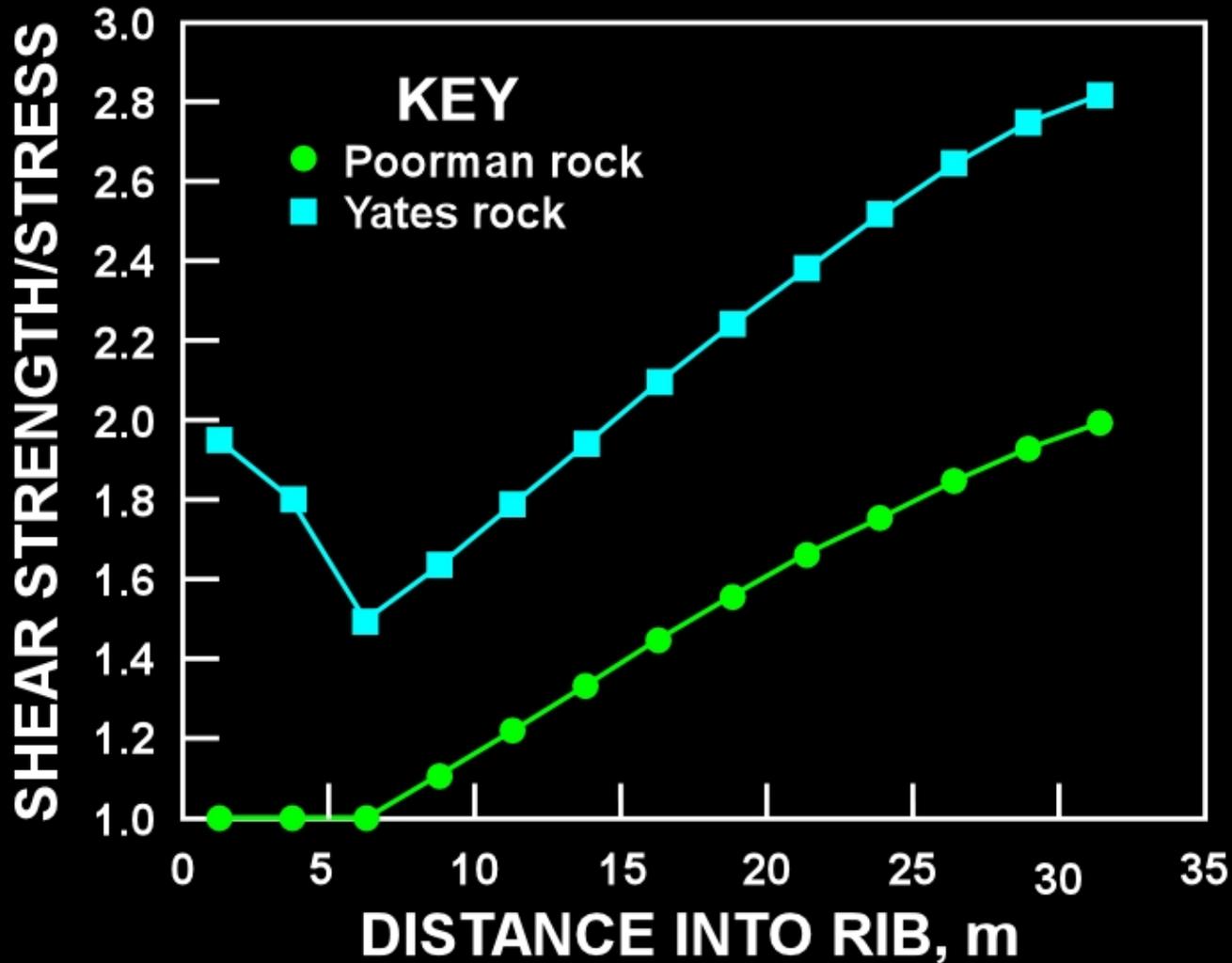
SCALE, m
0 10

DEPTH AT ORIGIN = 2141 m (7025 ft)



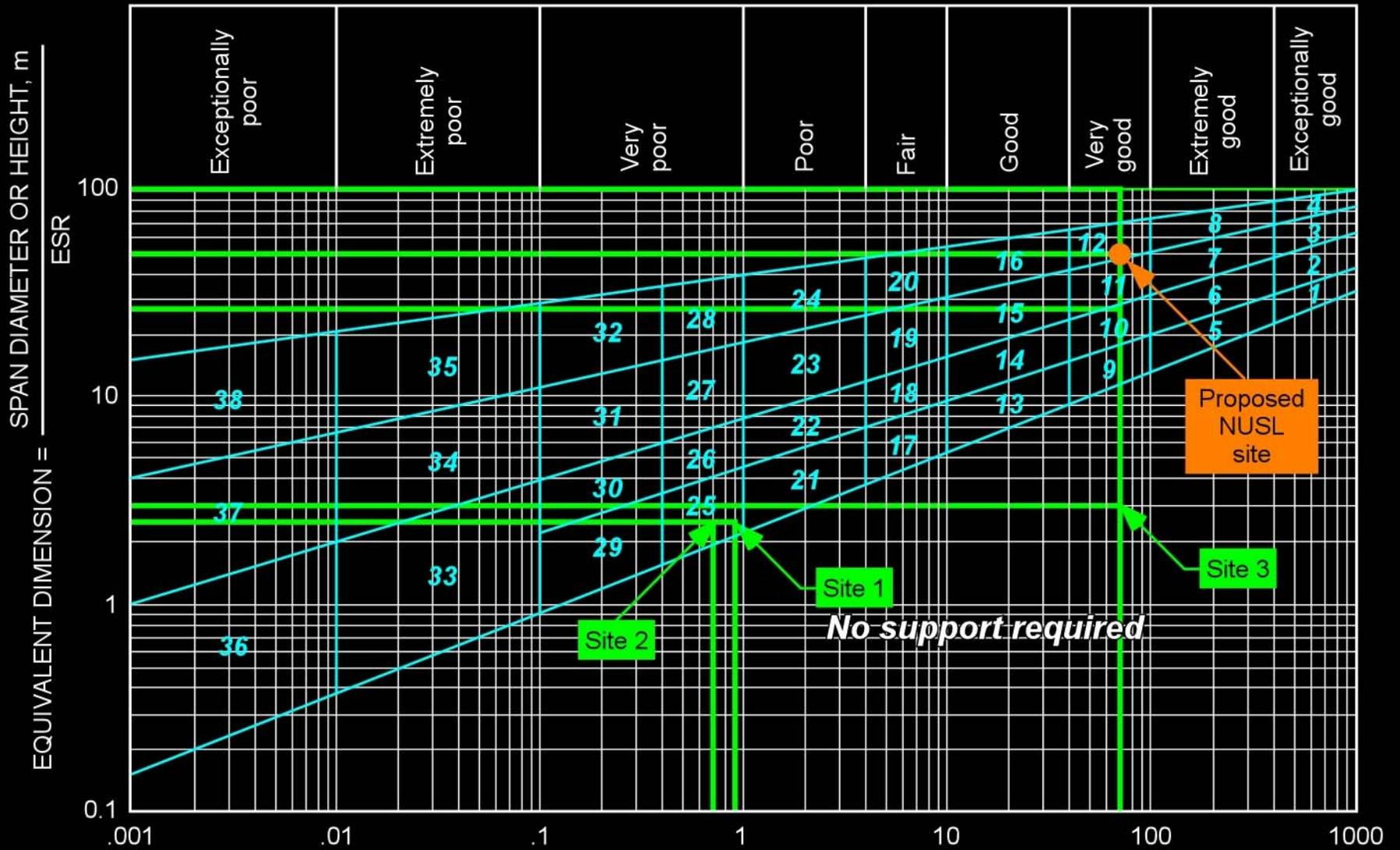


Shear Strength/Stress in Rib vs Distance Into Rib Without Cable Bolts



EMPIRICAL METHODS

Barton's Tunneling Quality Index



$$\text{TUNNELING QUALITY (Q)} = \left(\frac{\text{RQD}}{J_n} \right) \times \left(\frac{J_r}{J_a} \right) \times \left(\frac{J_w}{\text{SRF}} \right)$$

RECOMMENDED ROOF SUPPORT - BARTON

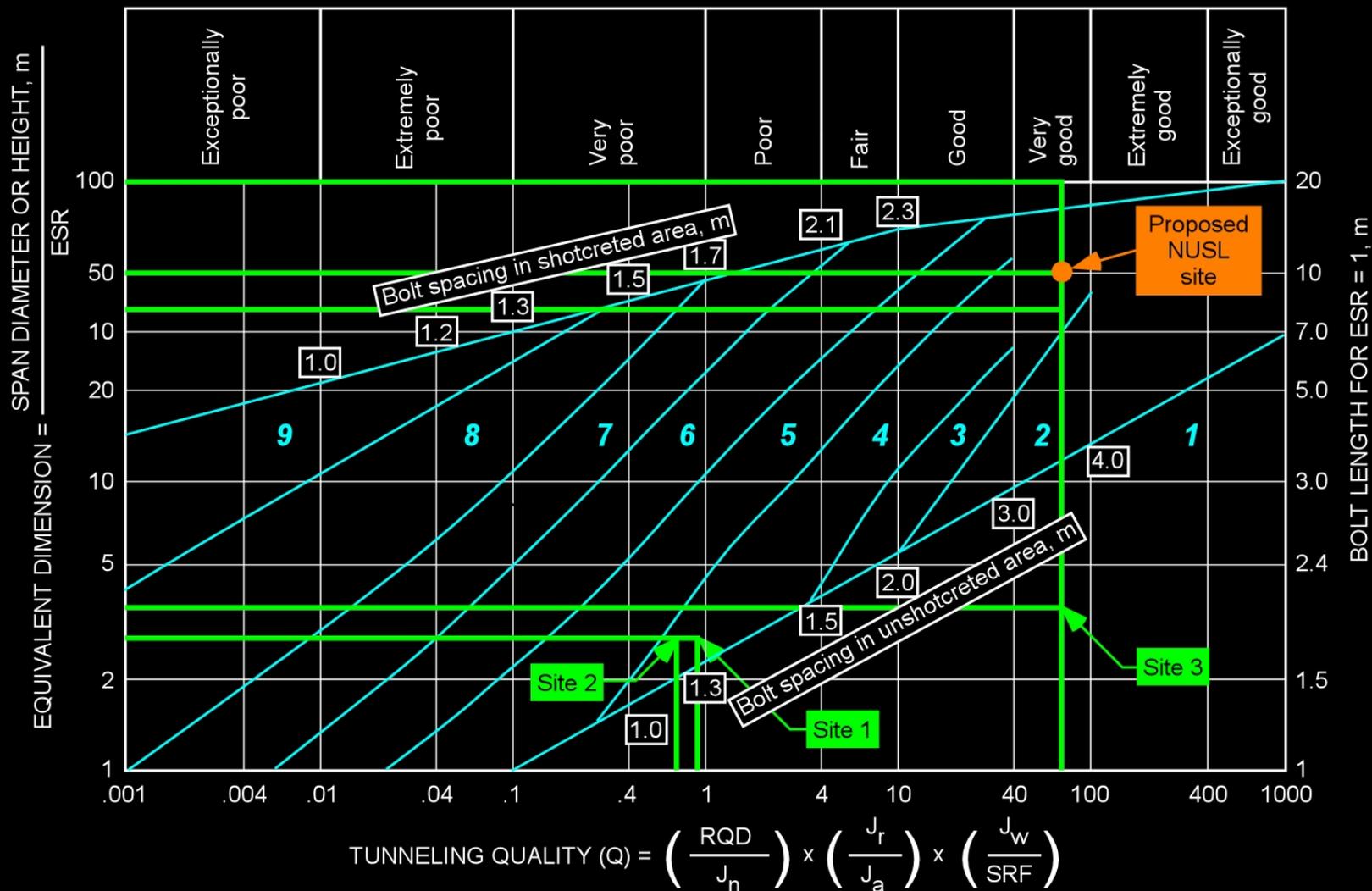
- TENSIONED BOLTS
- 2 – 3-m SPACING

EMPIRICAL METHODS

GRIMSTAD AND BARTON

KEY

- | | |
|--|--|
| 1 Unsupported | 6 Fibre reinforced shotcrete, 90-120 mm, and bolting |
| 2 Spot bolting | 7 Fibre reinforced shotcrete, 120-150 mm, and bolting |
| 3 Systematic bolting | 8 Fibre reinforced shotcrete, 150-250 mm, with reinforced ribs of shotcrete and bolting |
| 4 Systematic bolting with 40-50 mm unreinforced shotcrete | 9 Cast concrete lining |
| 5 Fibre reinforced shotcrete, 50-90 mm and bolting | |



RECOMMENDED ROOF SUPPORT – GRIMSTAD AND BARTON

- “SYSTEMATIC” BOLTING
- 5-mm SHOTCRETE

- NO “SHOWSTOPPERS”
- A COMPREHENSIVE ROCK MECHANICS STUDY IS MERITED
 - GEOLGICAL INVESTIGATION
 - ANISOTROPIC MODELING ?
 - IN SITU STRESS MEASUREMENTS