KRAFTINDUSTRINS BETONGDAG

Älvkarleby 21-22 Mars 2017

Årets tema: Kraftindustrins berg- och betongfrågor

Metoder för att tillståndsbedöma stag och förankringar

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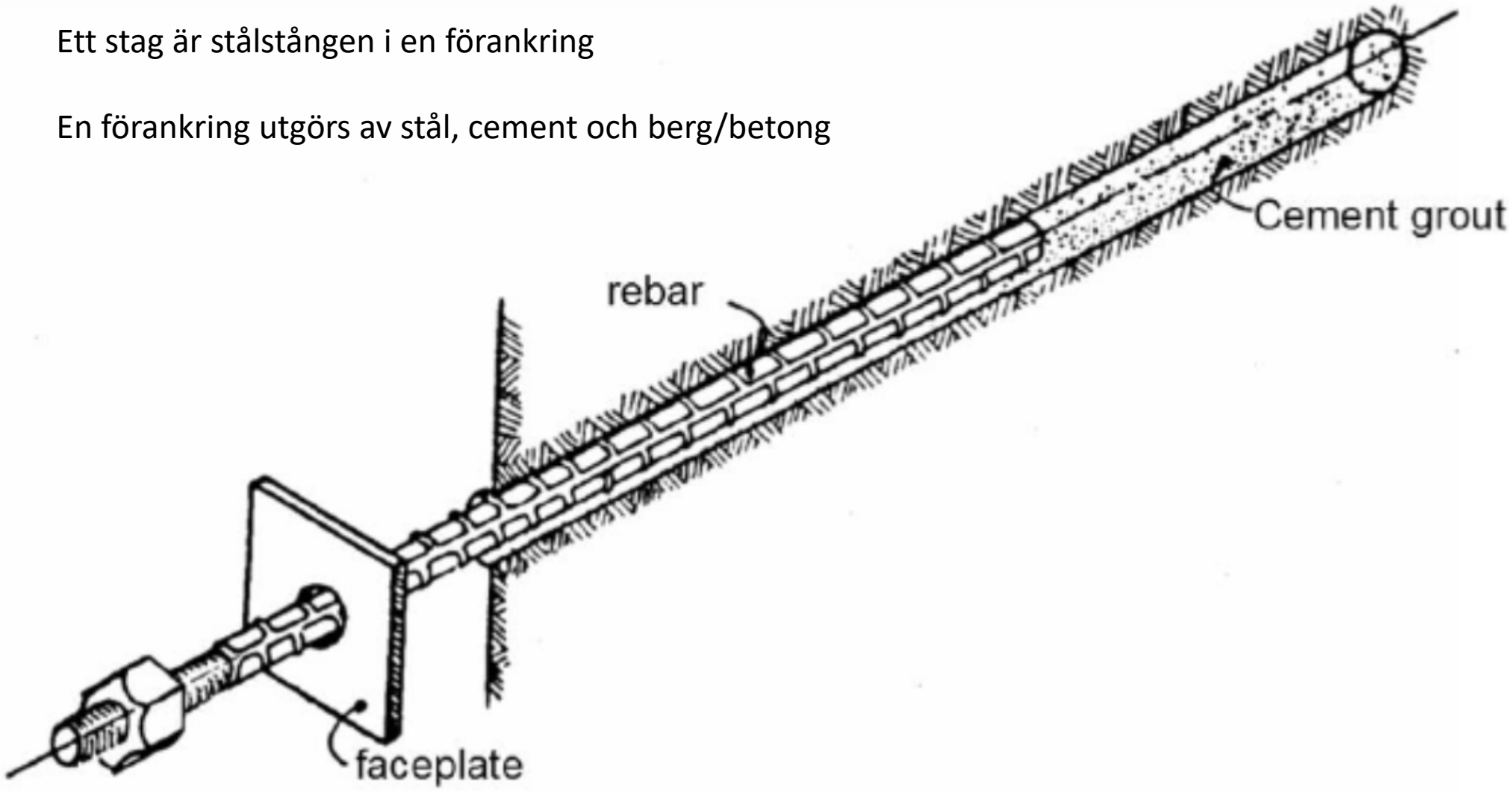
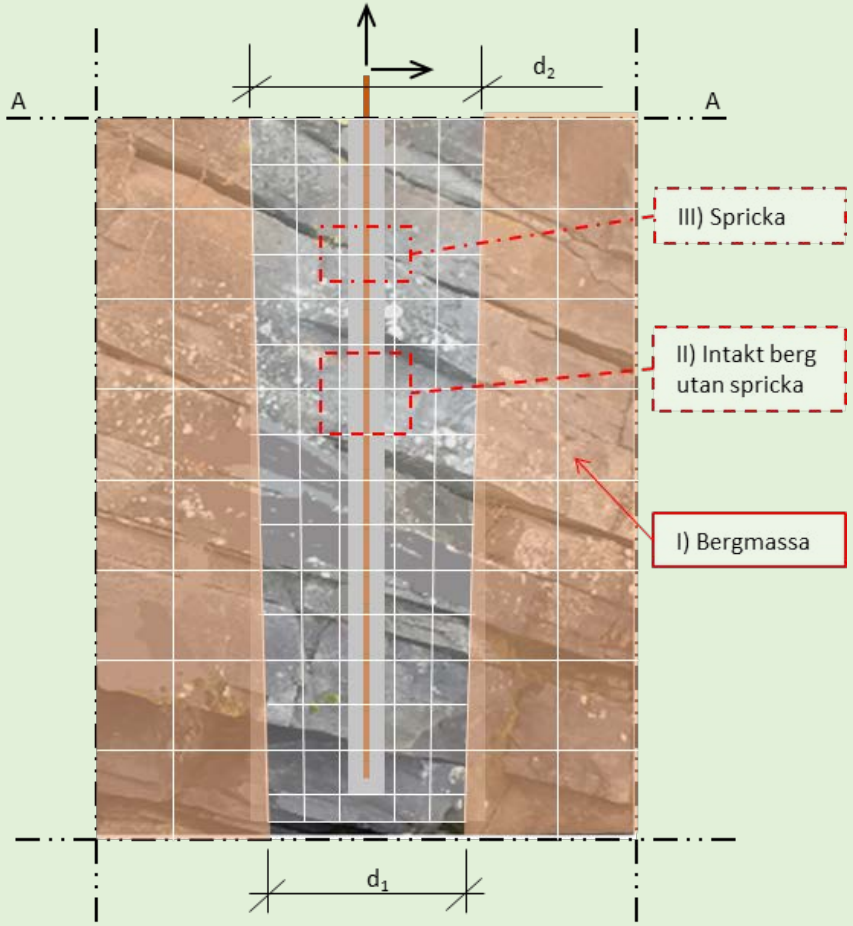
Ett stag är stålstången i en förankring

En förankring utgörs av stål, cement och berg/betong

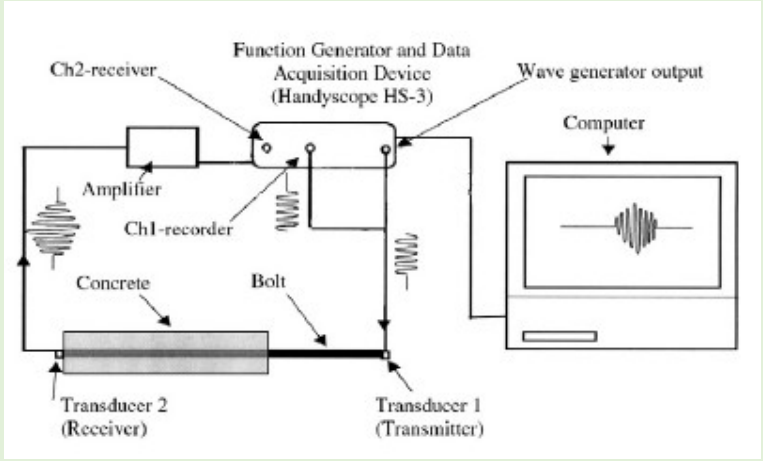


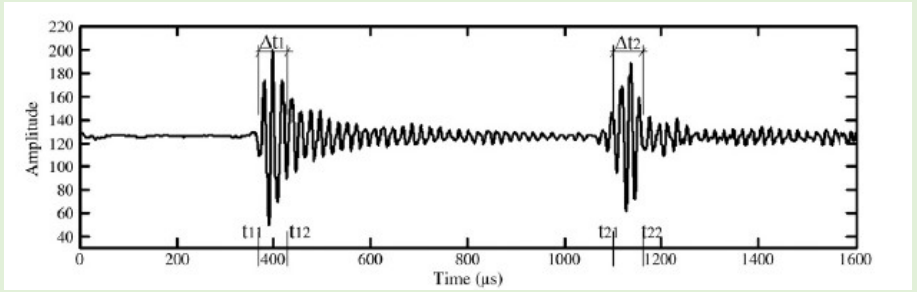
STAG CEMENT OCH BERG

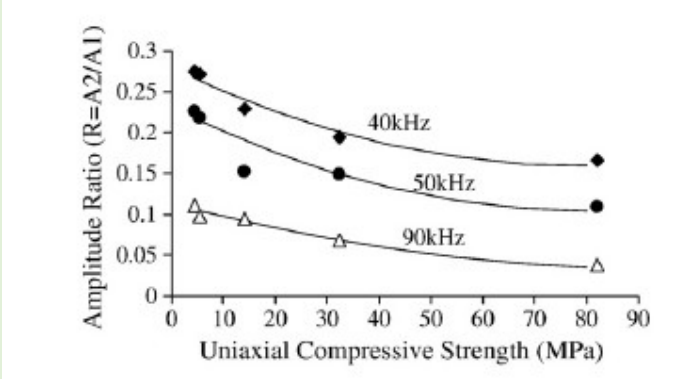


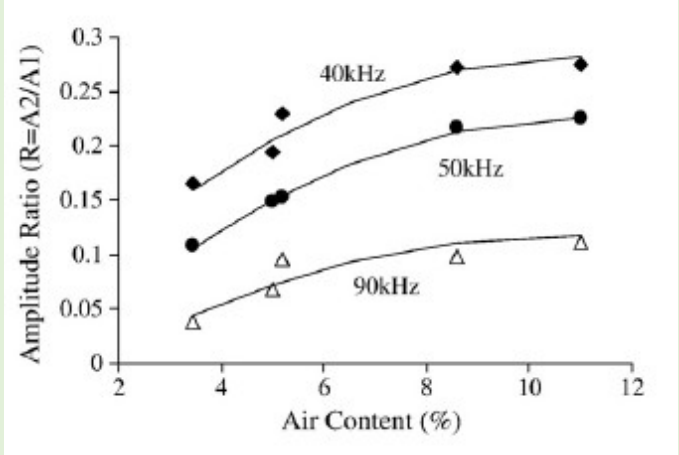
TEST AV STAG OCH CEMENT

ULTRALJUD PÅVERKAS AV CEMENTETS EGENSKAPER



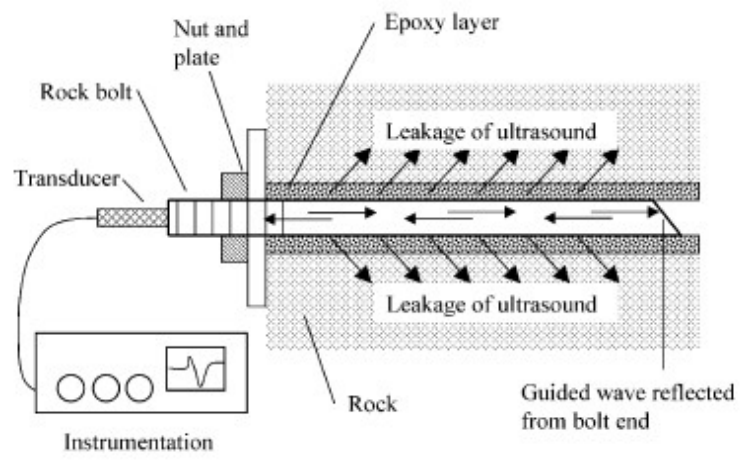




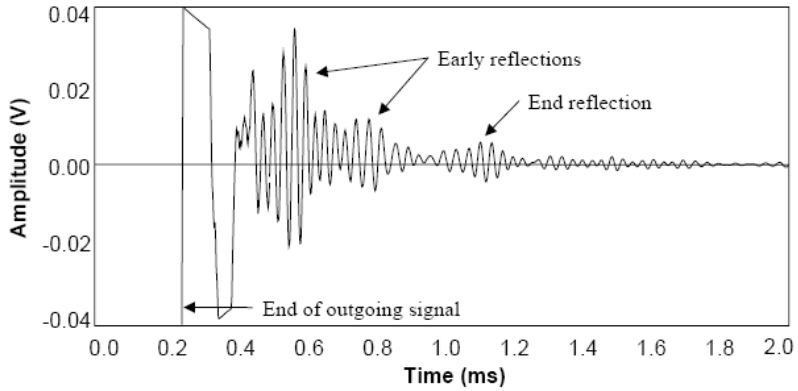


Zou 2010

Det påverkas också av stagdiameter och vald frekvens

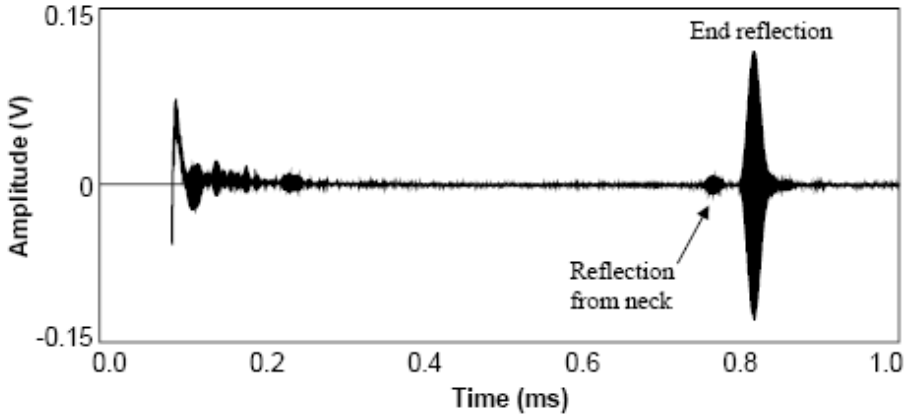


L(0,1)



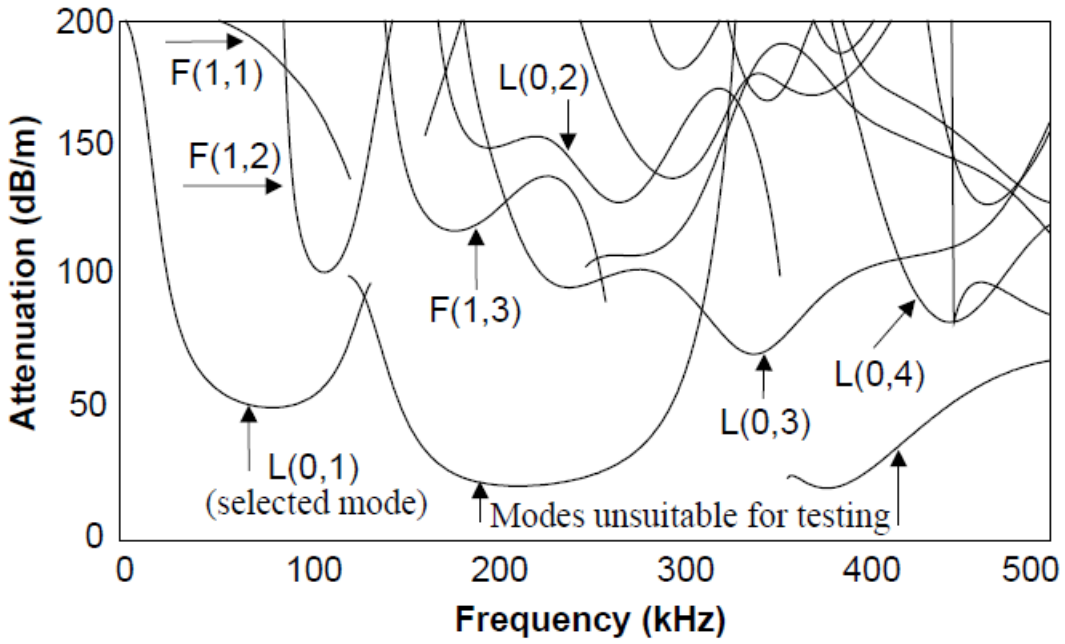
30 kHz

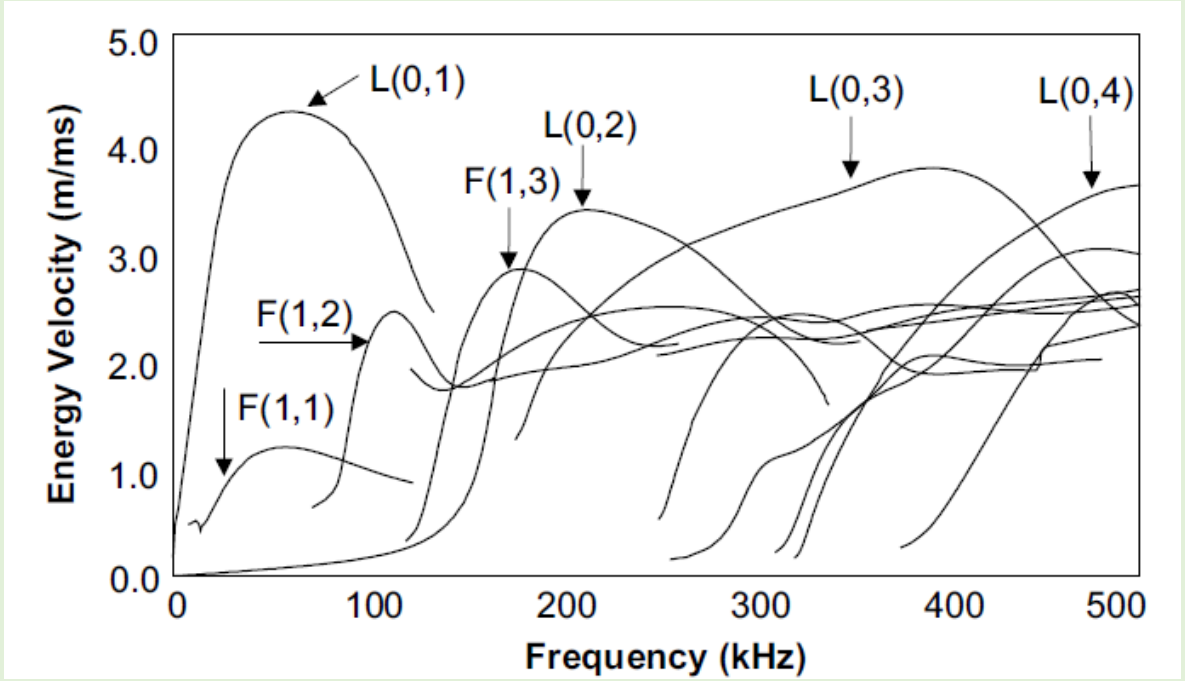
Fig. 11. Time trace recorded for a 2.4 m, fully encapsulated rock bolt, installed in a limestone mine. Excitation signal was a 30 kHz, 6 cycle, Gaussian windowed toneburst.

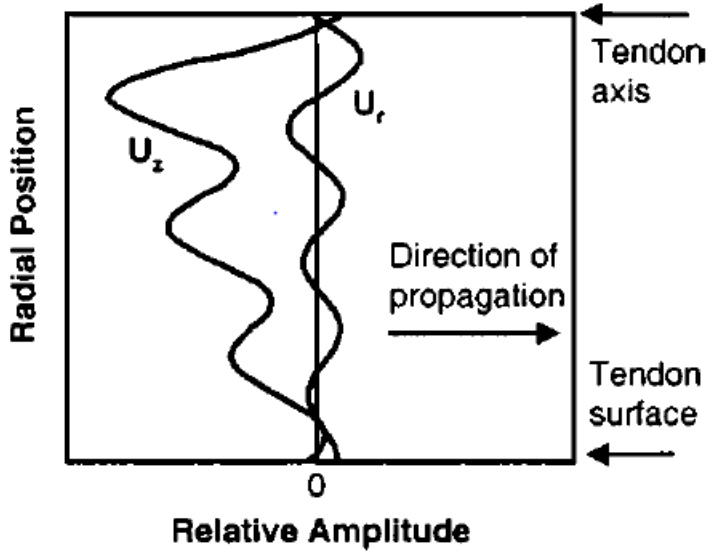


2.4 MHz

Beard *et al* 2003







It is desirable to use a mode that has a low attenuation due to leakage, to maximise the inspection range, and also to use a mode that has a high energy velocity, to separate it in time from slower modes, which could complicate the received signal.

Beard *et al* 2003

SIMULERAD DEFORMATION INUTI STAG (AMPLITUD)

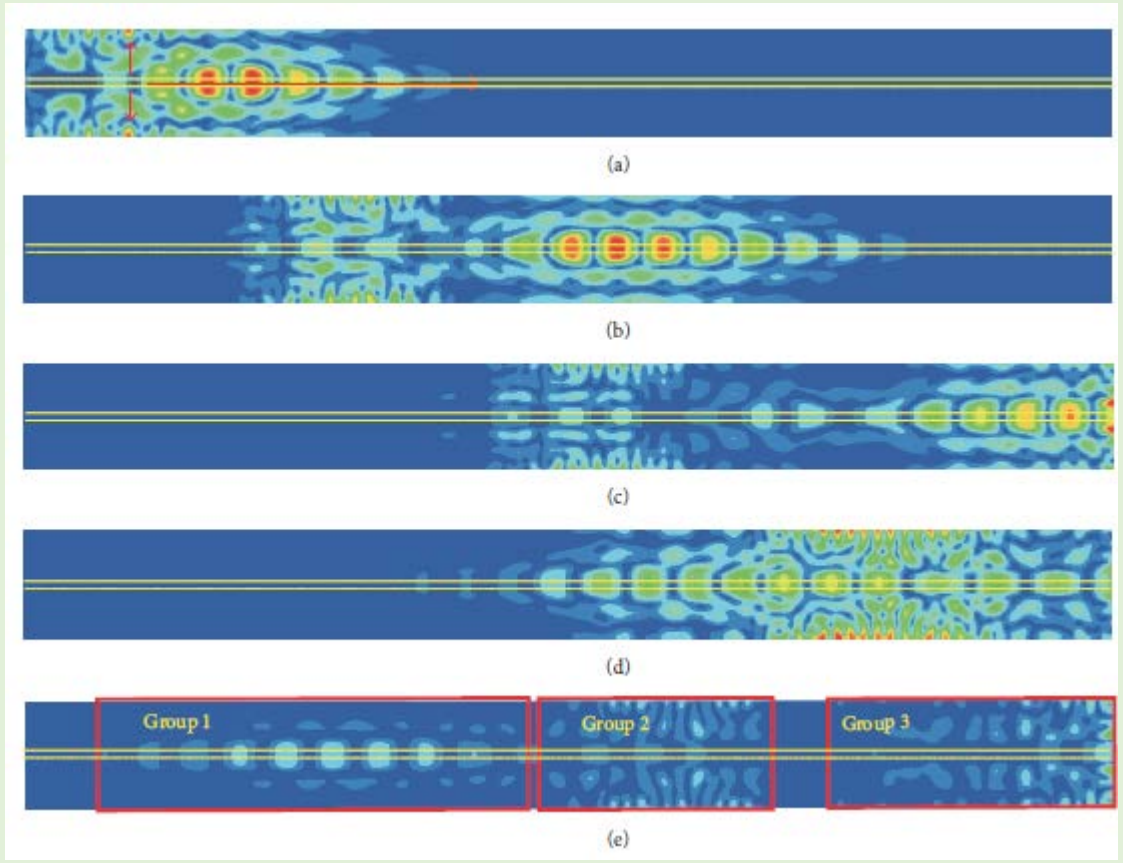
0.1 ms

0.2 ms

0.3 ms

0.4 ms

0.5 ms



Dispersion

Xiaoyang Rong *et al* 2017

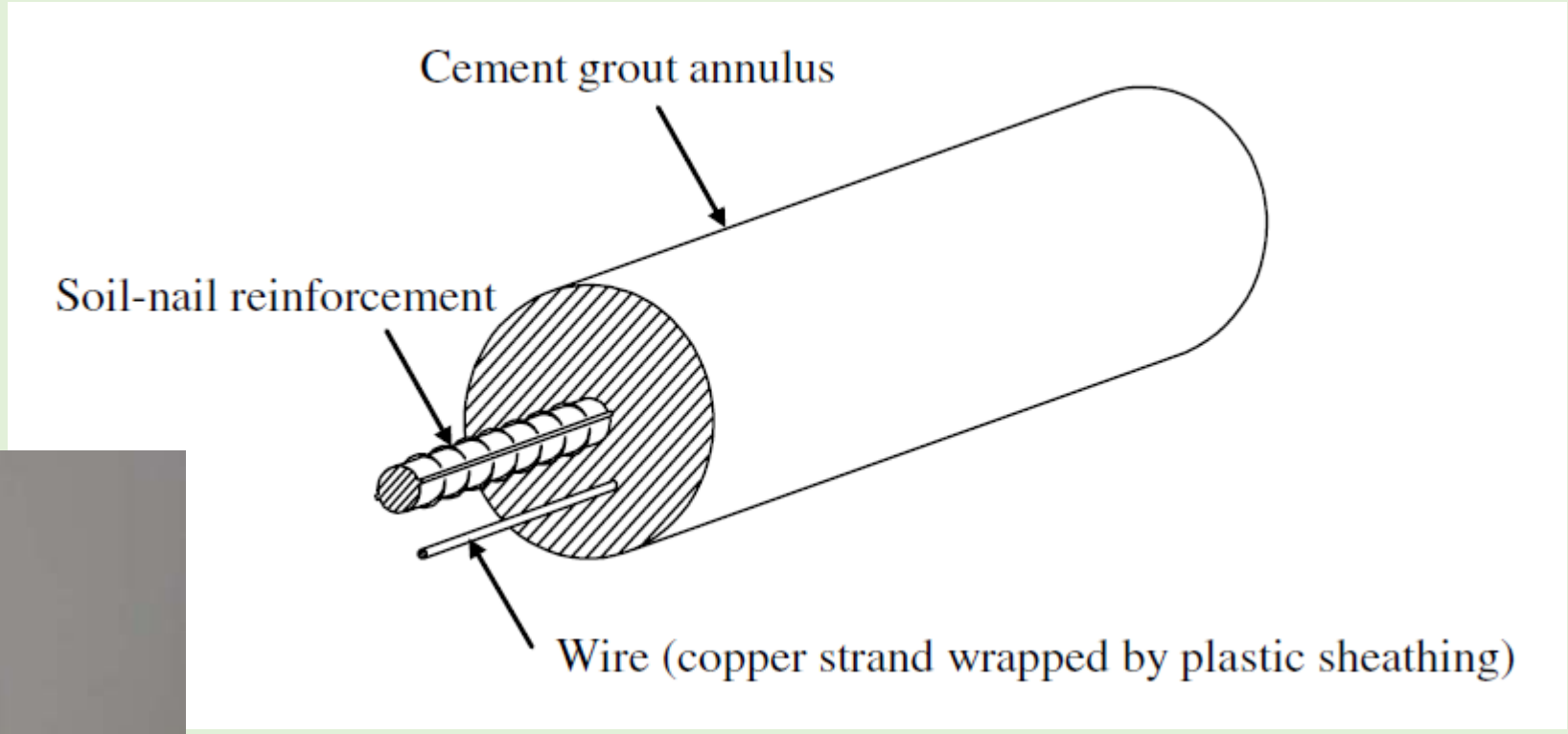
Classic Boltometer (Thurner)

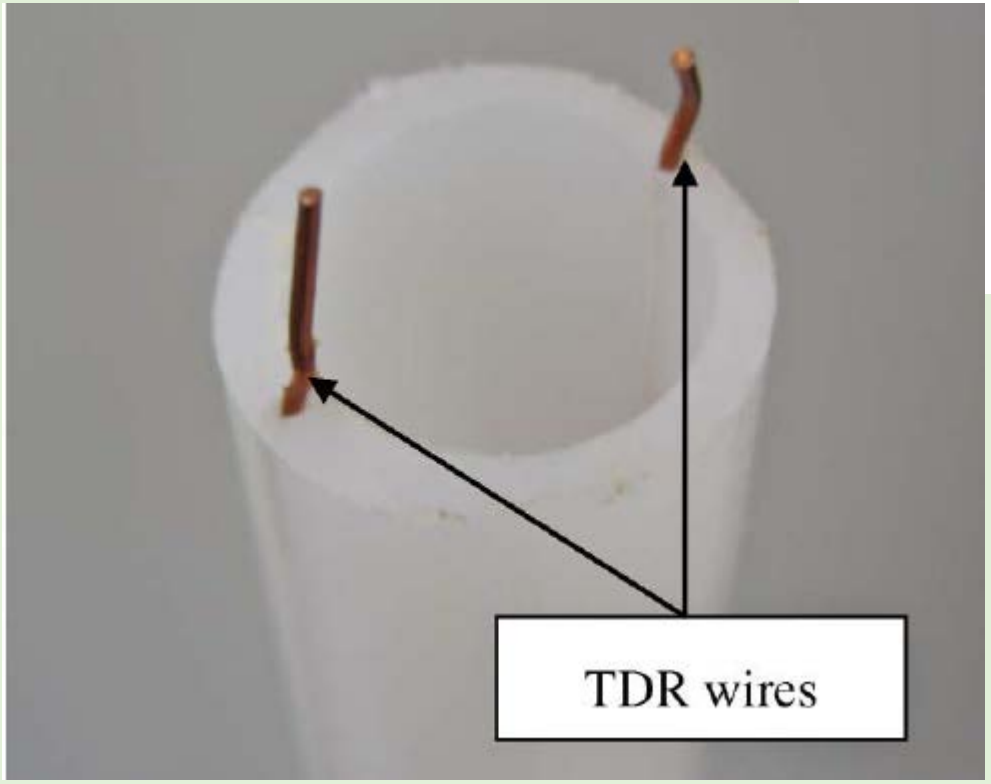
Rock Bolt Tester RBT (Stepinsky, GEOSIGMA)

TIME DOMAIN REFLECTOMETRY – TDR

RADAR ON A CABLE

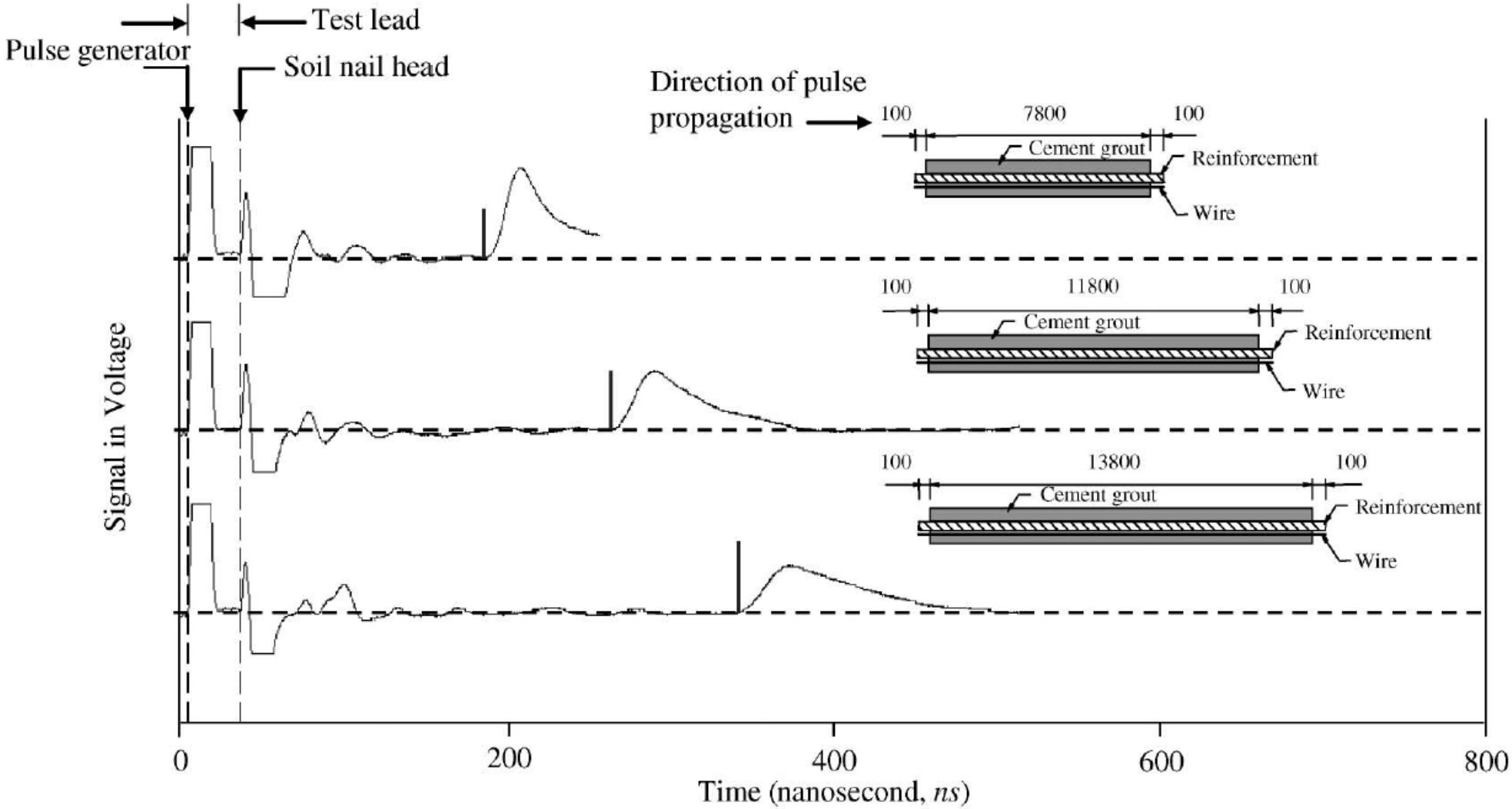
TDR UTFÖRS VANLIGEN PÅ KABELPAR





FÖRSÖK VISAR ATT DET ÄVEN KAN FUNGERA PÅ ENKEL KABEL

TDR

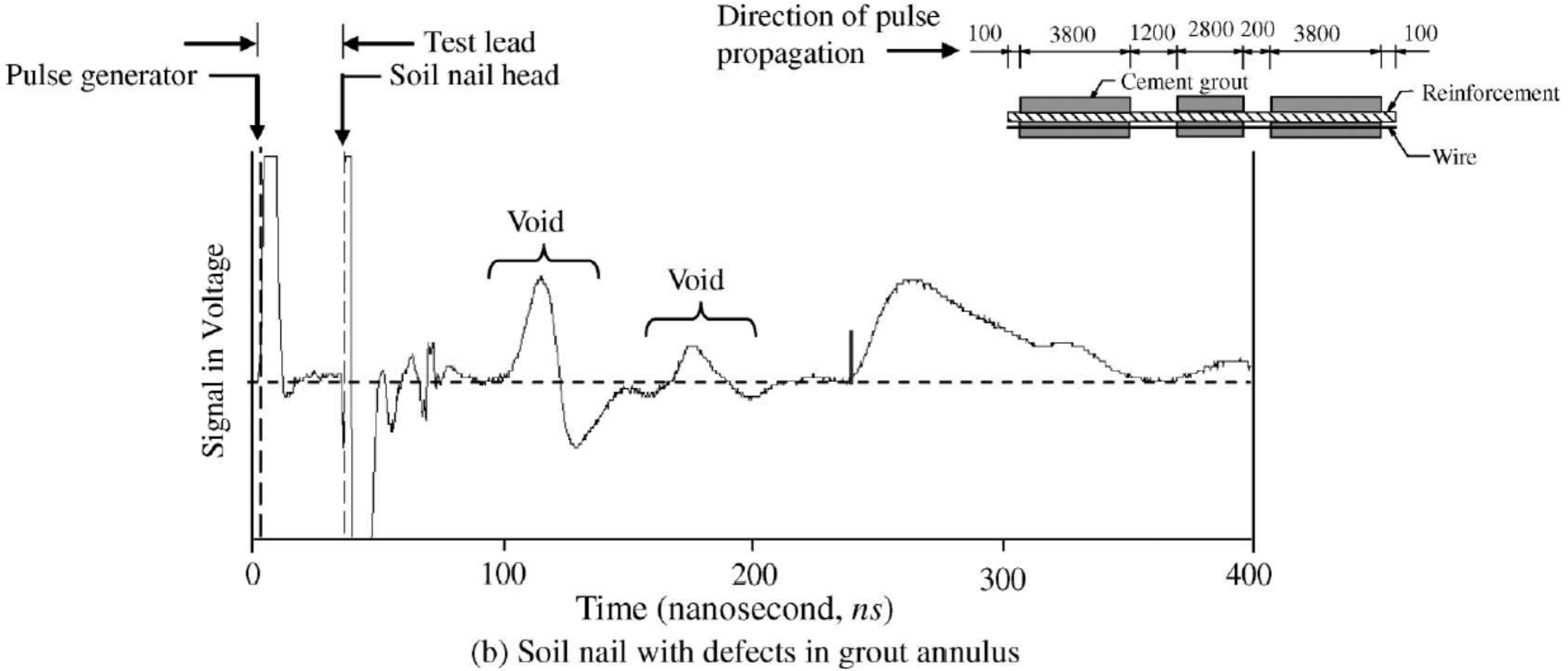


Note: All dimensions are in mm.

Legend:

| Reflection from end of soil nail

TDR



(b) Soil nail with defects in grout annulus

Note: All dimensions are in mm.

Verklig bärkraft

Ljungberg 2016

Denna bestäms genom utdragsprov. Vid sådana prov är det viktigt att man ser till att provningsmetoden liknar det faktiska belastningsfallet. *Särskilt bör man undvika att använda bergmassan runt staget som mothåll*, då det motverkar ytbrott i berget.

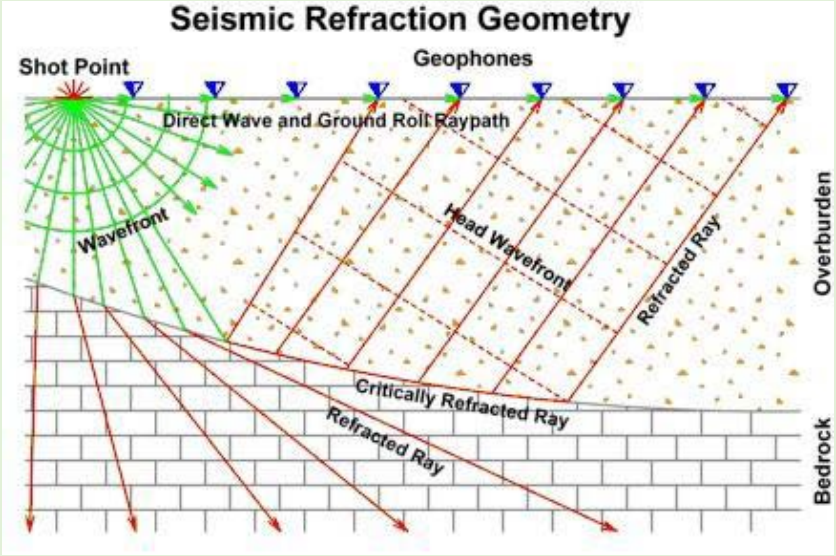
Då man ofta räknar med en 45-gradig spridning av krafterna från stagets spets, kan ovanstående princip i realiteten bli svår att följa för långa bultar.

En i Norge använd metod bygger på att man använder en hydraulisk grävmaskin för belastningen (Capucine 2012). Utdragskraften mäts då med en kraftgivare mellan skopa och bergbult.

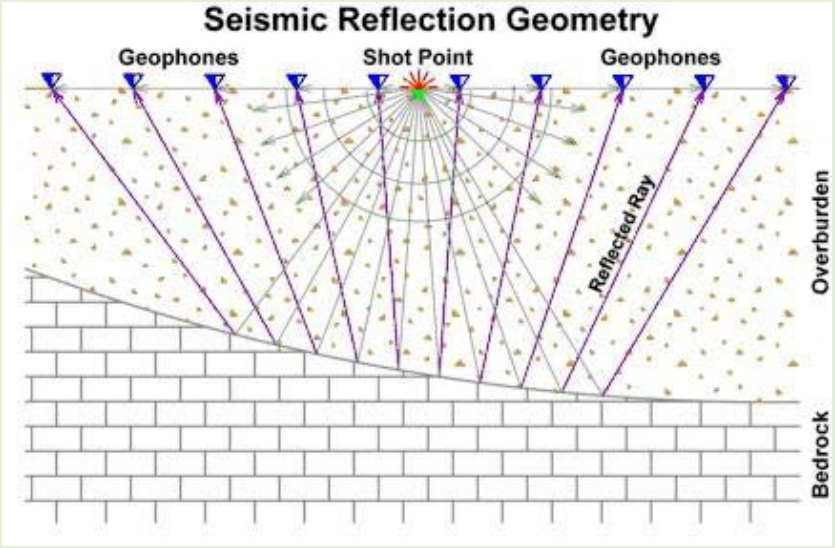
Differentiell GPS eller s.k. RTK (Real Time Kinematic) korrigering av GPS signalen kan vara en möjlighet liksom instrumenterat slangvattenpass för deformationsmätningen.

TEST AV BERGMASSAN

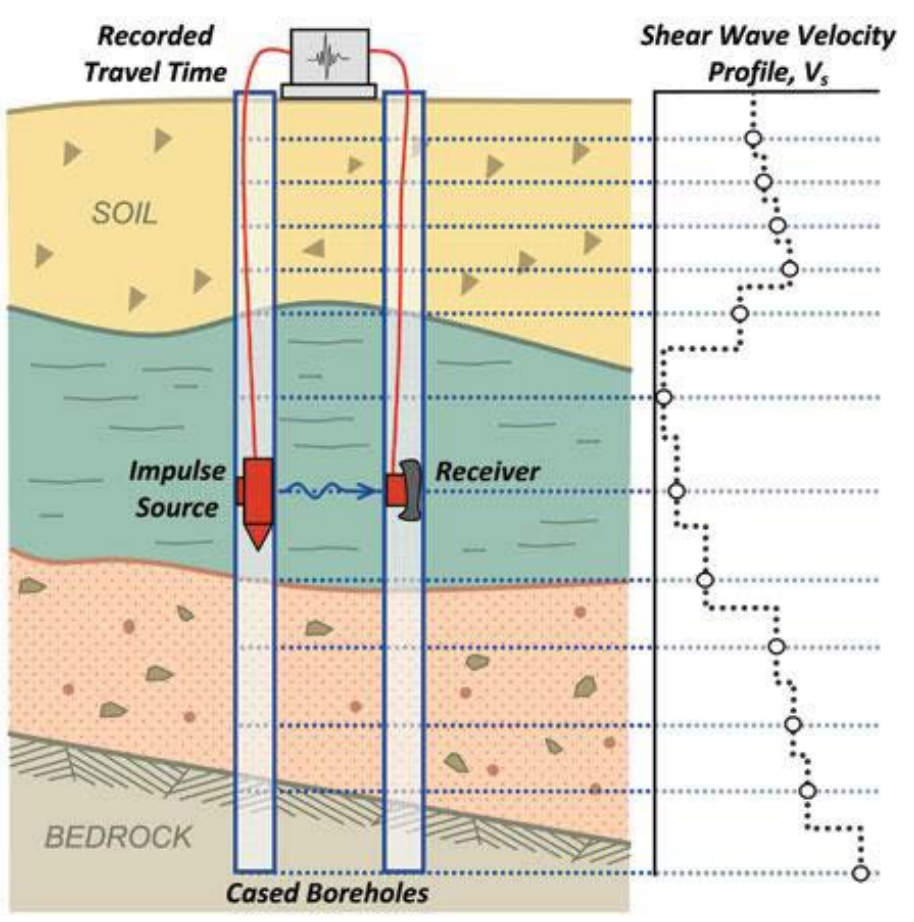
REFRAKTIONSSEISMIK

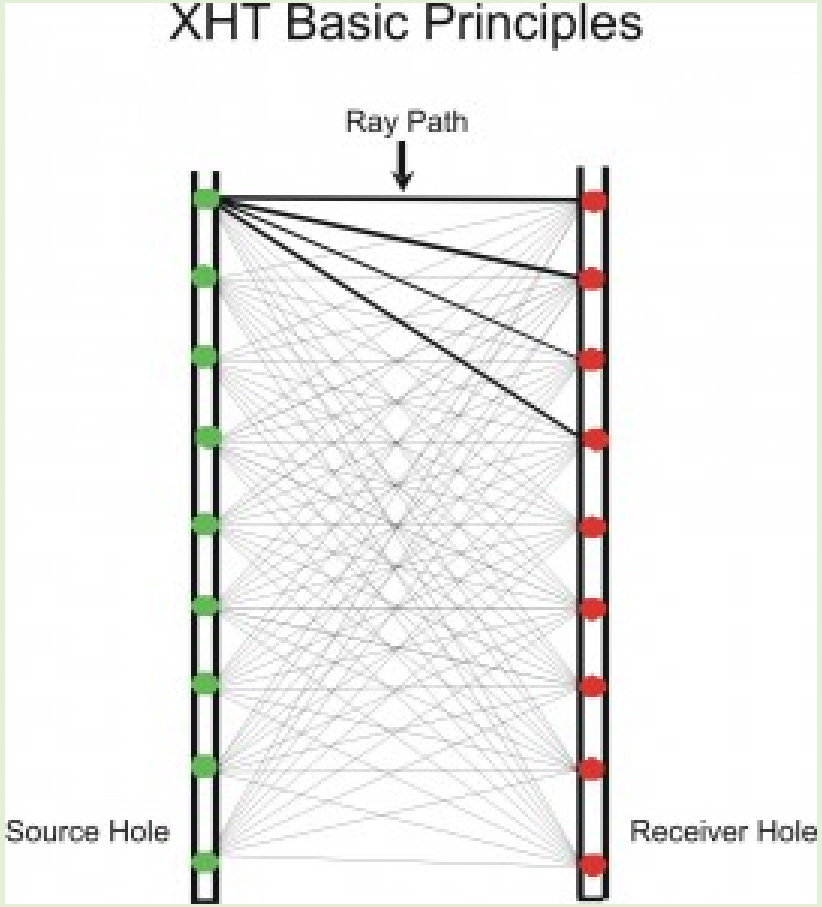


REFLEKTIONSSEISMIK



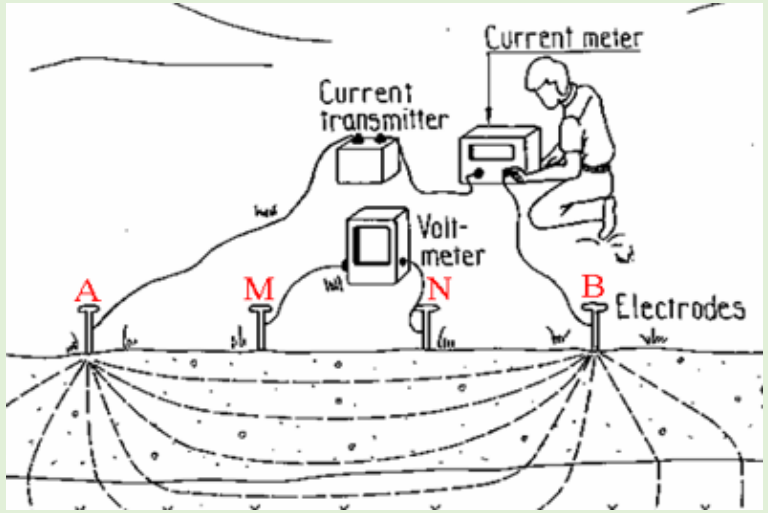
CROSS-HOLE SEISMIK / TOMOGRAFI



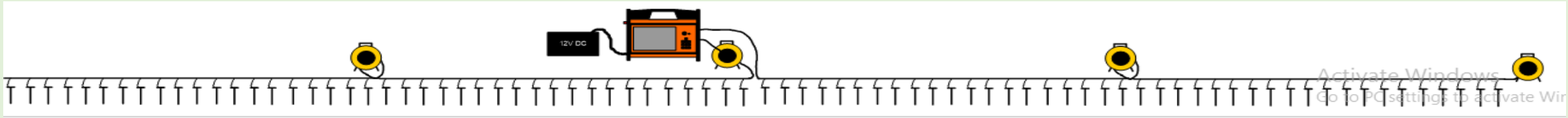


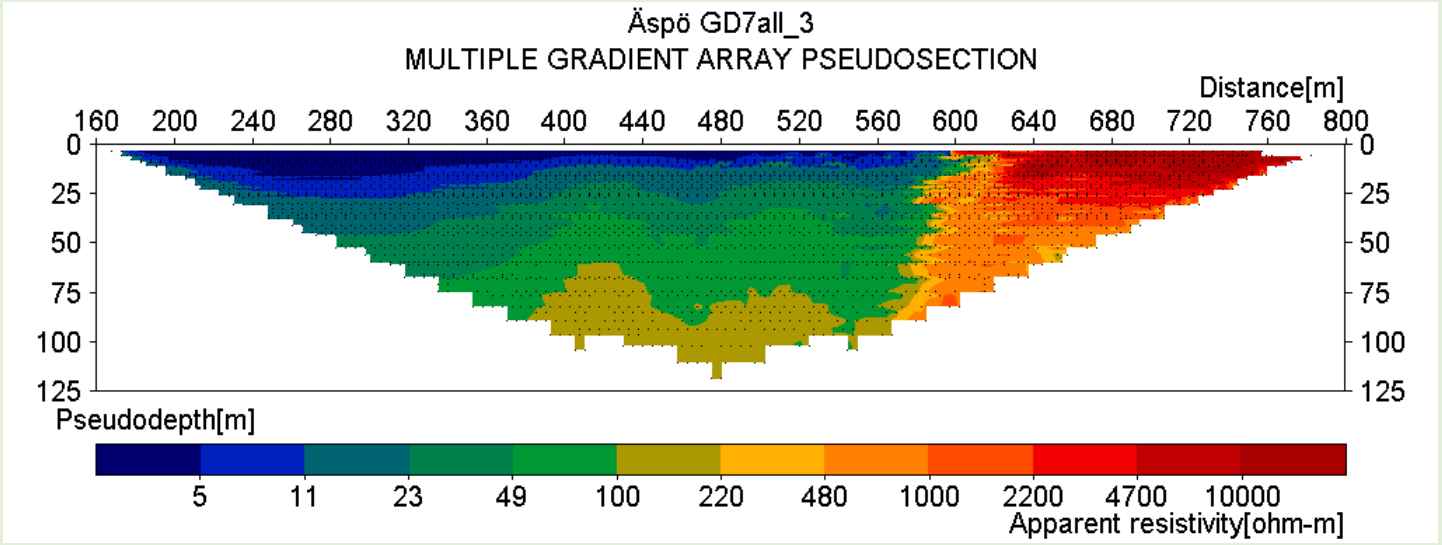
RESISTIVITETSMÄTNING

Klassisk illustration



Modernt mätsystem med automatisk elektrodväxling





Datapresentation

Energiforsk

Tack för att Ni lyssnade!

LUNDS UNIVERSITET
Lunds Tekniska Högskola

Liten bibliografi. Refererade artiklar indikerade med *

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