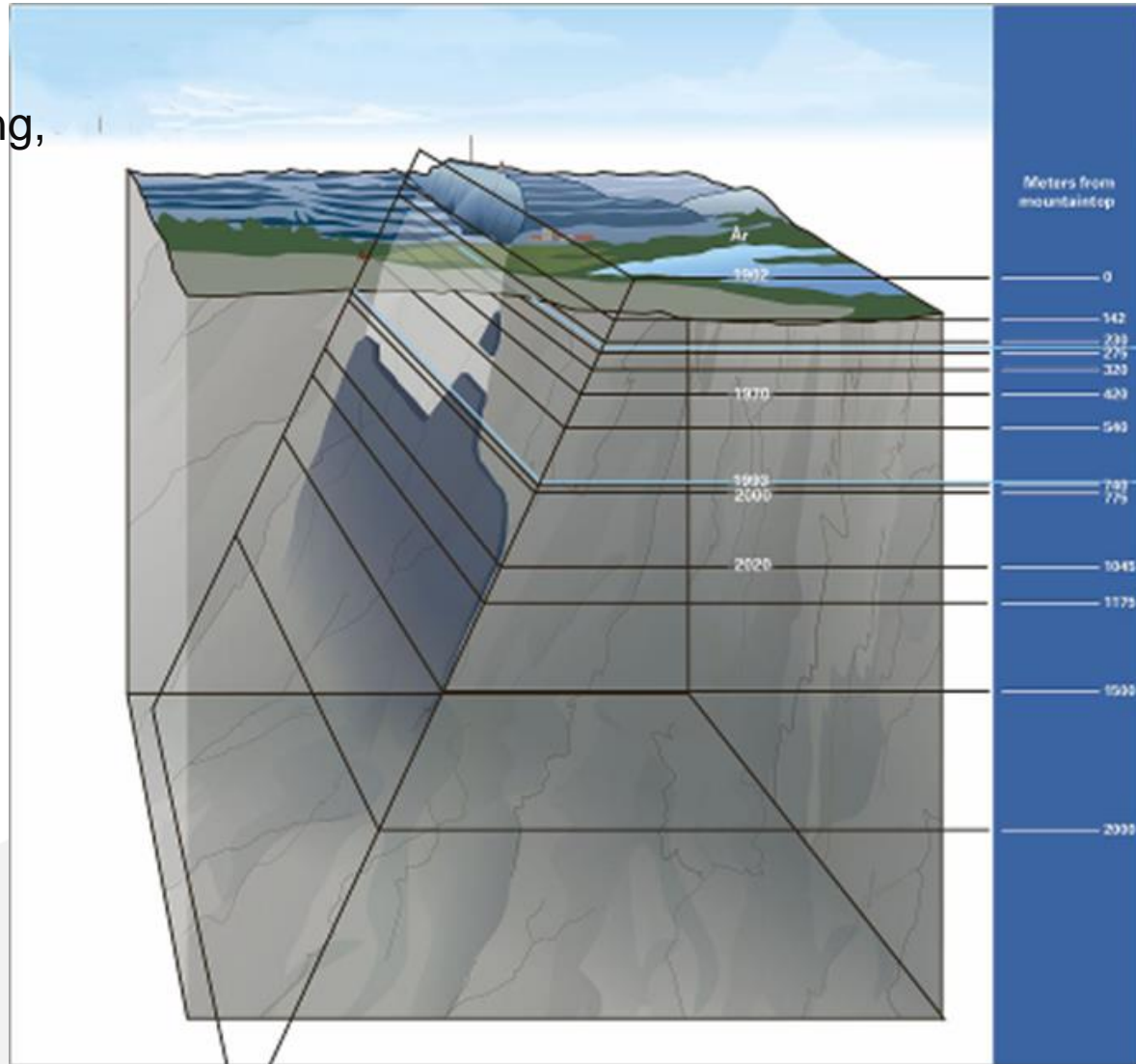
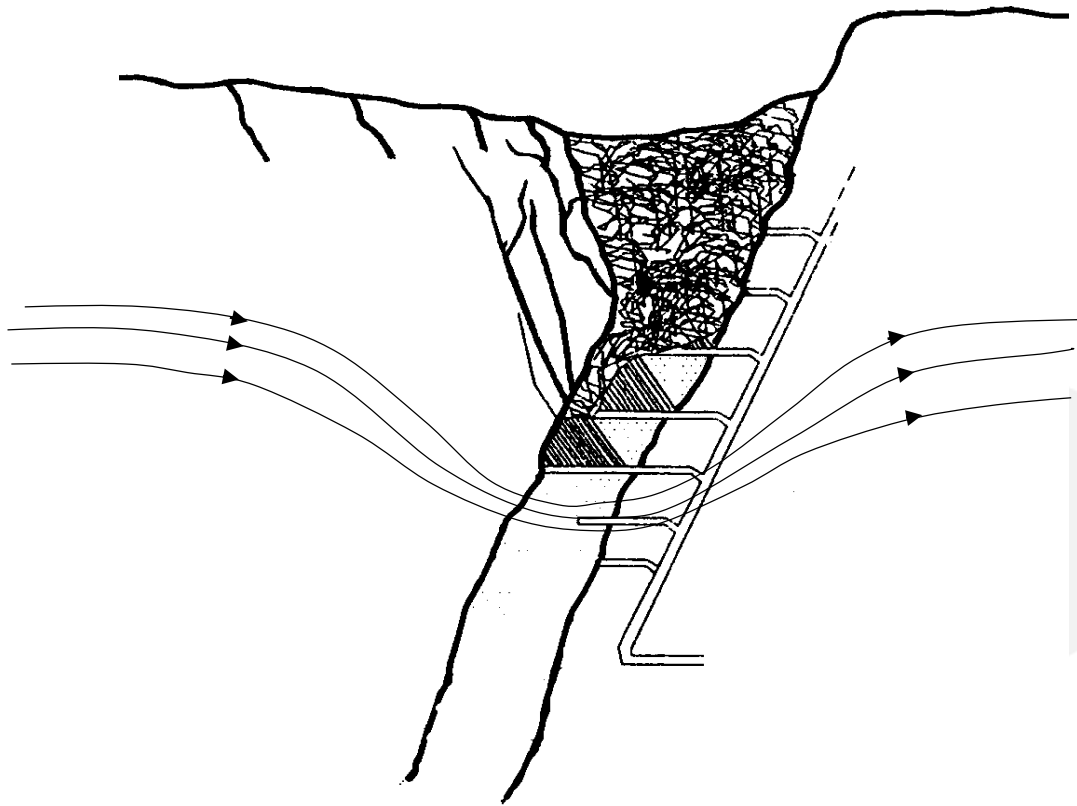


ROCK SUPPORT IN KIRUNAVAARA

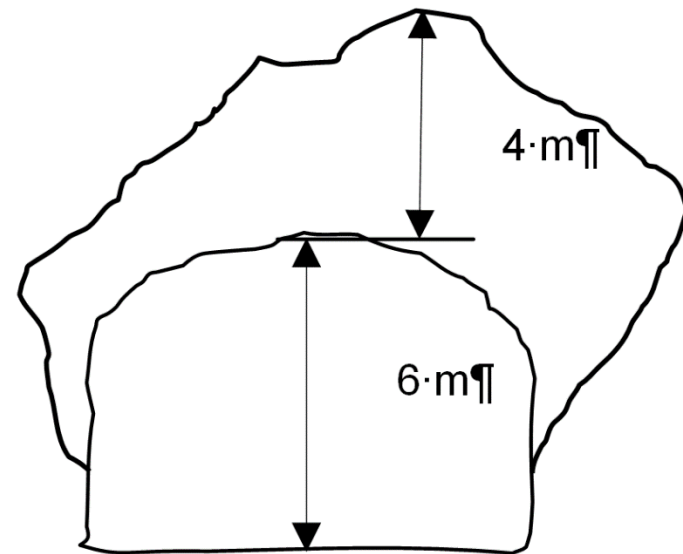
- A continuous ore body, 4 km long, 80 m wide and a known depth of 1,500 m (below zero point).
- Mining began around 1900
- Mining takes place via two haulage levels at 1,045 m and 1,365m.
- Production 2014:
Crude ore 26.5 Mt



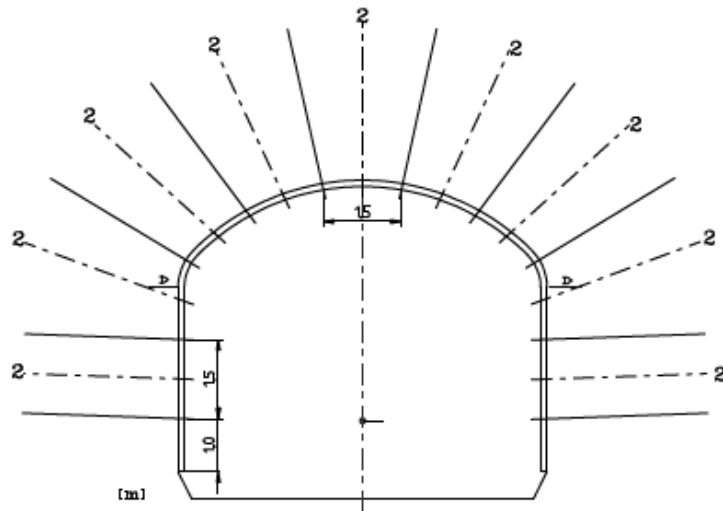
MINING INDUCED ROCK STRESS STATE



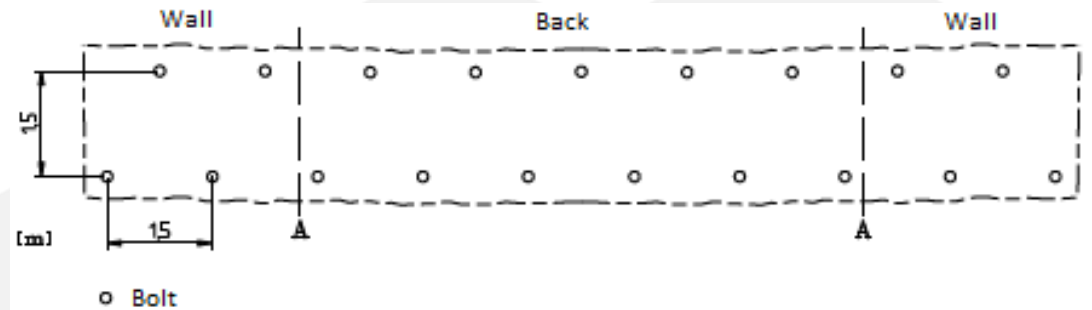
SEISMICALLY ACTIVE MINES



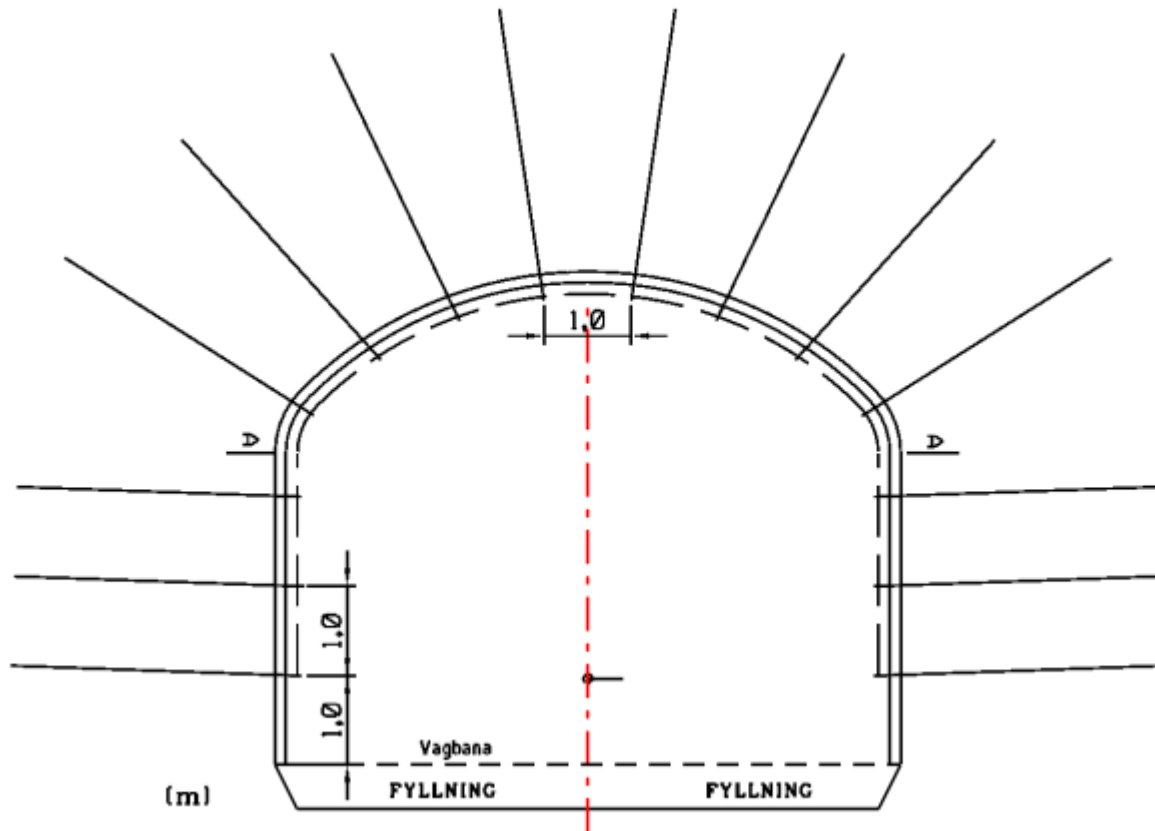
STATIC ROCK SUPPORT



Rebar, length=3.05 m, c/c 1.5 m
Steel-fiber reinforced shotcrete,
thickness=70 mm



DYNAMIC ROCK SUPPORT



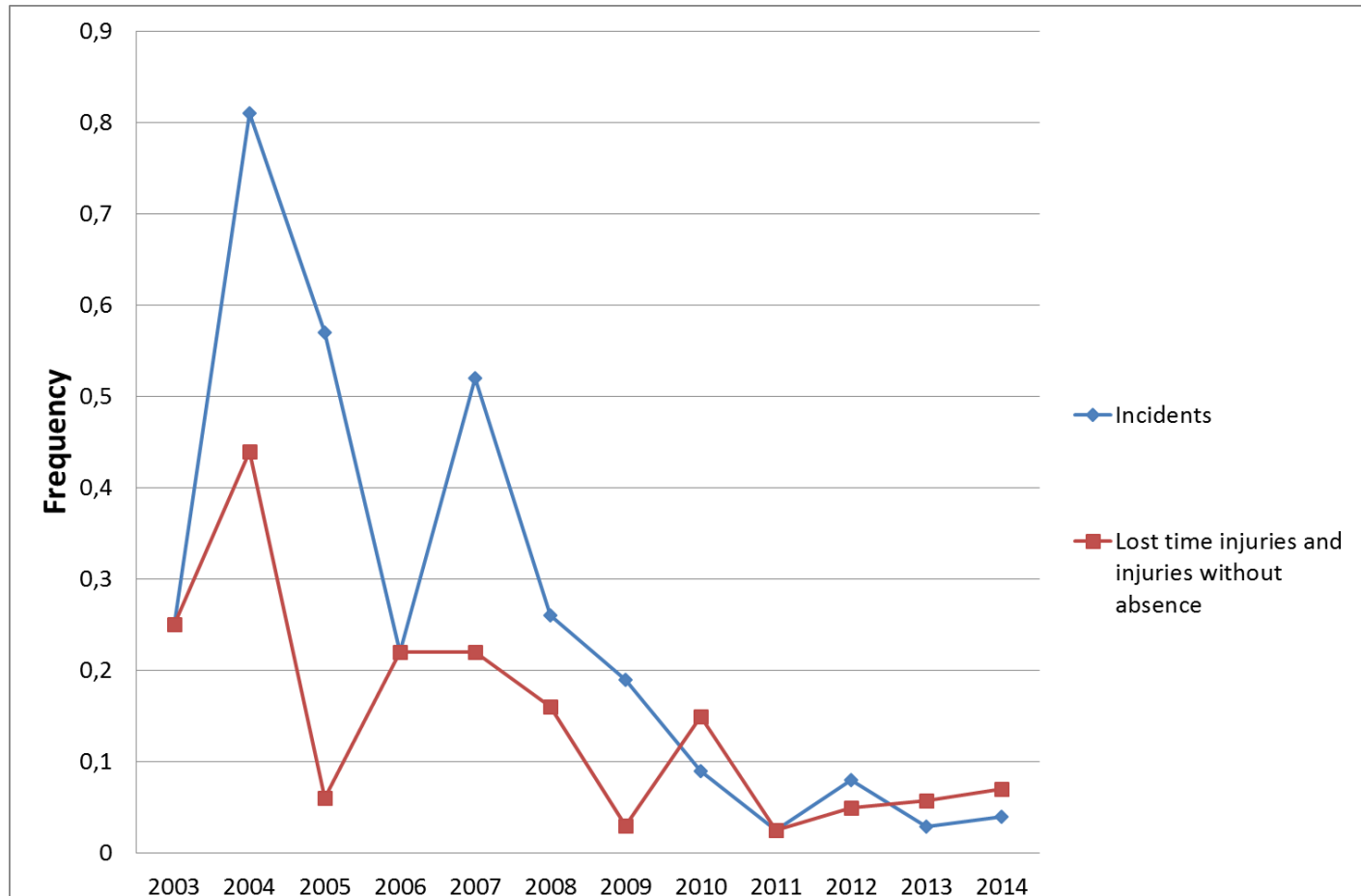
Bolt type: Dynamic rockbolt
(NMX dynamic, D-Bolt)
length: 3.0m ϕ 20 mm
c/c: 1 m

Shotcrete: Fibre reinforced
thickness: 100 mm

Steel mesh: ϕ 5.5 mm, c/c 75 mm

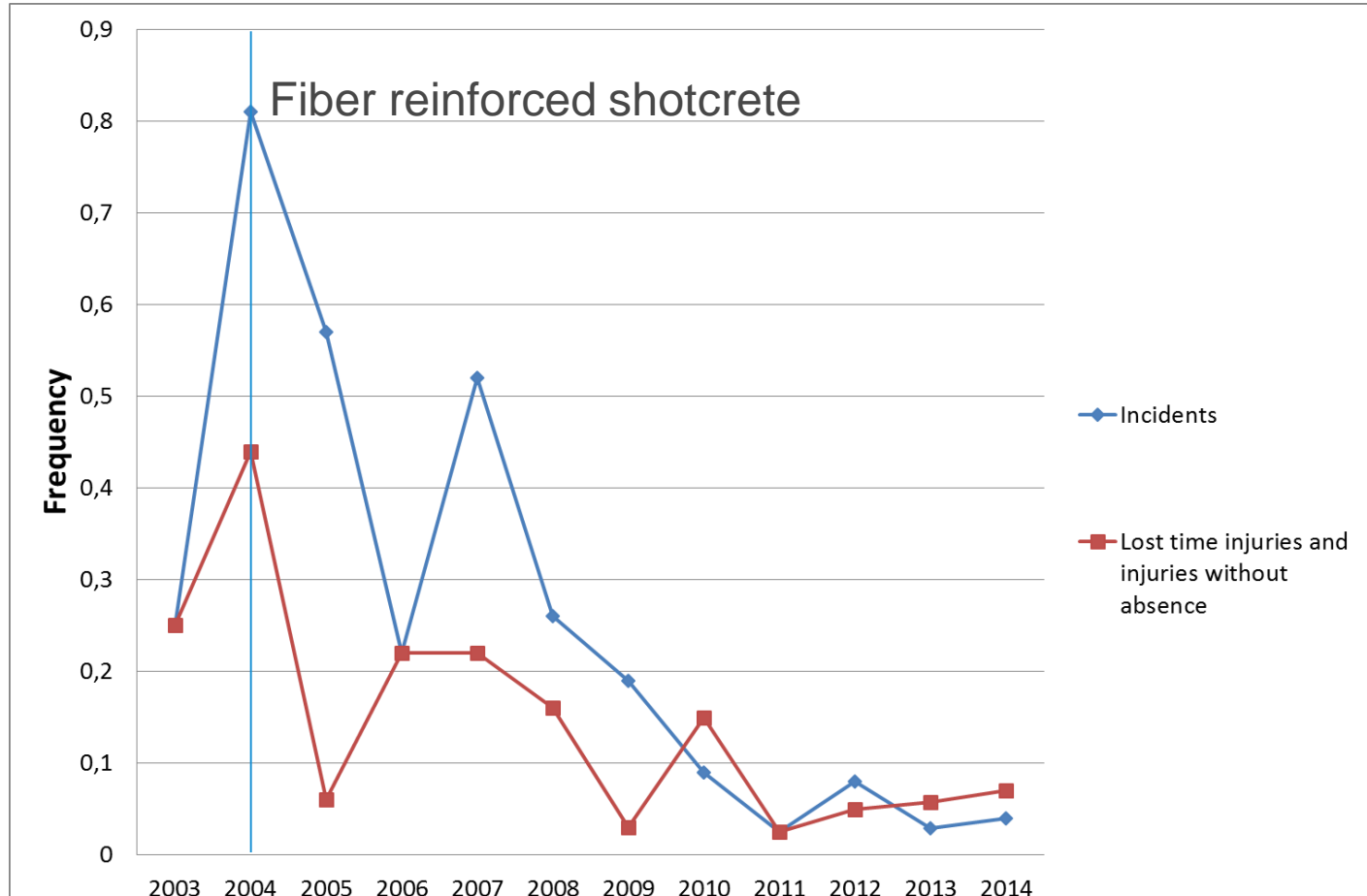
FREQUENCY OF INCIDENTS AND INJURIES

-for drift charging per 1000 m of development work



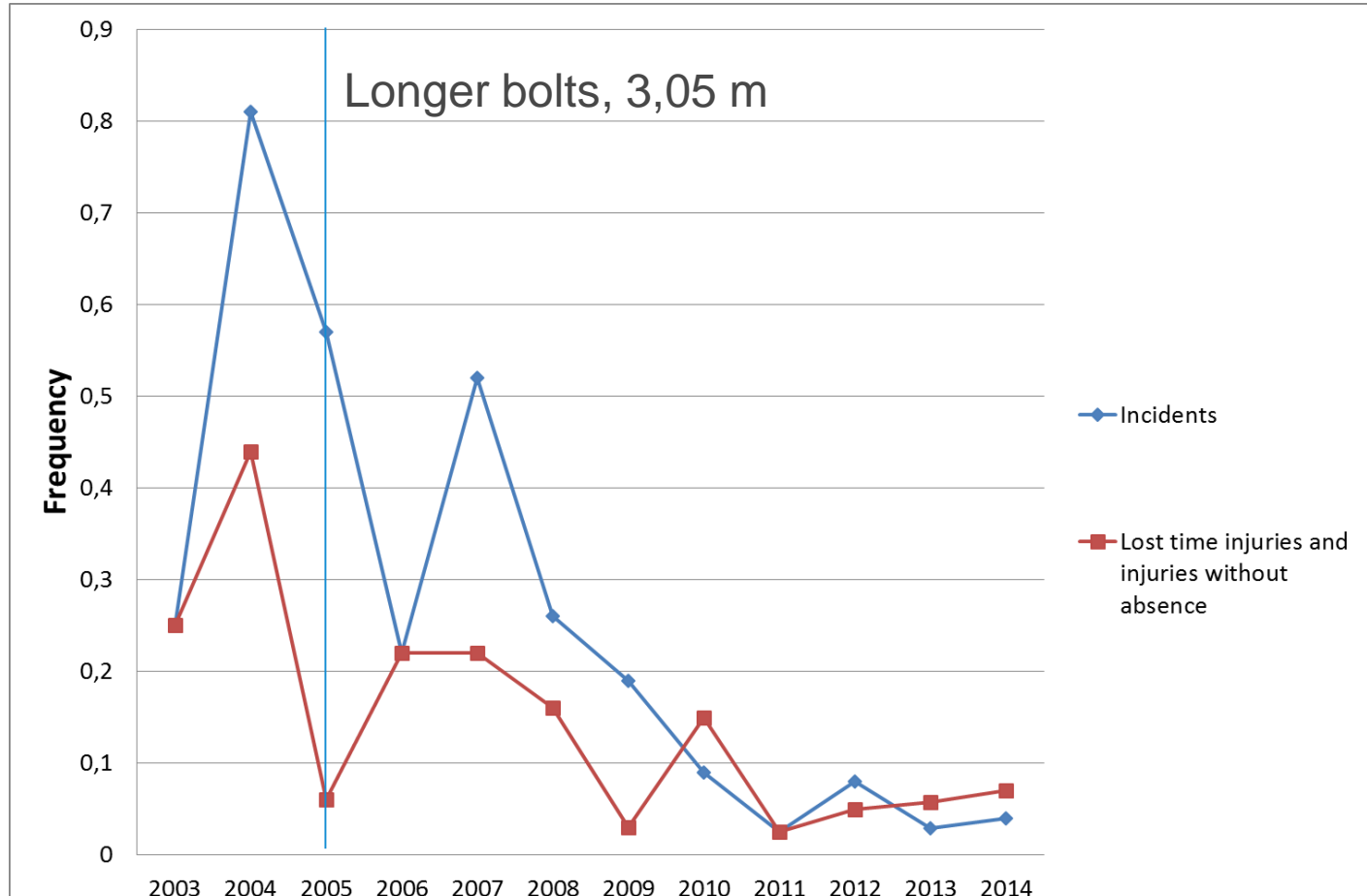
FREQUENCY OF INCIDENTS AND INJURIES

-for drift charging per 1000 m of development work



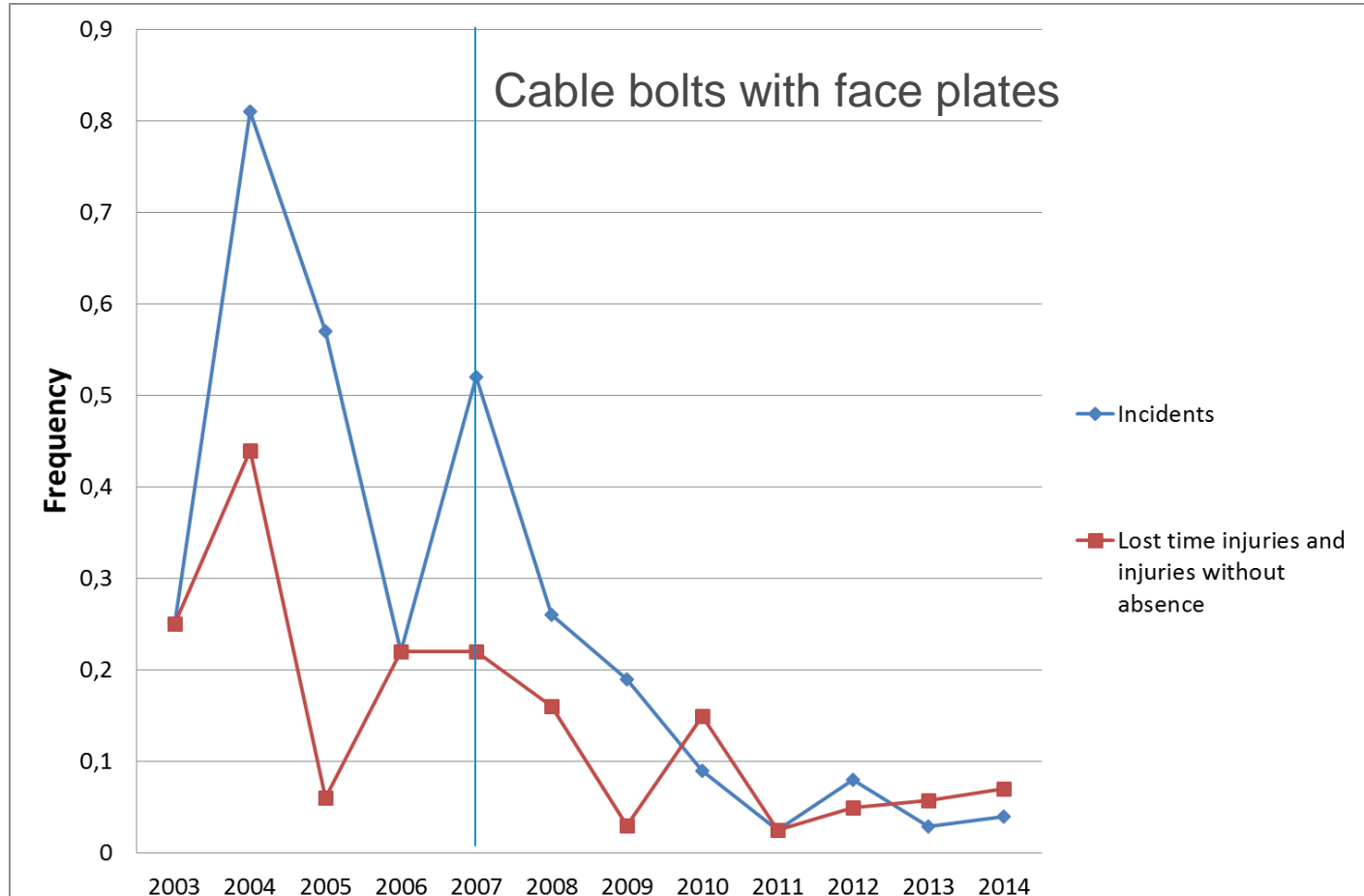
FREQUENCY OF INCIDENTS AND INJURIES

-for drift charging per 1000 m of development work



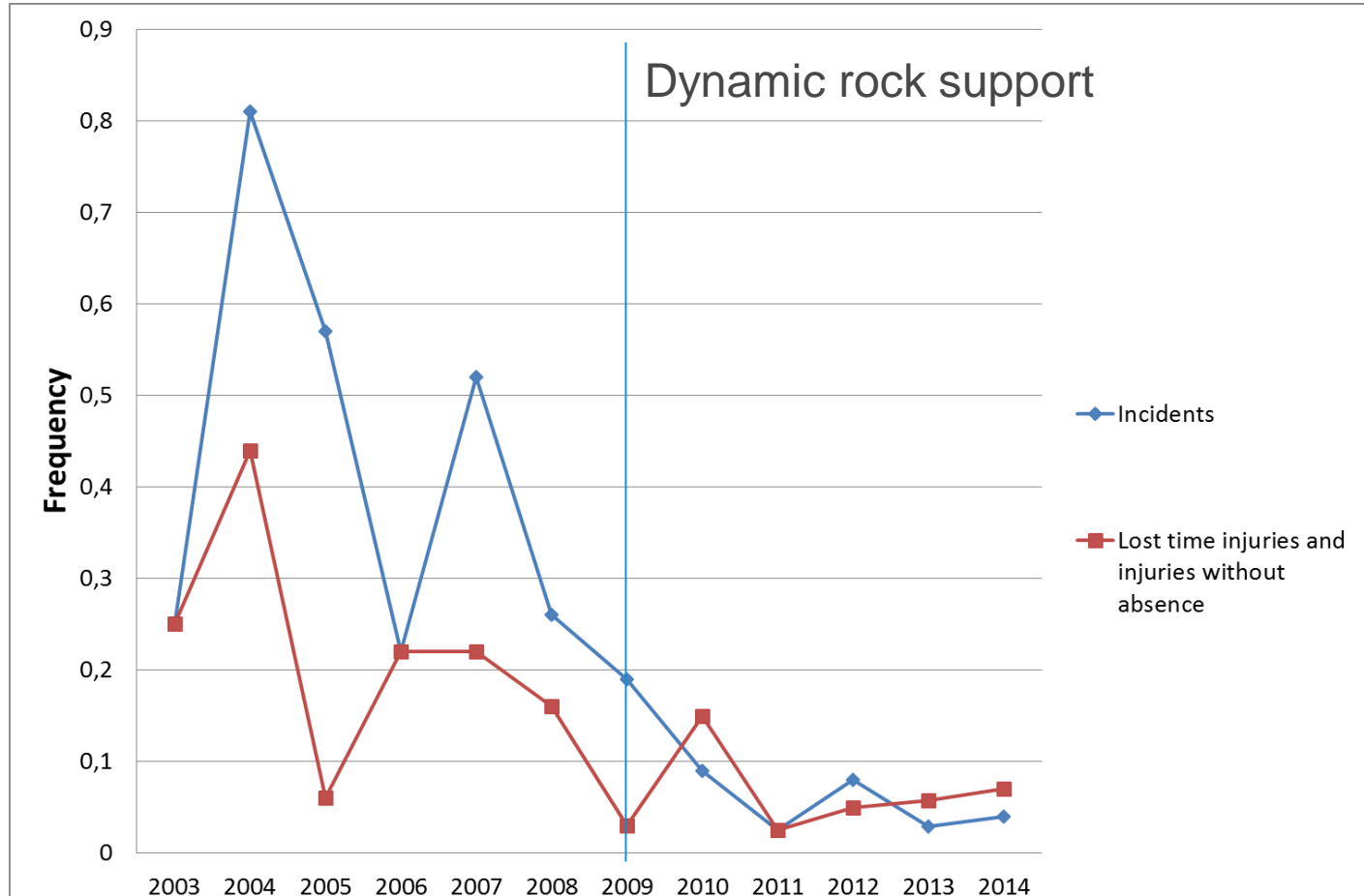
FREQUENCY OF INCIDENTS AND INJURIES

-for drift charging per 1000 m of development work

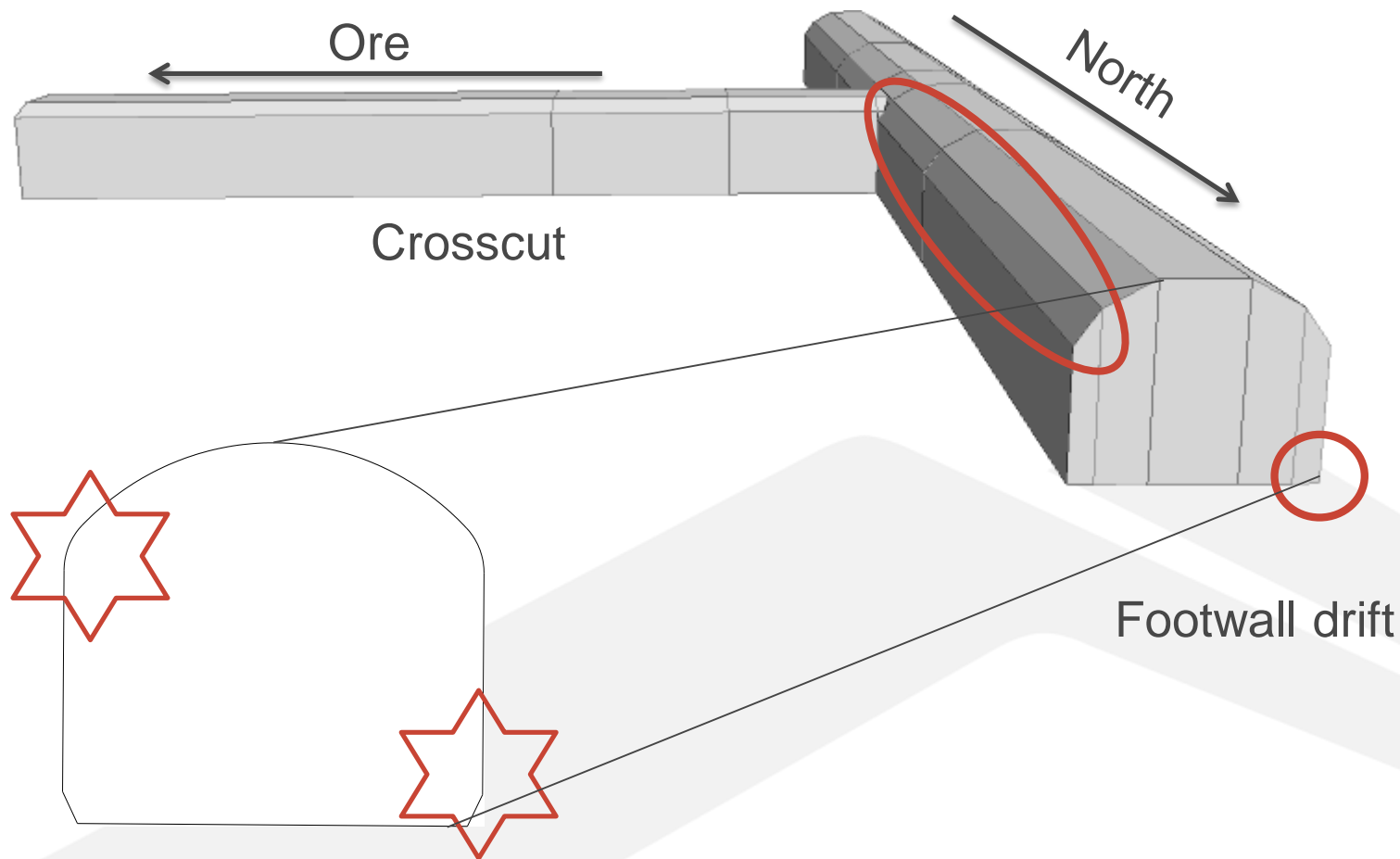


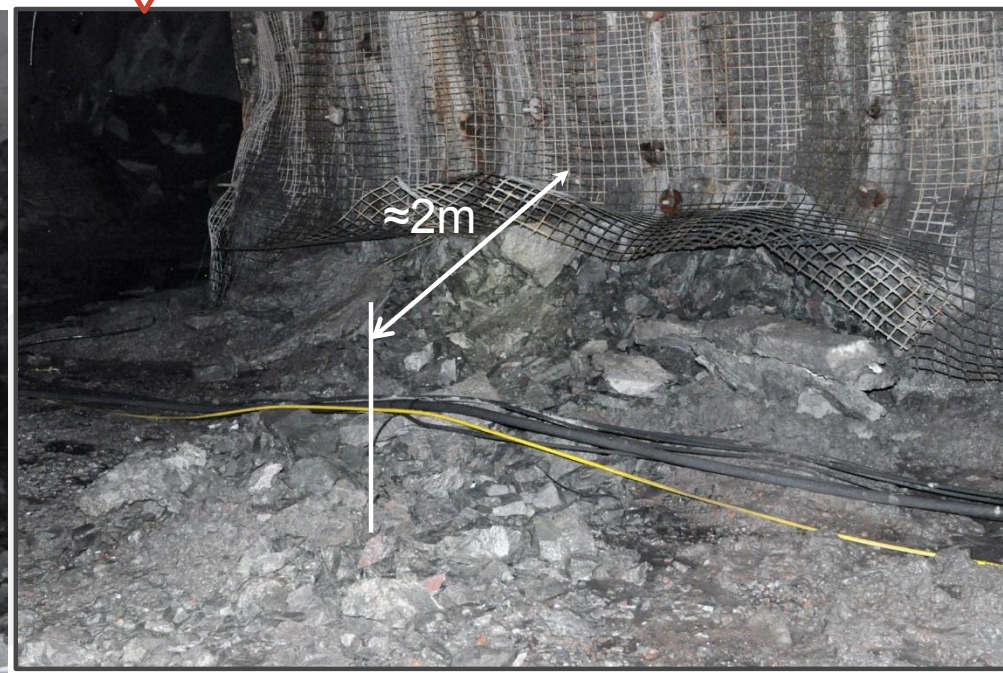
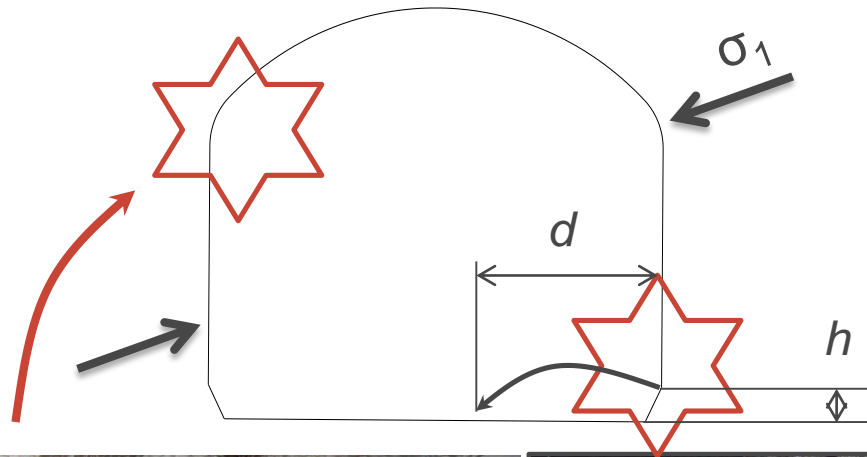
FREQUENCY OF INCIDENTS AND INJURIES

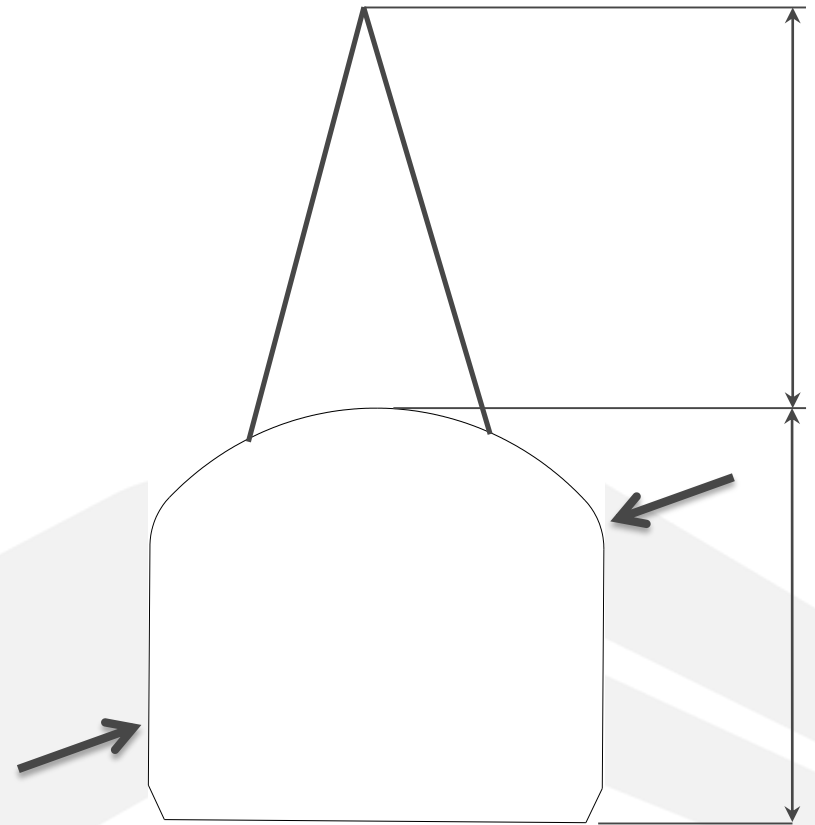
-for drift charging per 1000 m of development work



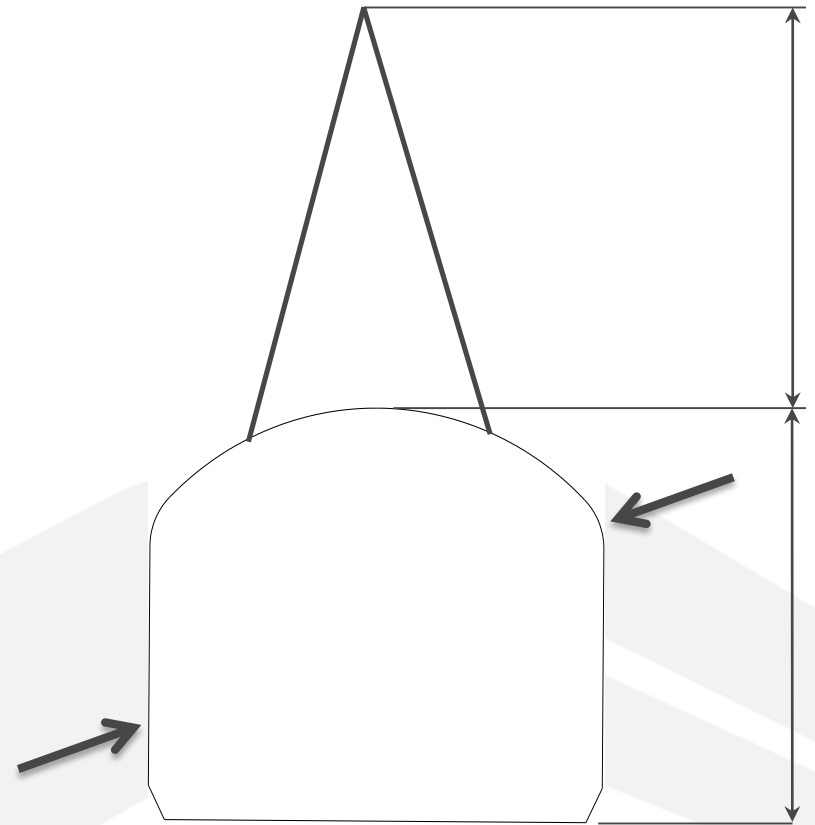
TYPICAL DAMAGE

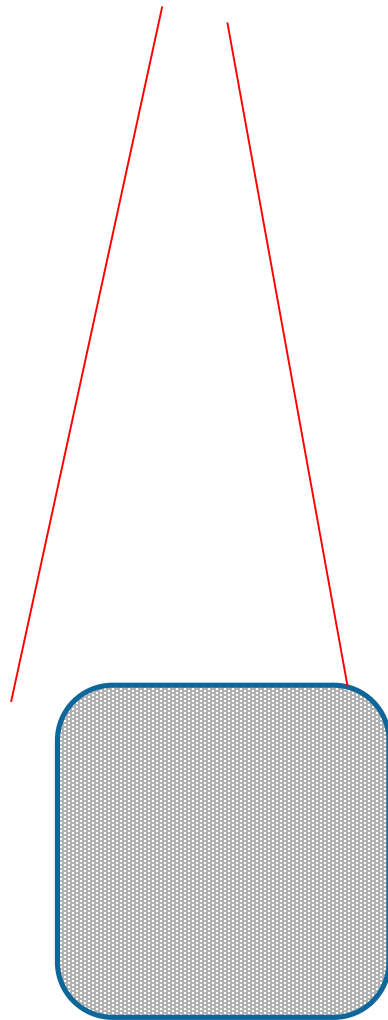






Better knowledge regarding
critical structures => cable bolt

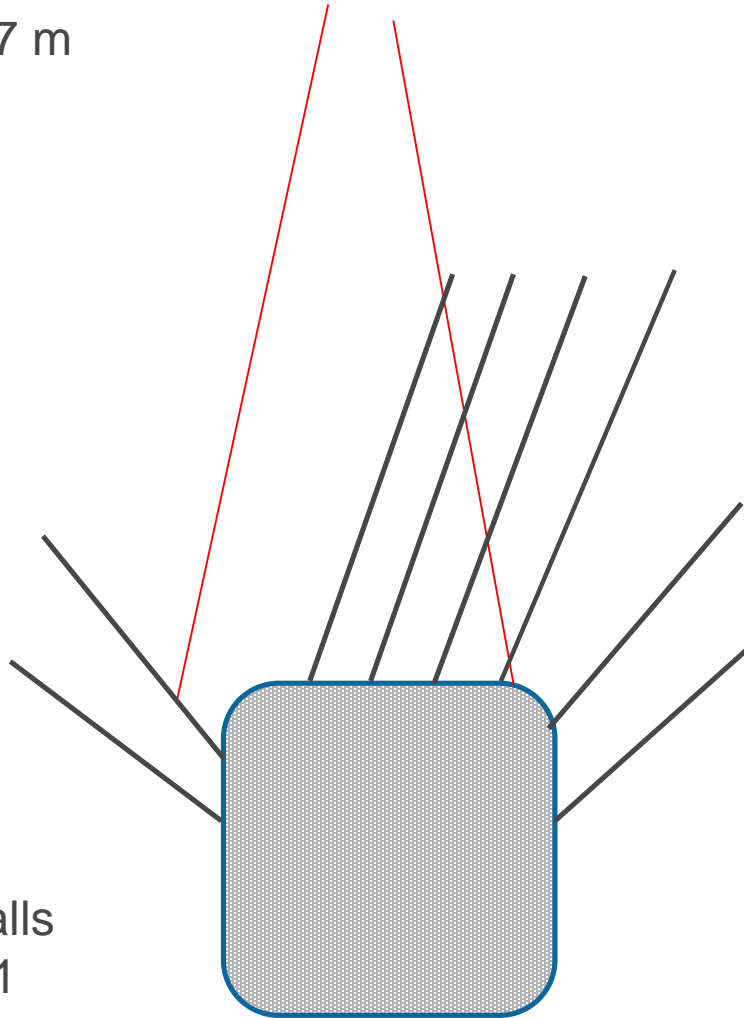




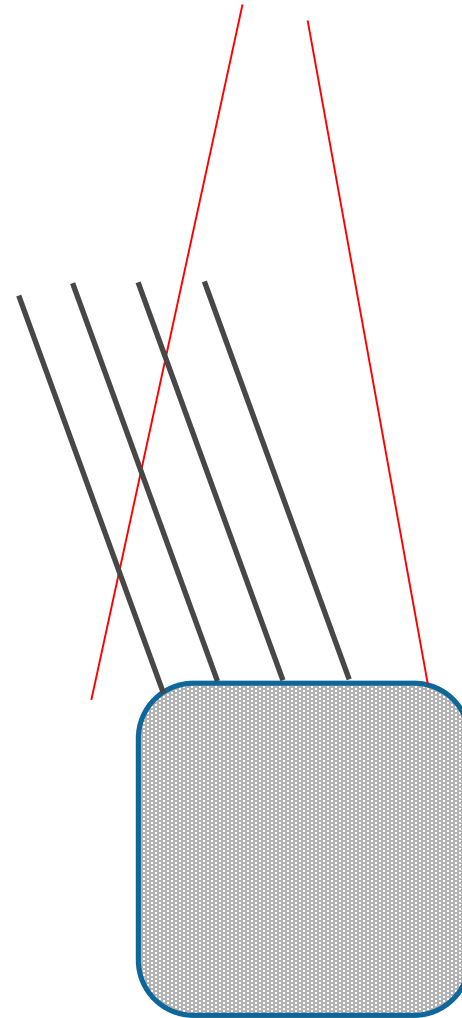
Slickensided structures
Hematite



Cable length
Roof 10 m or more
Walls 7 m

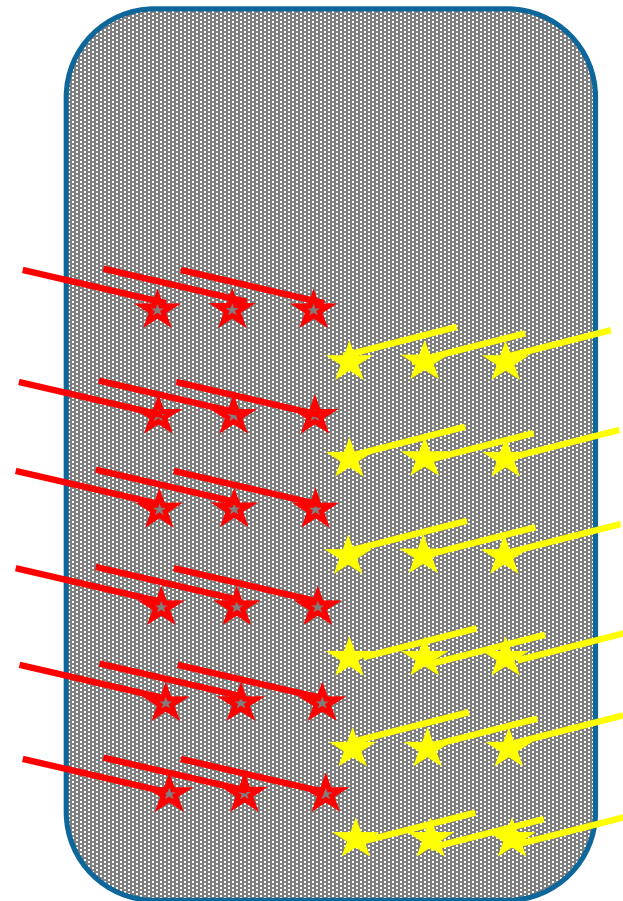
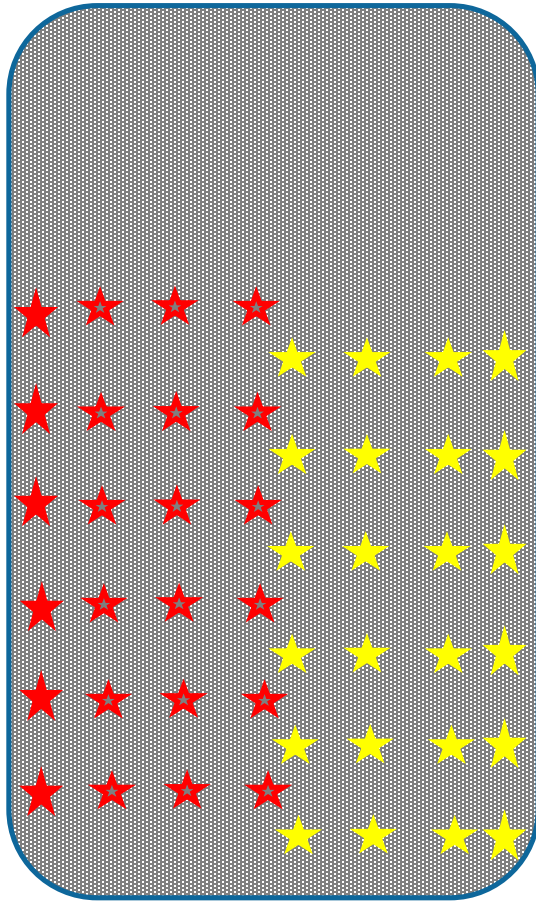


Cables
Roof/walls
Layout 1



Cables
Roof/walls
Layout 2







THANK YOU!

