Testing for integrity

American Concrete Institute
Fall Convention
Oct. 24th-28th, 2010, Pittsburgh, USA

Claus Germann Petersen
Germann Instruments

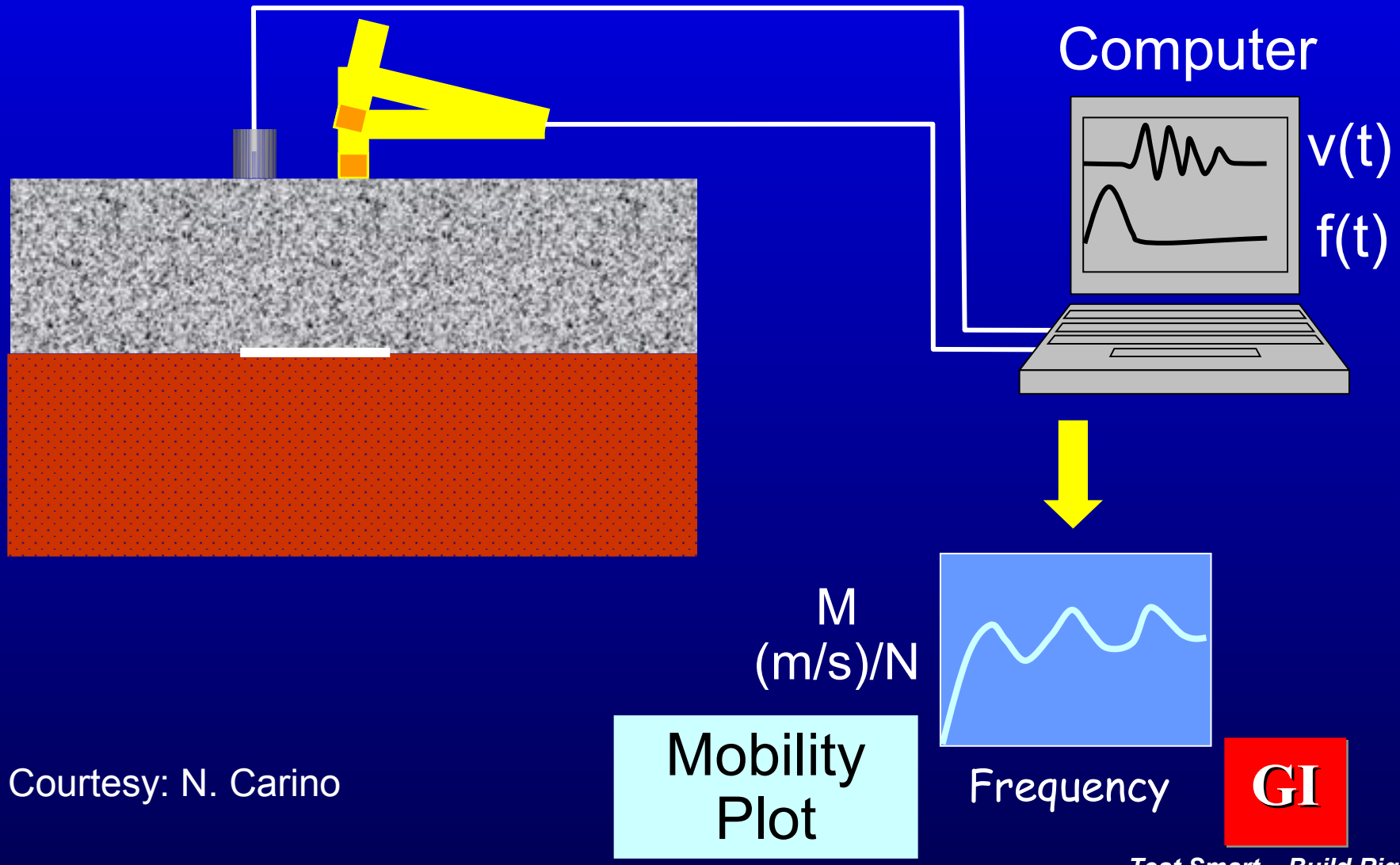
Integrity Testing

- s´MASH Impulse Response
- DOCter Impact-Echo
- MIRA 3D-Tomography

GI

Test Smart – Build Right

s'MASH Impulse Response



Courtesy: N. Carino

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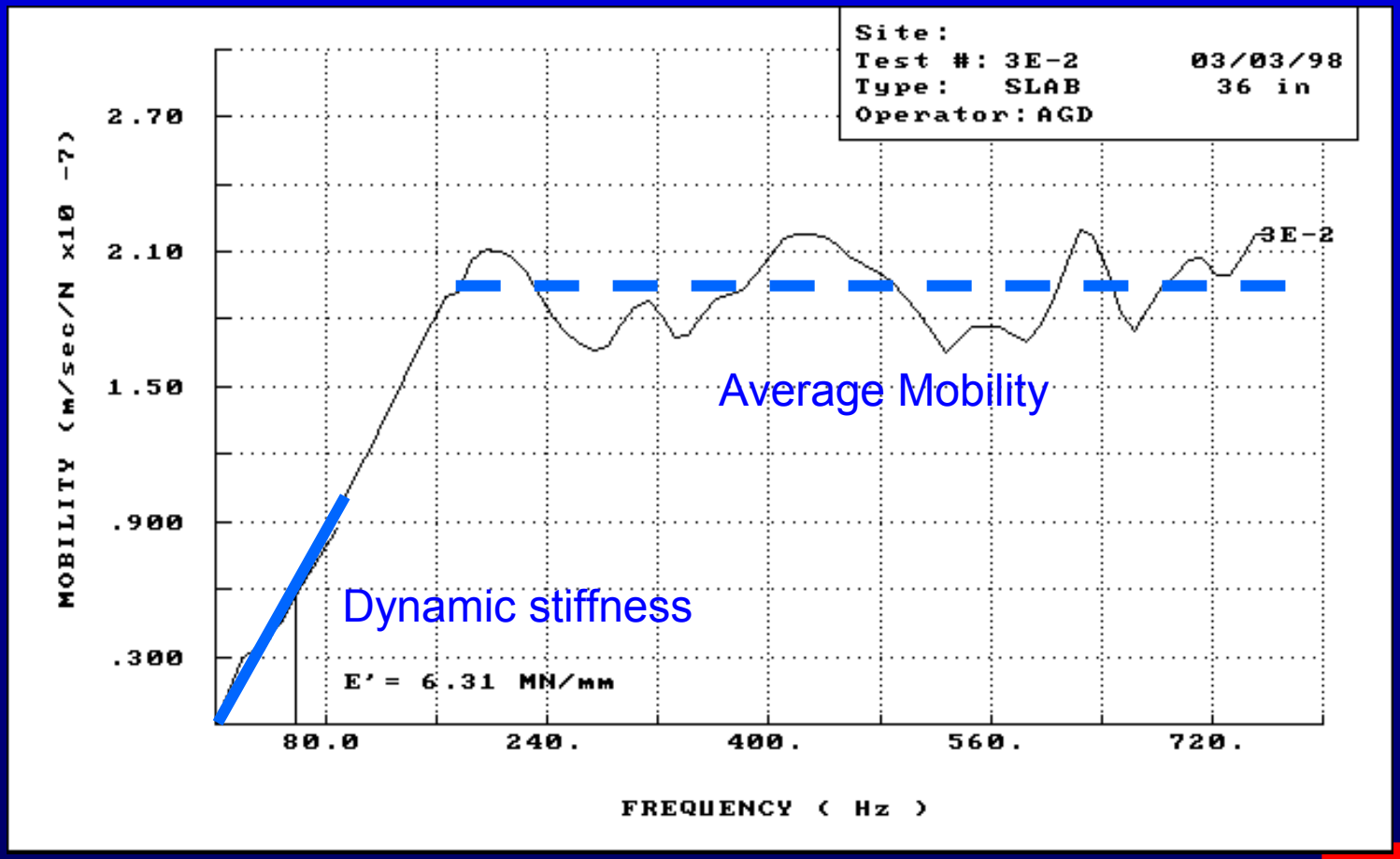
s´MASH - Mobility Plot



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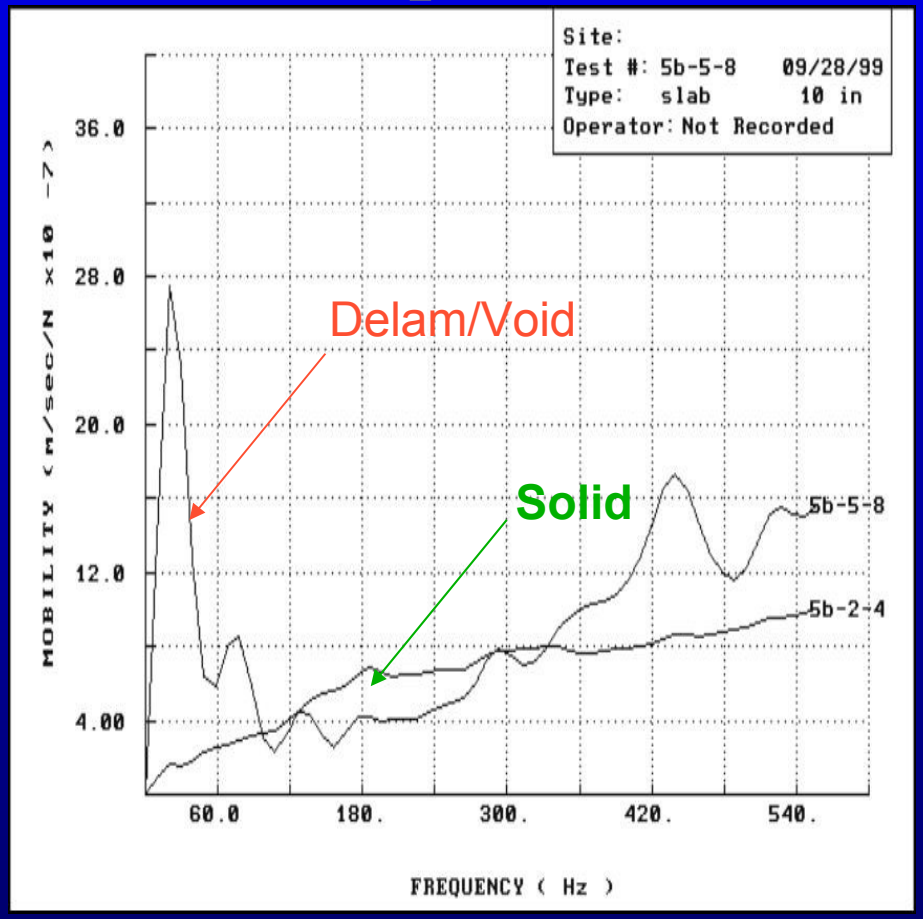
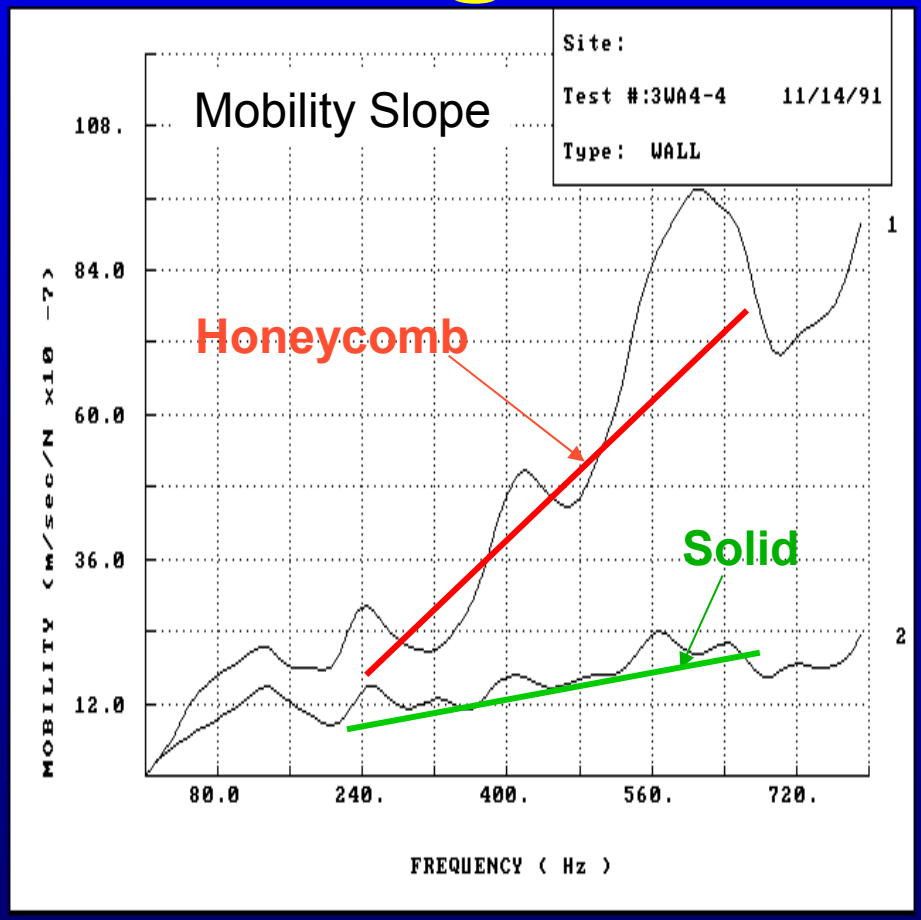
s´MASH Flaw Signals compared to Solid Signals





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Courtesy: Ramboll

IS Bridge

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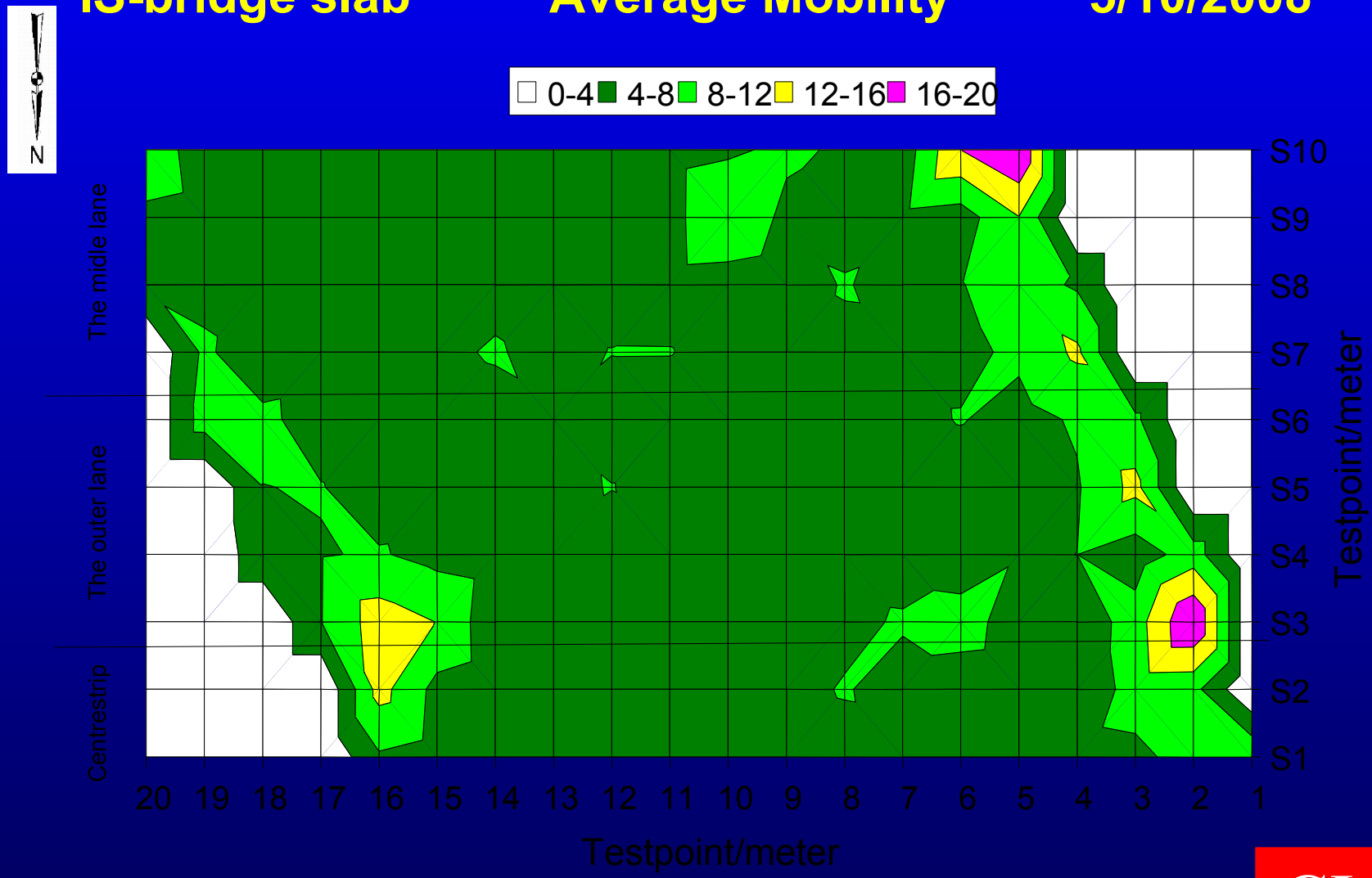
IS-bridge slab Average Mobility 5/10/2008



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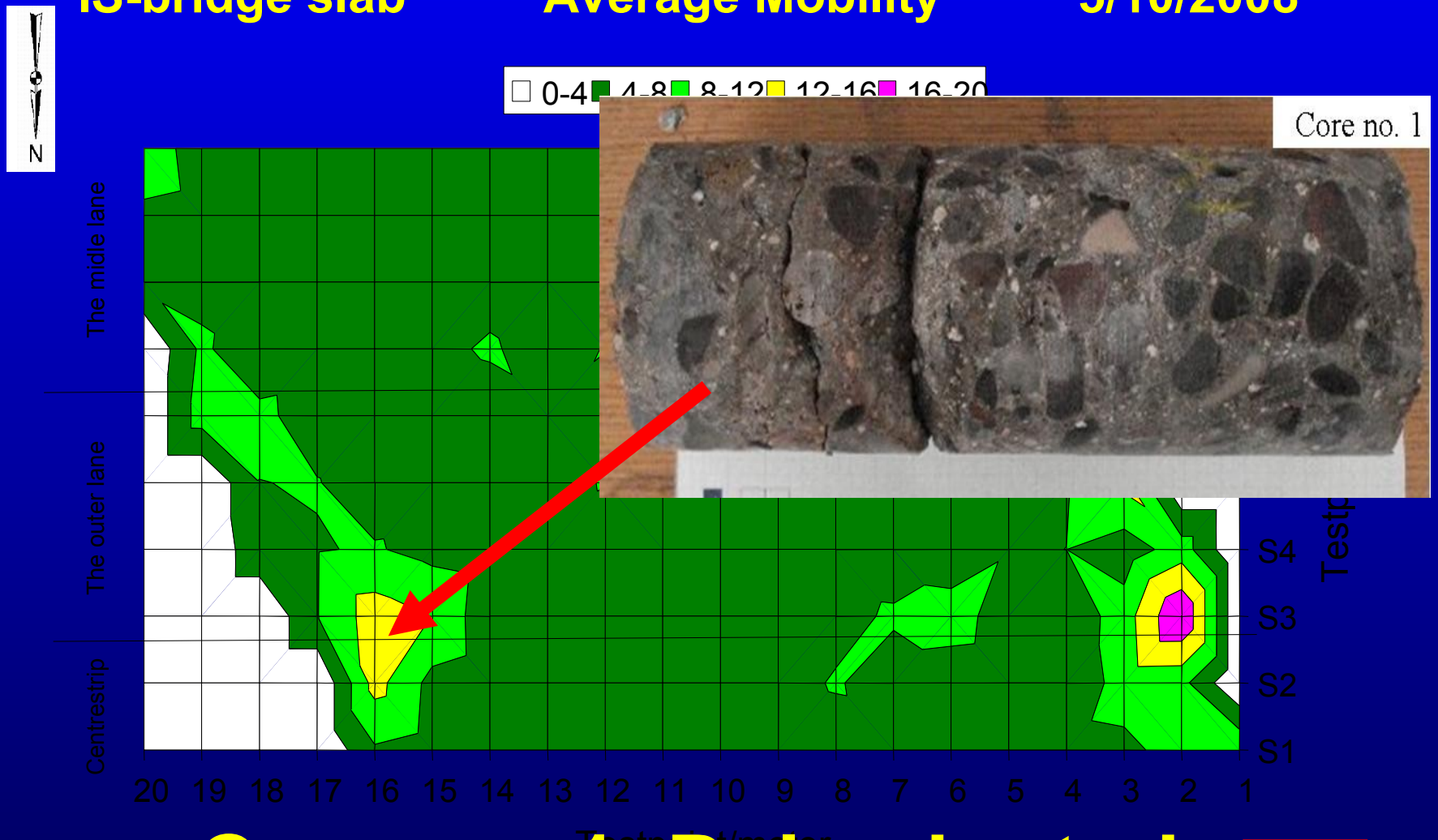
IS-bridge slab Average Mobility 5/10/2008



Core no 1, Delaminated

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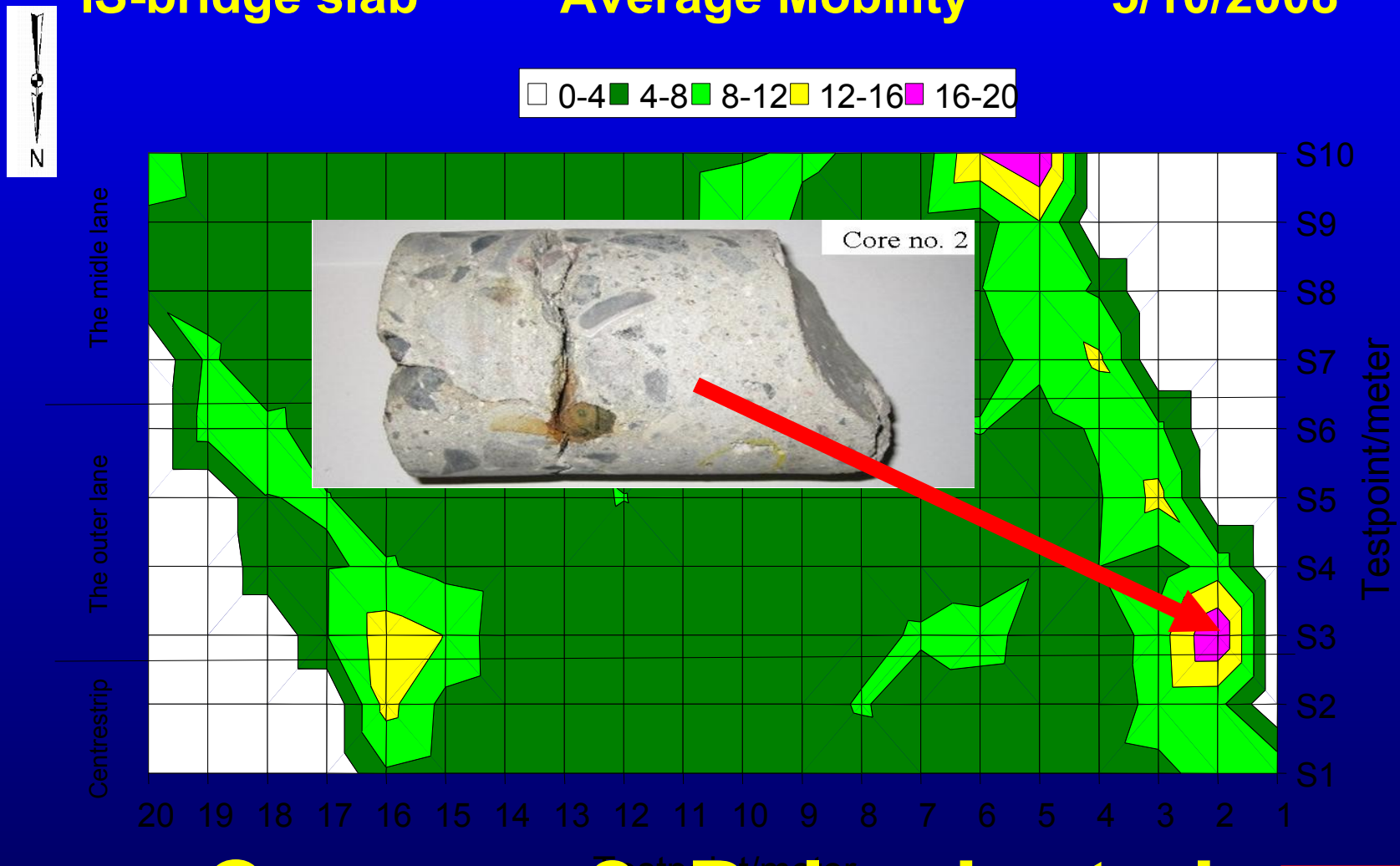
IS-bridge slab Average Mobility 5/10/2008



Core no 2, Delaminated

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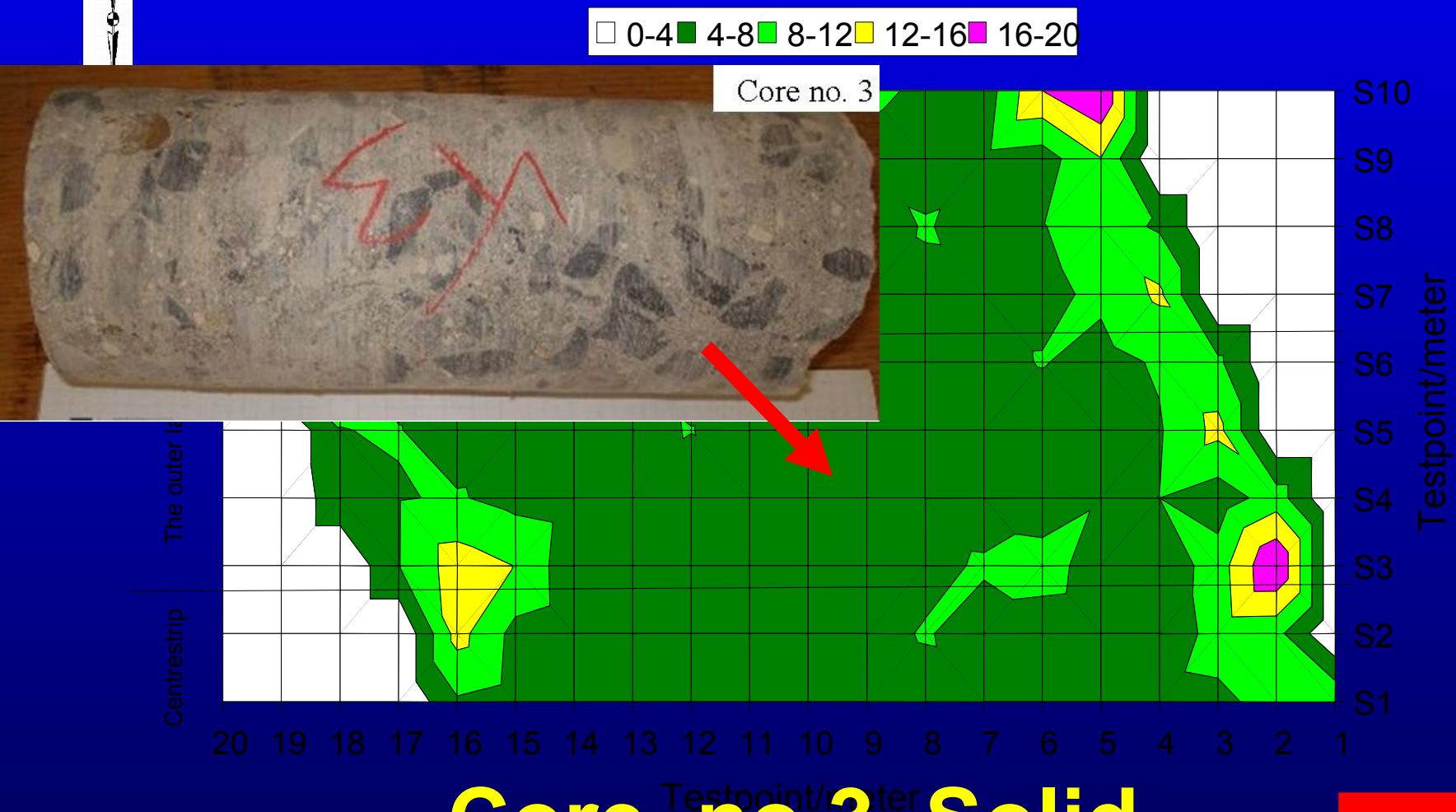
IS-bridge slab Average Mobility 5/10/2008



Core no 3, Solid

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Lindenborg Bridge

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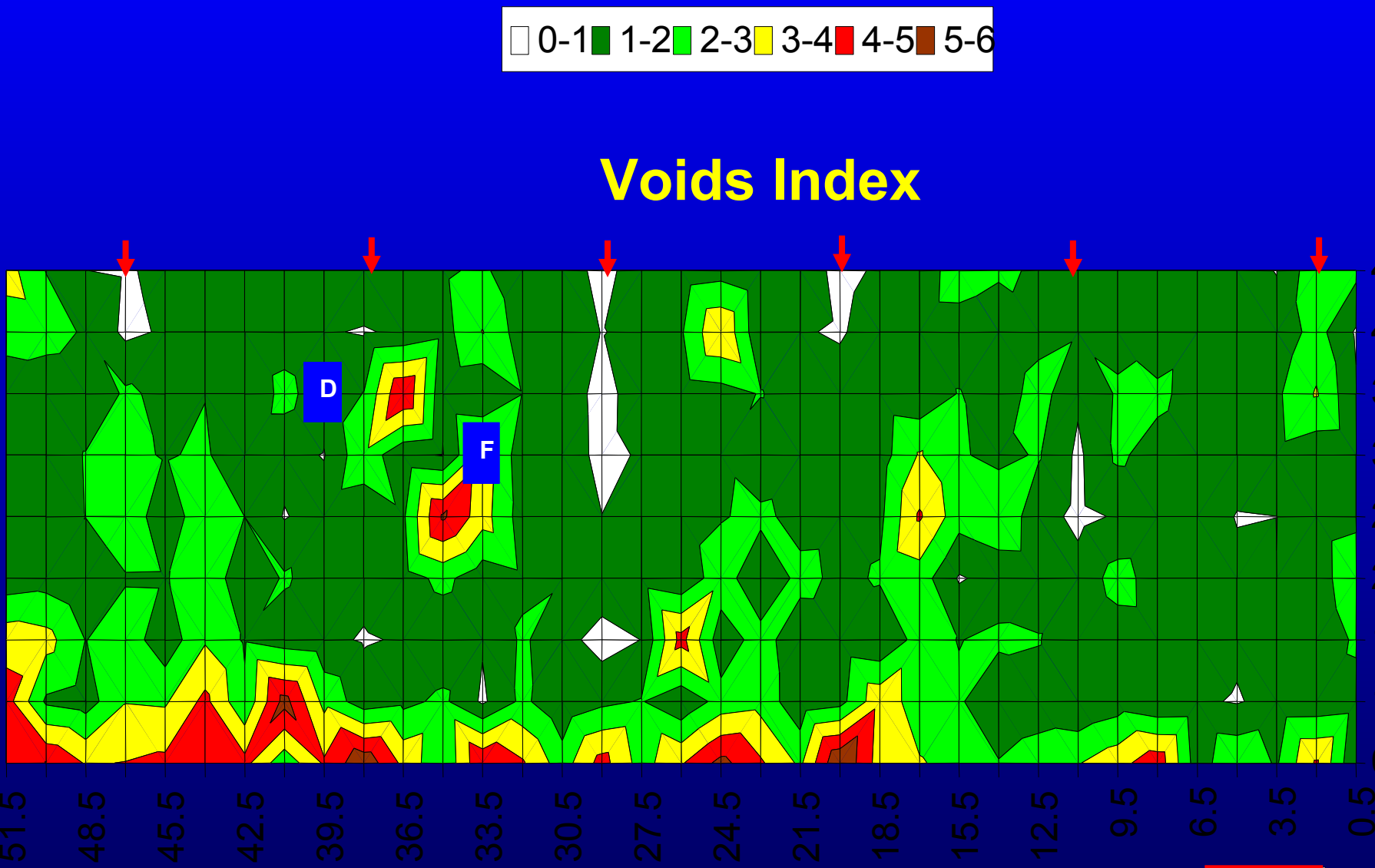

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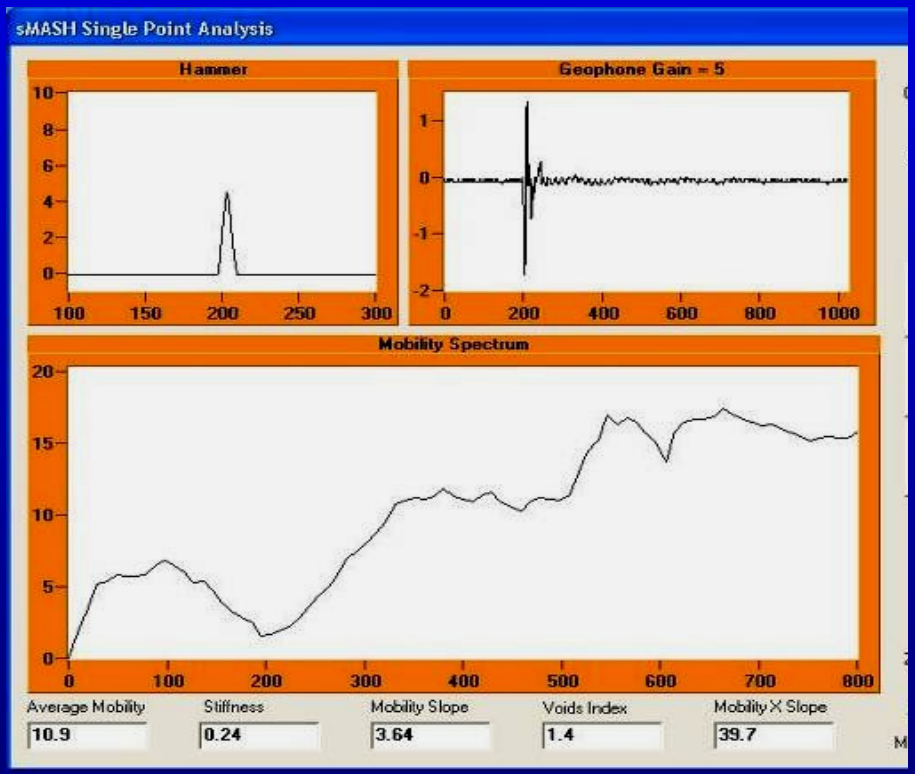
Location D, solid



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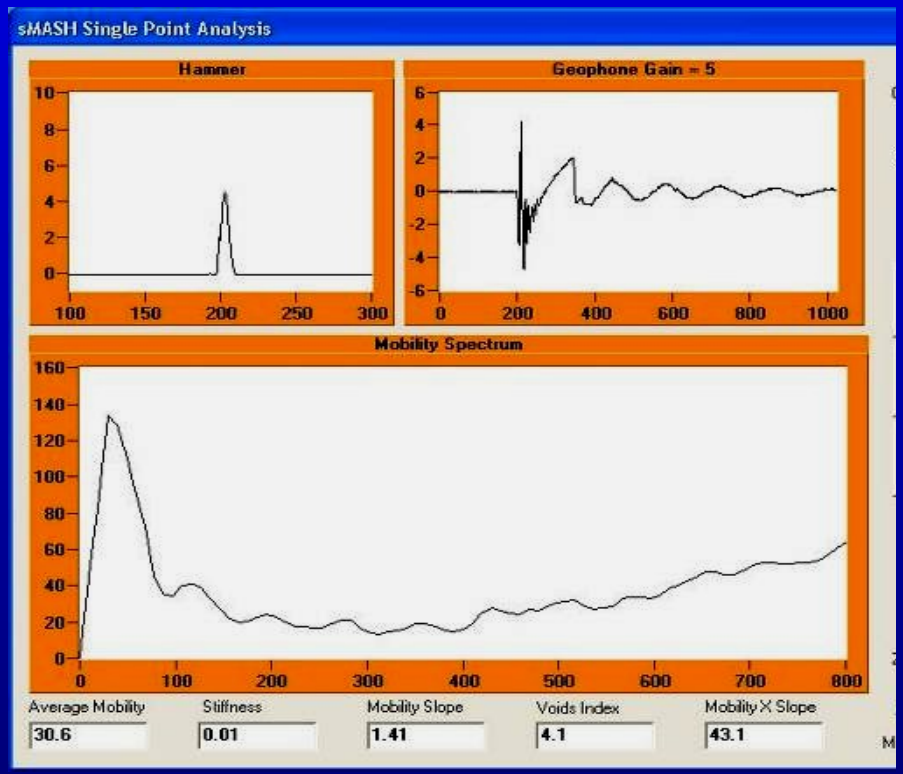
Location D, delaminated



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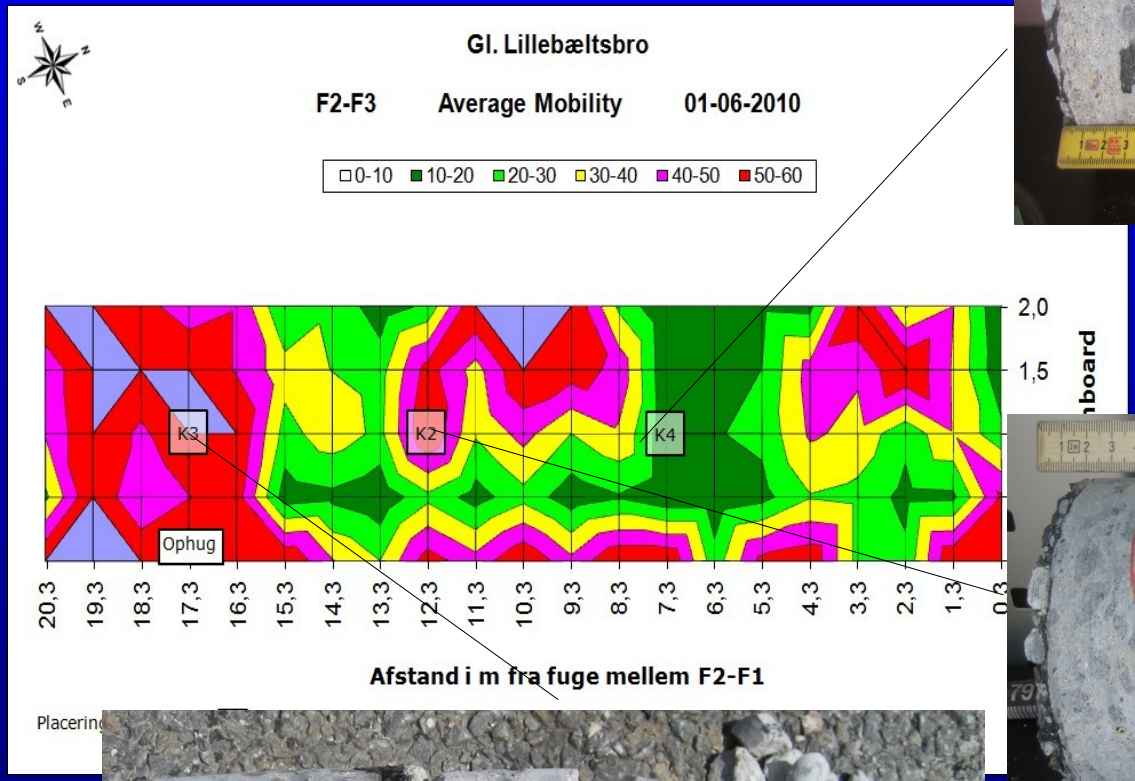

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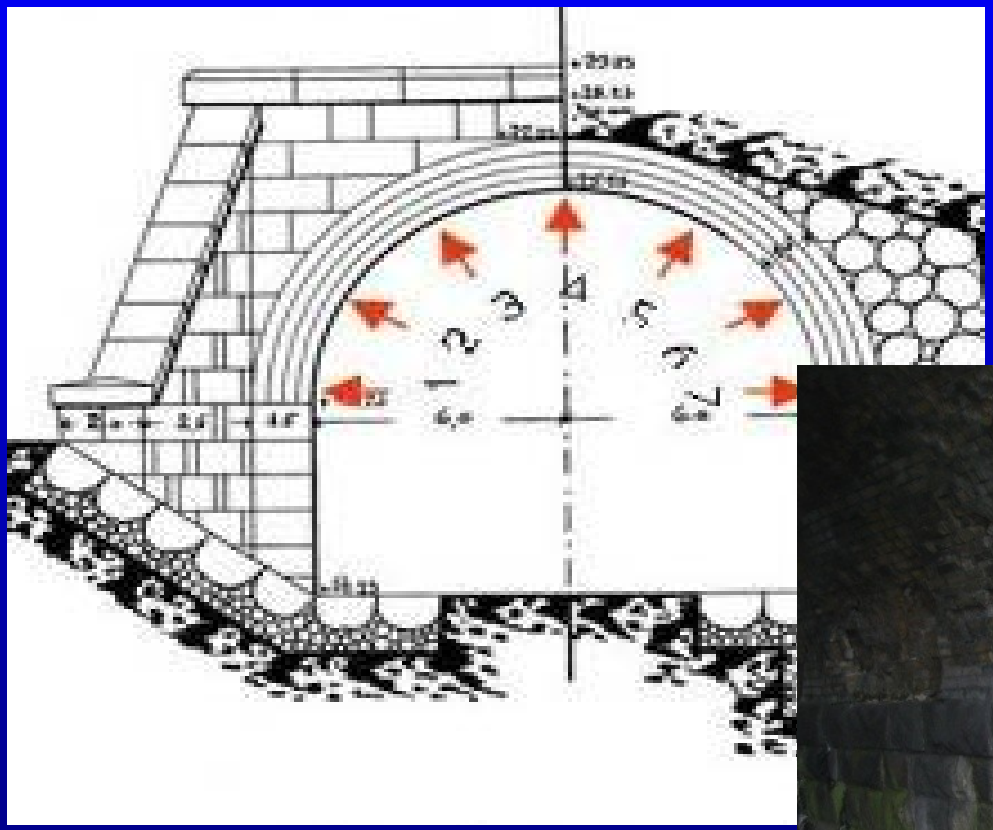
Brick Arch Bridge



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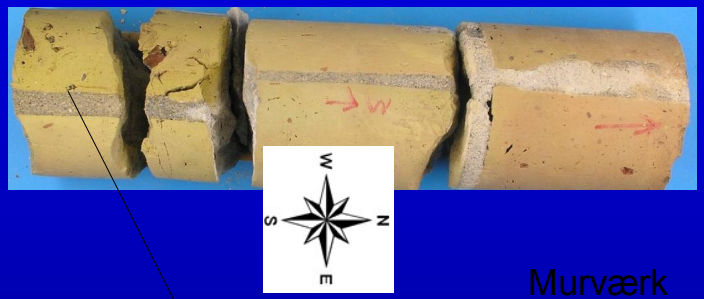
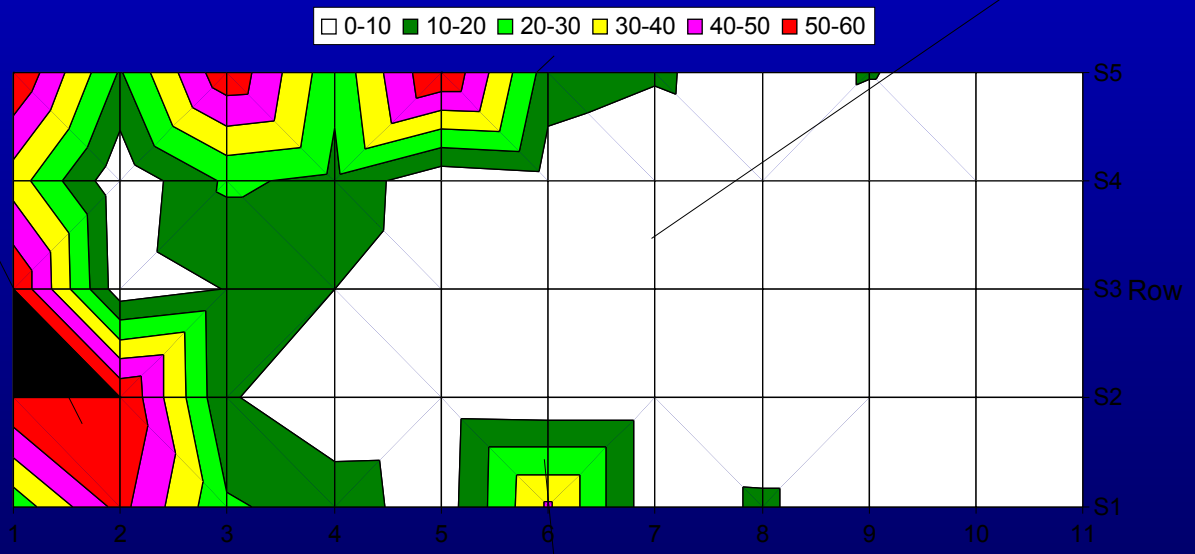
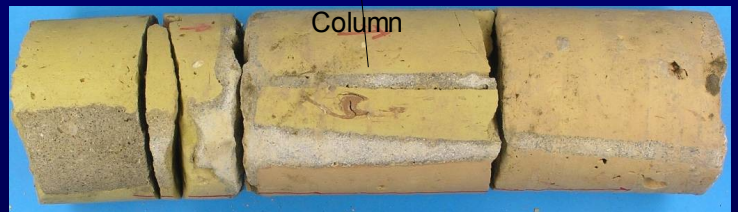
s'MASH Impulse Response



Bro 20236

Murværk Average Mobility 14/4/2009





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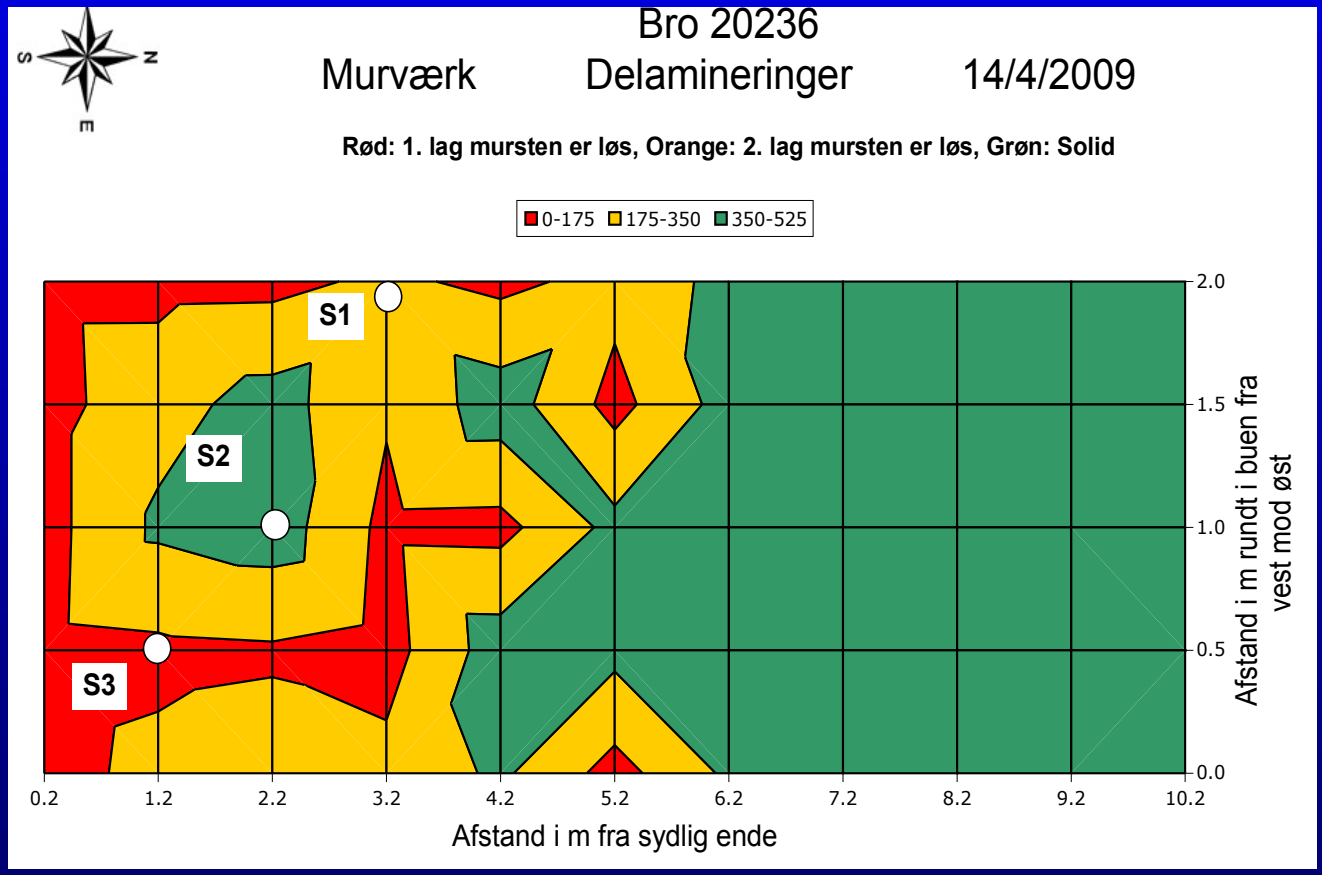
DOCter Impact-Echo



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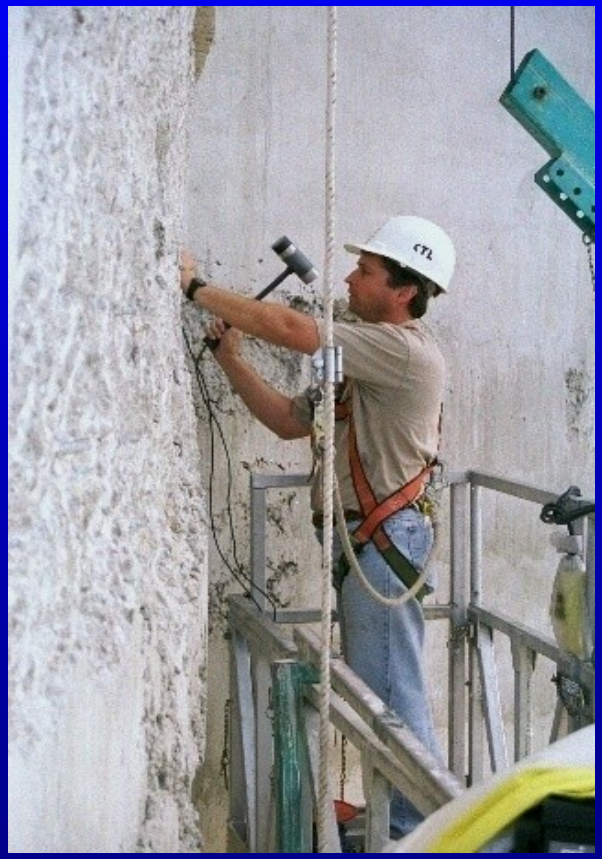

Courtesy: CTL

s´MASH Application Examples

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Test Smart – Build Right

Courtesy: CTL

s´MASH Application Examples

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s´MASH
Application Examples

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DOCter Impact-Echo

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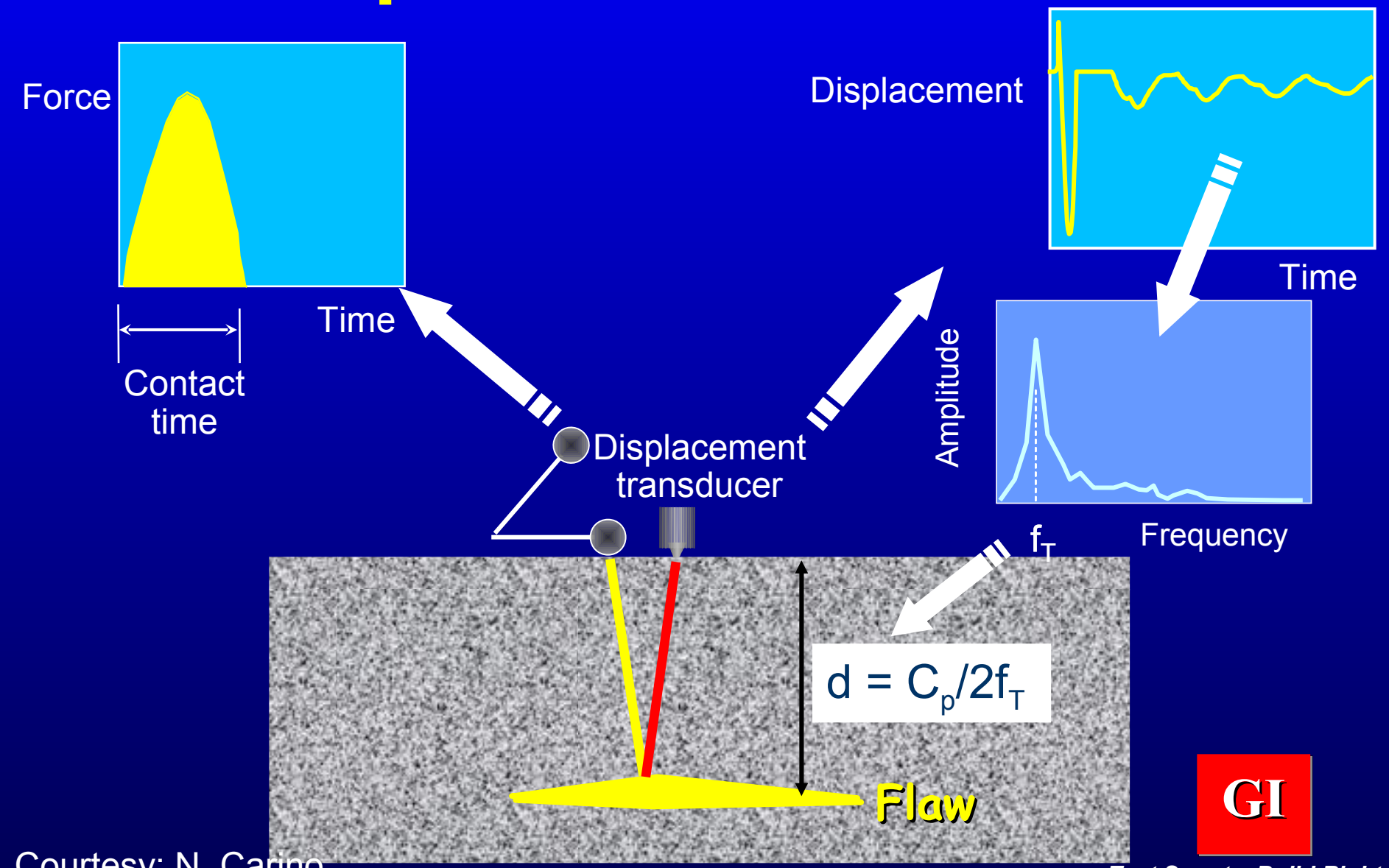
Impact-Echo Method



Courtesy: N. Carino

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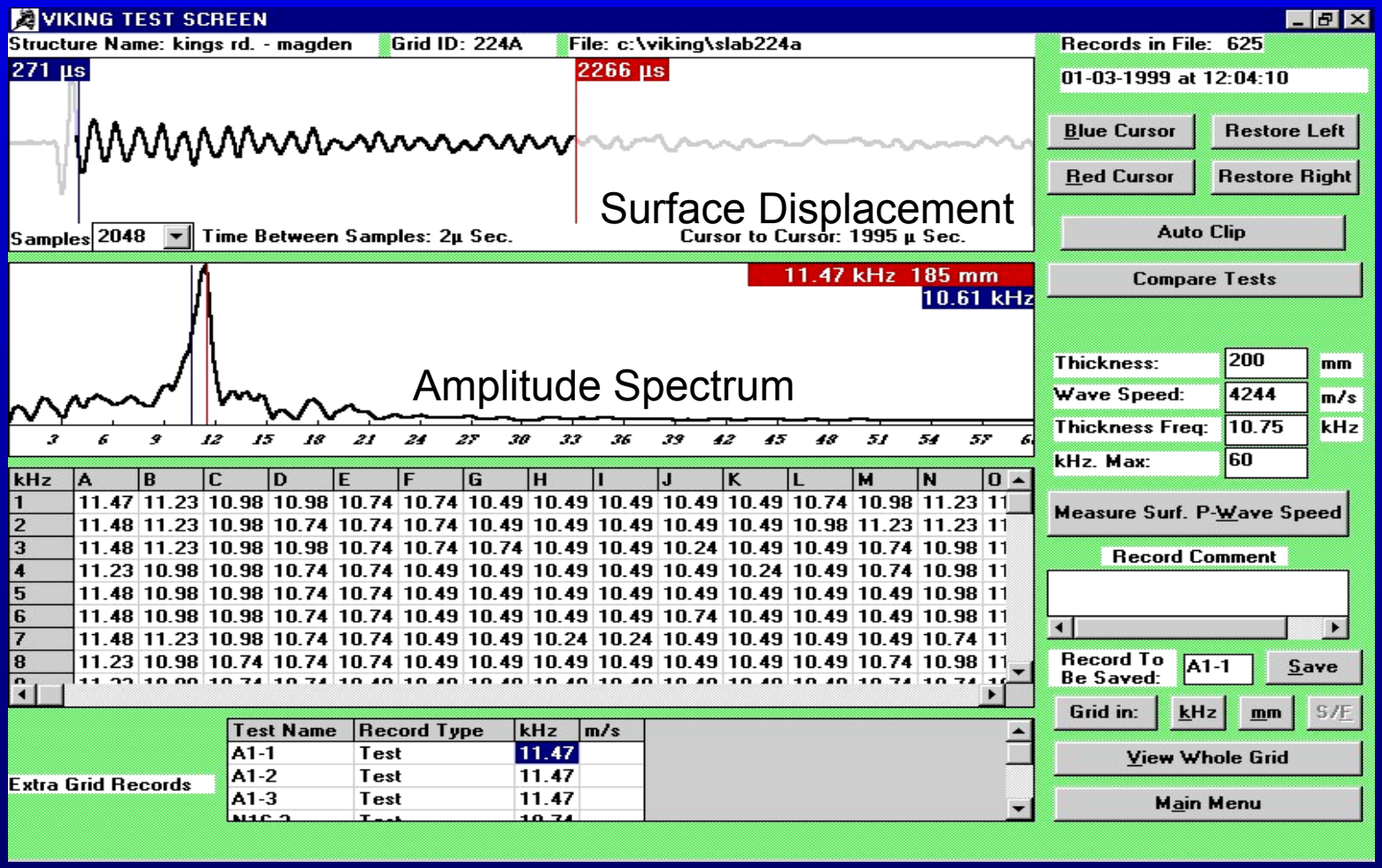
Test record



kHz	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	11.47	11.23	10.98	10.98	10.74	10.74	10.49	10.49	10.49	10.49	10.49	10.74	10.98	11.23	11
2	11.48	11.23	10.98	10.74	10.74	10.74	10.49	10.49	10.49	10.49	10.49	10.98	11.23	11.23	11
3	11.48	11.23	10.98	10.98	10.74	10.74	10.74	10.49	10.49	10.24	10.49	10.49	10.74	10.98	11
4	11.23	10.98	10.98	10.74	10.74	10.49	10.49	10.49	10.49	10.49	10.24	10.49	10.74	10.98	11
5	11.48	10.98	10.98	10.98	10.74	10.74	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.98	11
6	11.48	10.98	10.98	10.74	10.74	10.49	10.49	10.49	10.49	10.74	10.49	10.49	10.49	10.98	11
7	11.48	11.23	10.98	10.74	10.74	10.49	10.49	10.24	10.24	10.49	10.49	10.49	10.49	10.74	11
8	11.23	10.98	10.74	10.74	10.74	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.74	10.98	11

Test Name	Record Type	kHz	m/s
A1-1	Test	11.47	
A1-2	Test	11.47	
A1-3	Test	11.47	

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DOCter Impact-Echo

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Surface wave speed

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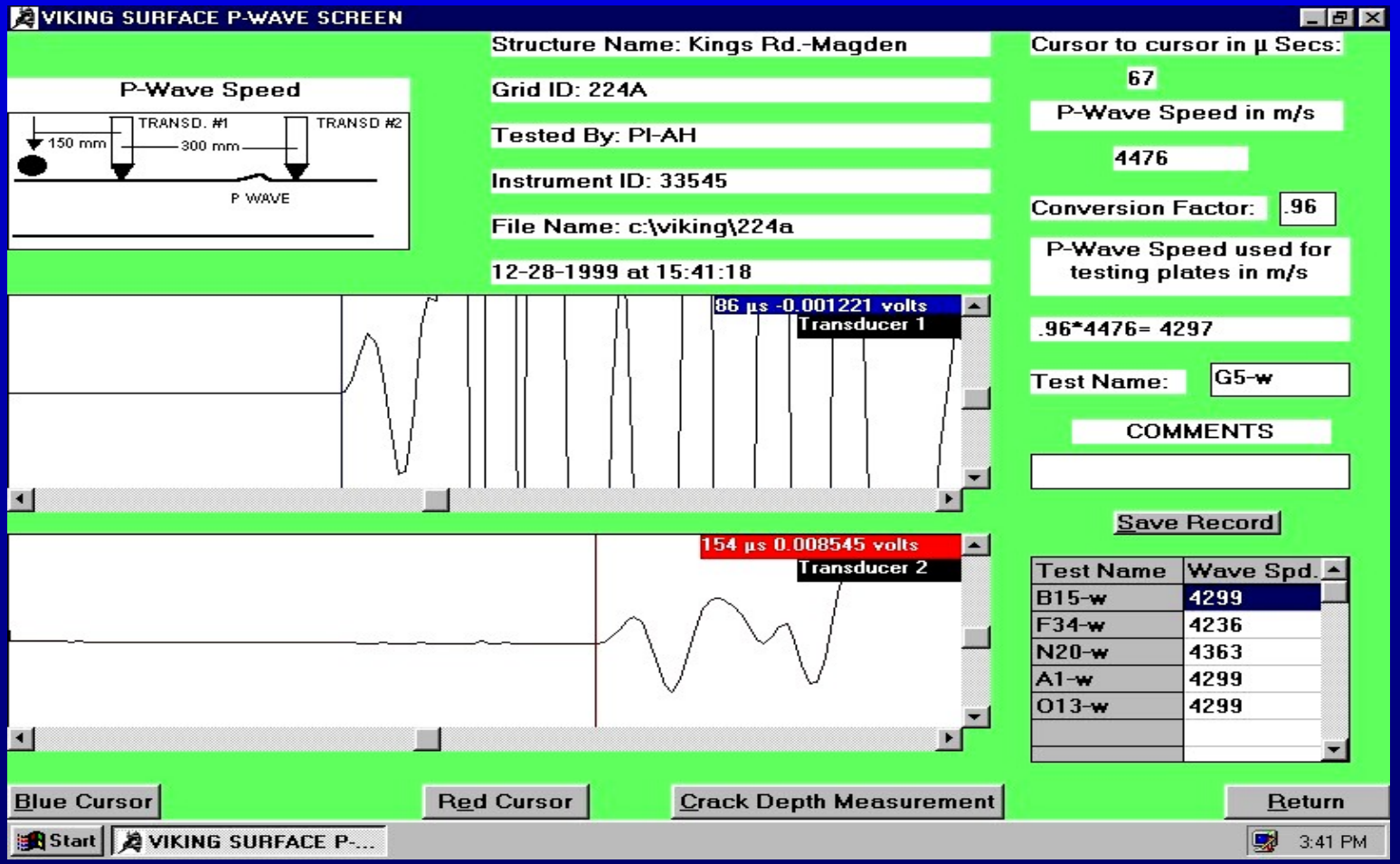
Wave speed record



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DOCter Application
Injection quality of cable ducts

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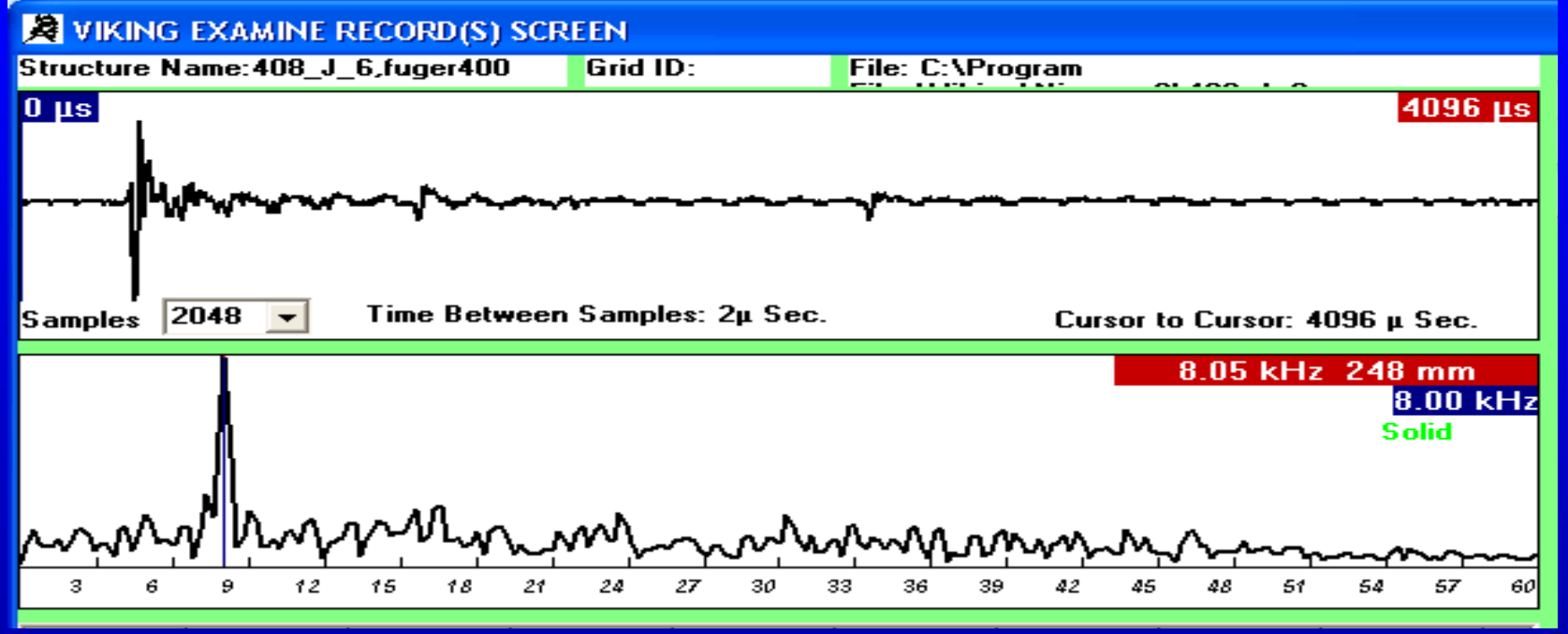
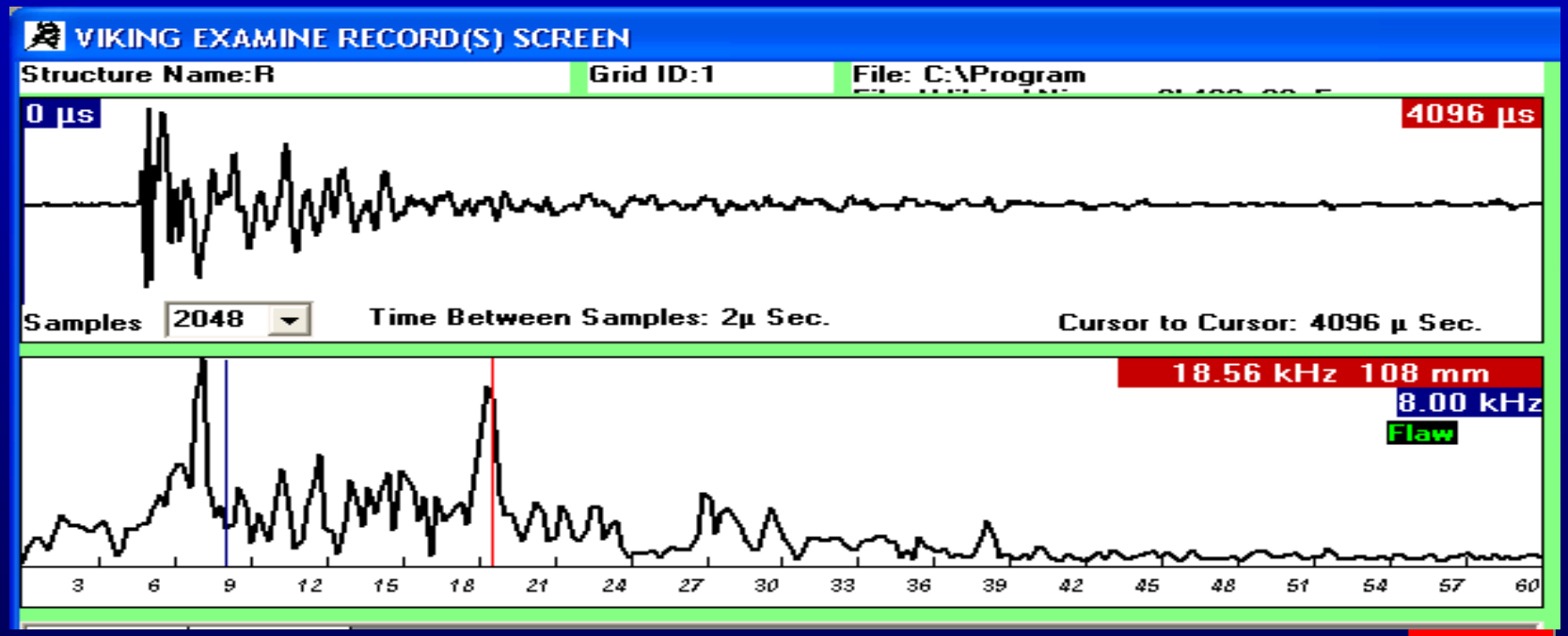

VIKING EXAMINE RECORD(S) SCREEN
Structure Name:408_J_6,fuger400
Grid ID:
File: C:\Program
0 µs
4096 µs
Samples
2048
Time Between Samples: 2µ Sec.
Cursor to Cursor: 4096 µ Sec.
8.05 kHz 248 mm
8.00 kHz
Solid
3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60


VIKING EXAMINE RECORD(S) SCREEN
Structure Name:R
Grid ID:1
File: C:\Program
0 µs
4096 µs
Samples
2048
Time Between Samples: 2µ Sec.
Cursor to Cursor: 4096 µ Sec.
18.56 kHz 108 mm
8.00 kHz
Flaw
3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60

DOCter Applications
Delaminations

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Impact-echo for voided ducts

Courtesy: Ramboll

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Confirmation of Voided Duct

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DOCter Application
Honeycombs

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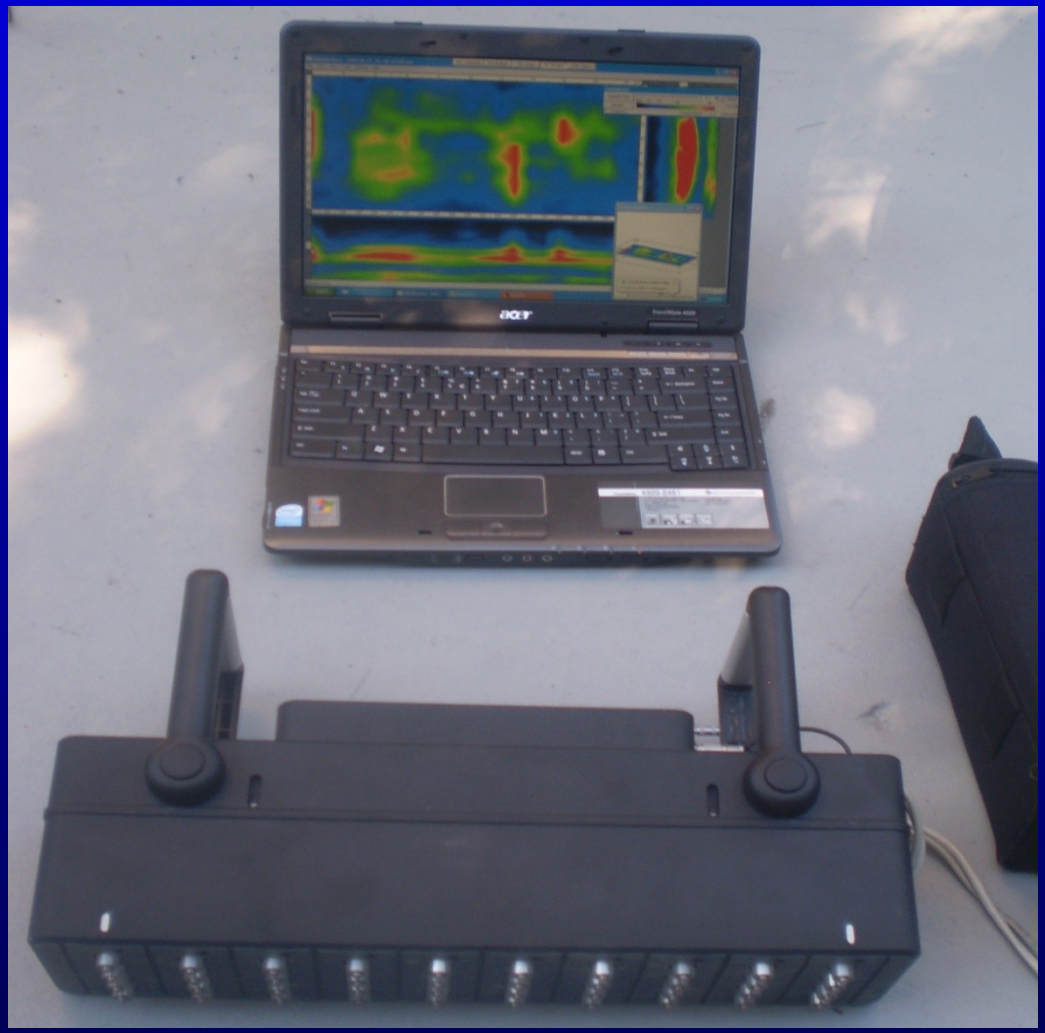
MIRA 3D Tomographer



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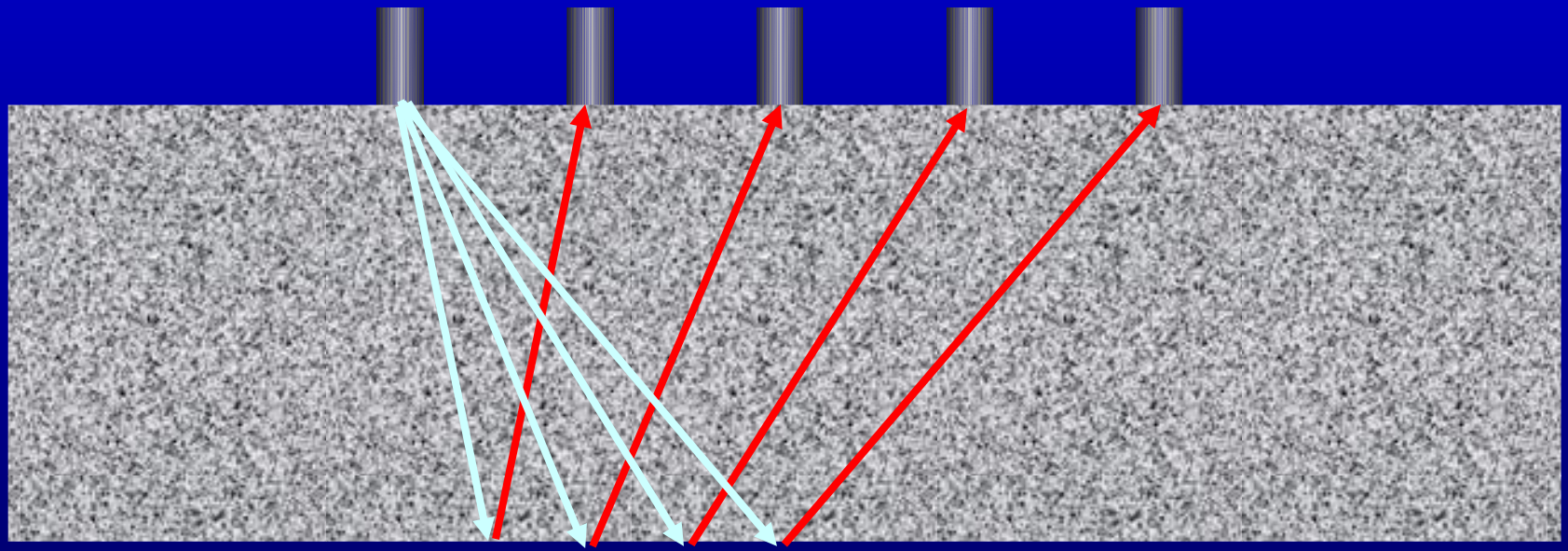
Transducer Array System

Multiple pitch-catch tests



Courtesy: N. Carino

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MIRA Antenna

- 4 x 10 shear wave transducer array
- 45 x 4 = 180 ray paths per scan
- Scan time = 0.35 s

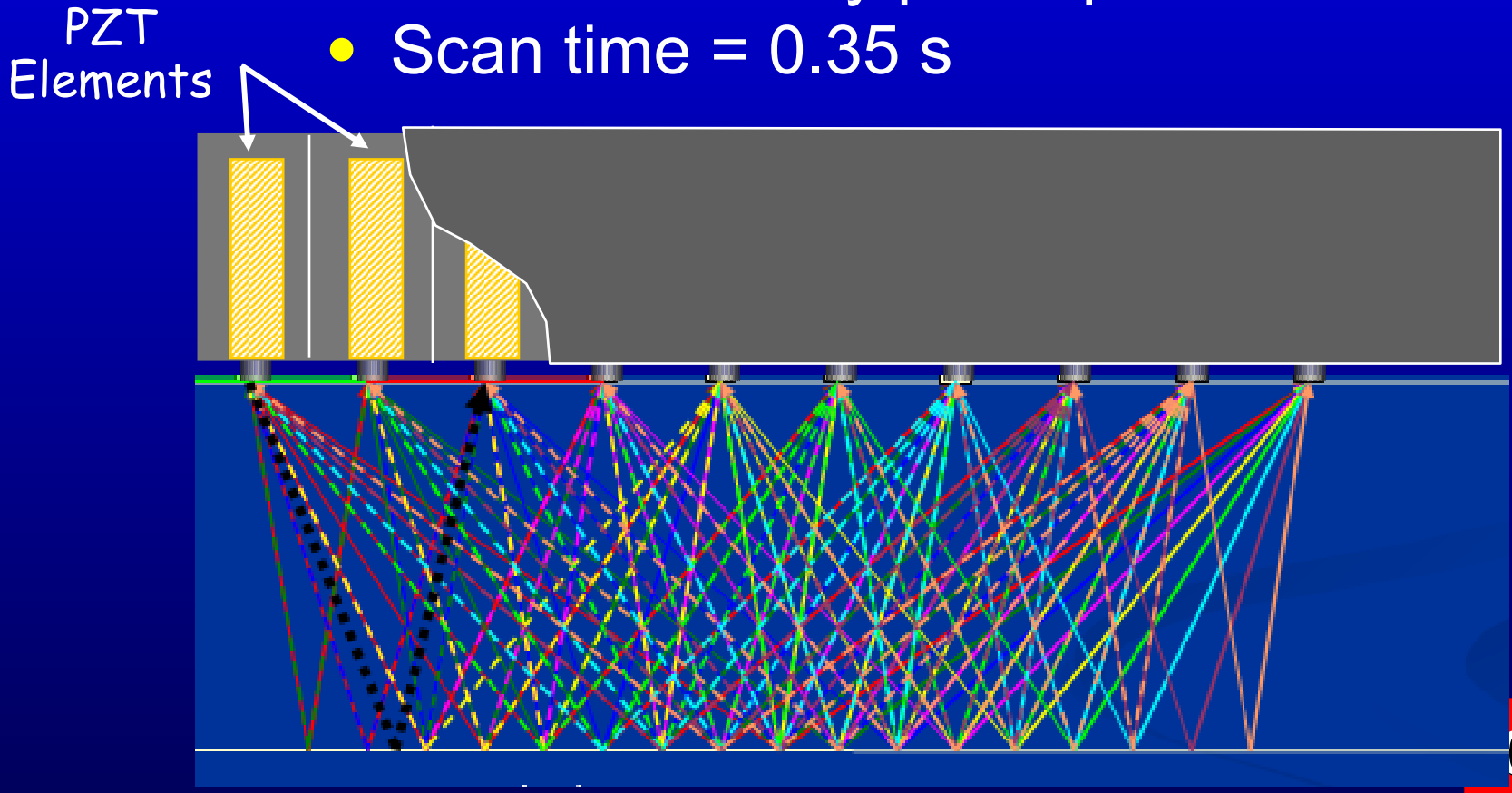
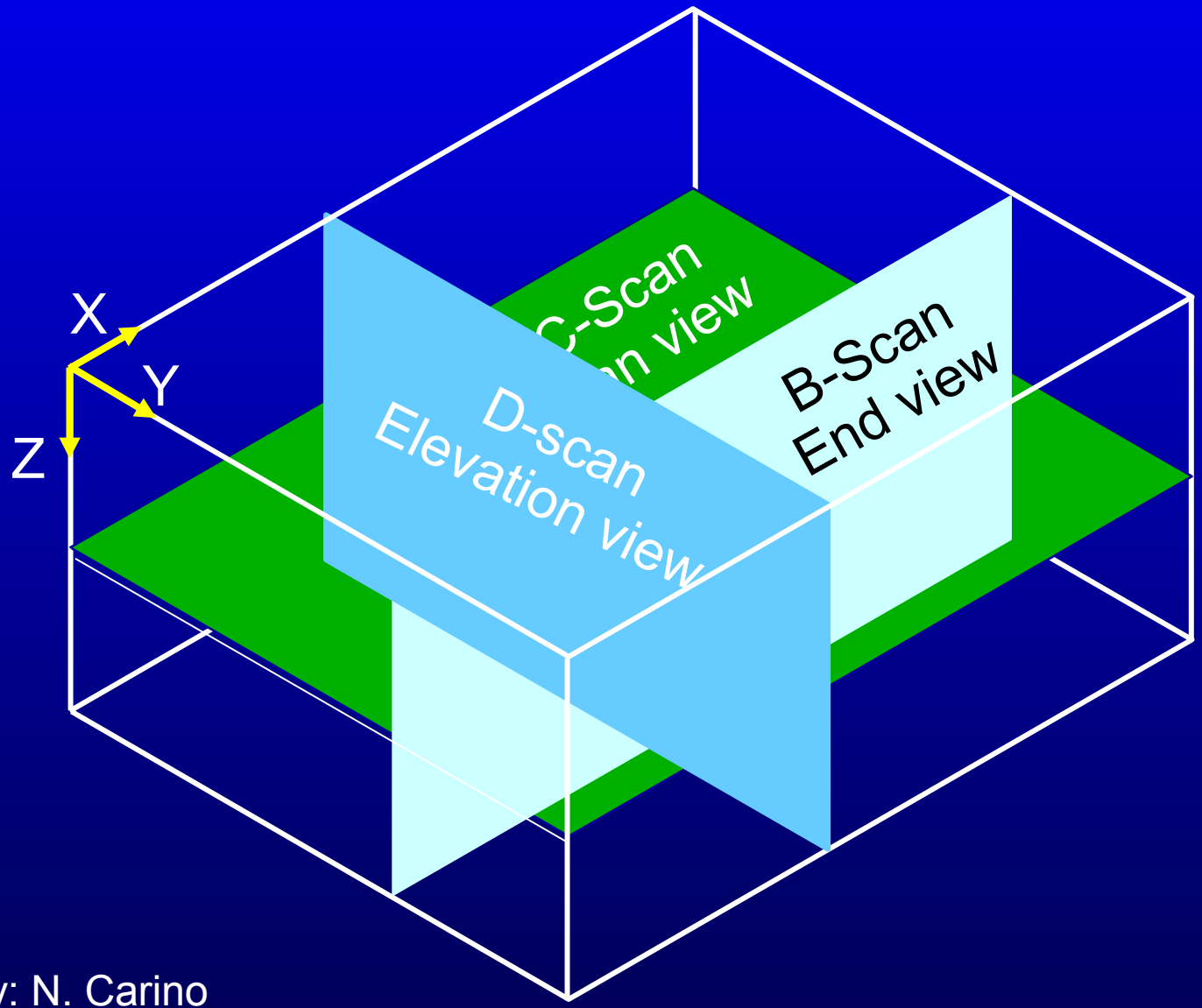


Image Planes



Courtesy: N. Carino

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Highway bridge BB70

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MIRA testing

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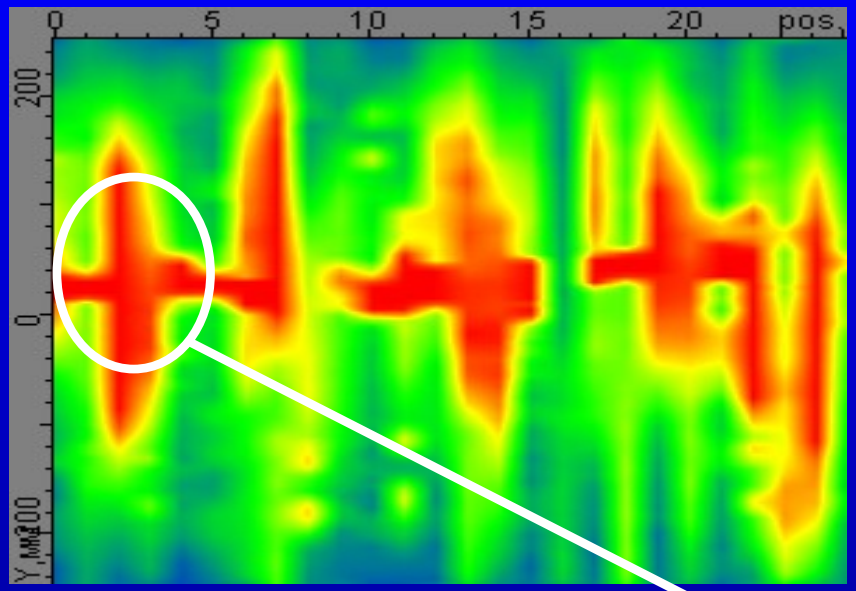

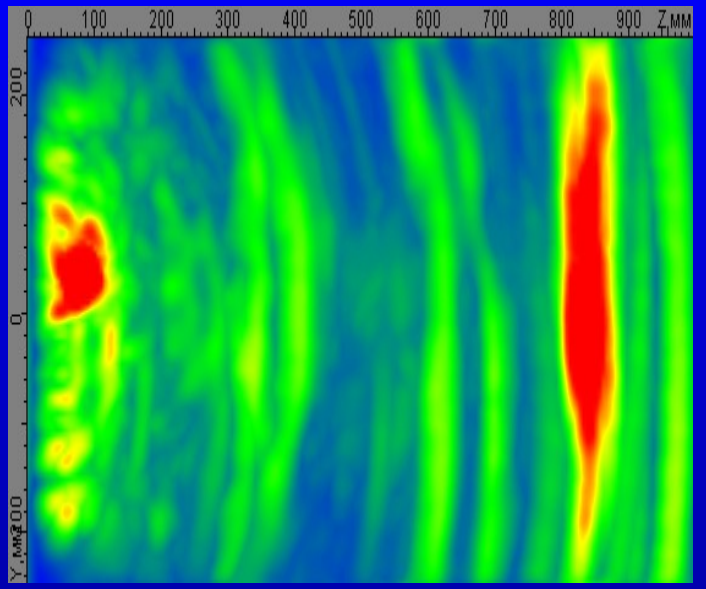

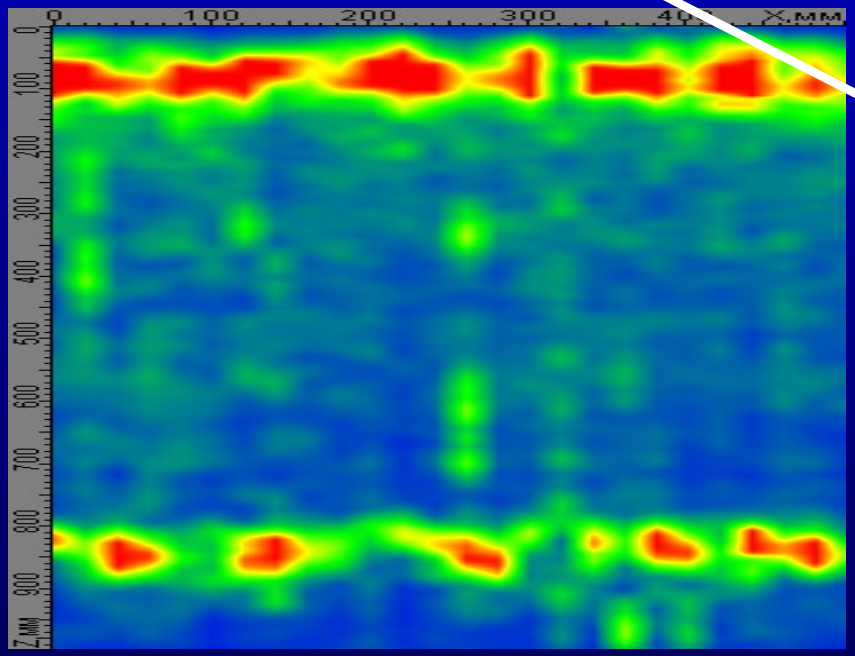

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MIRA, test example

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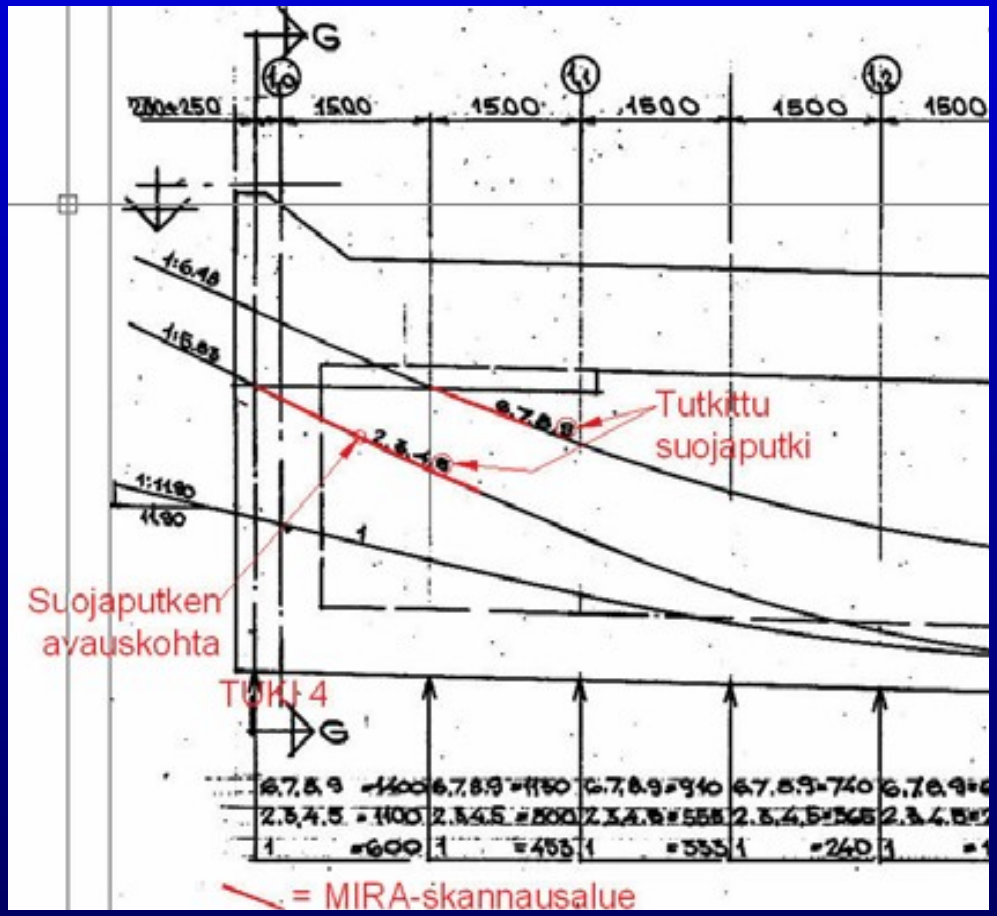
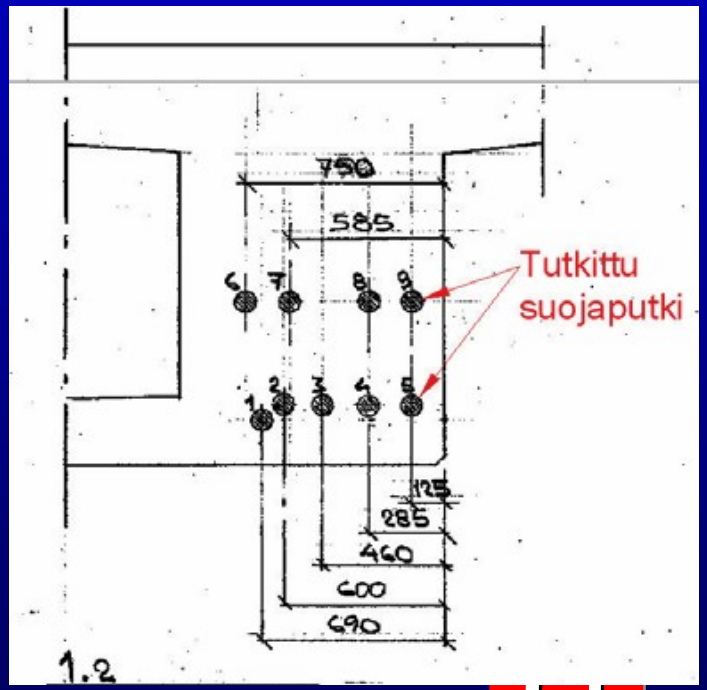
Cable ducts, injected





MIRA testing

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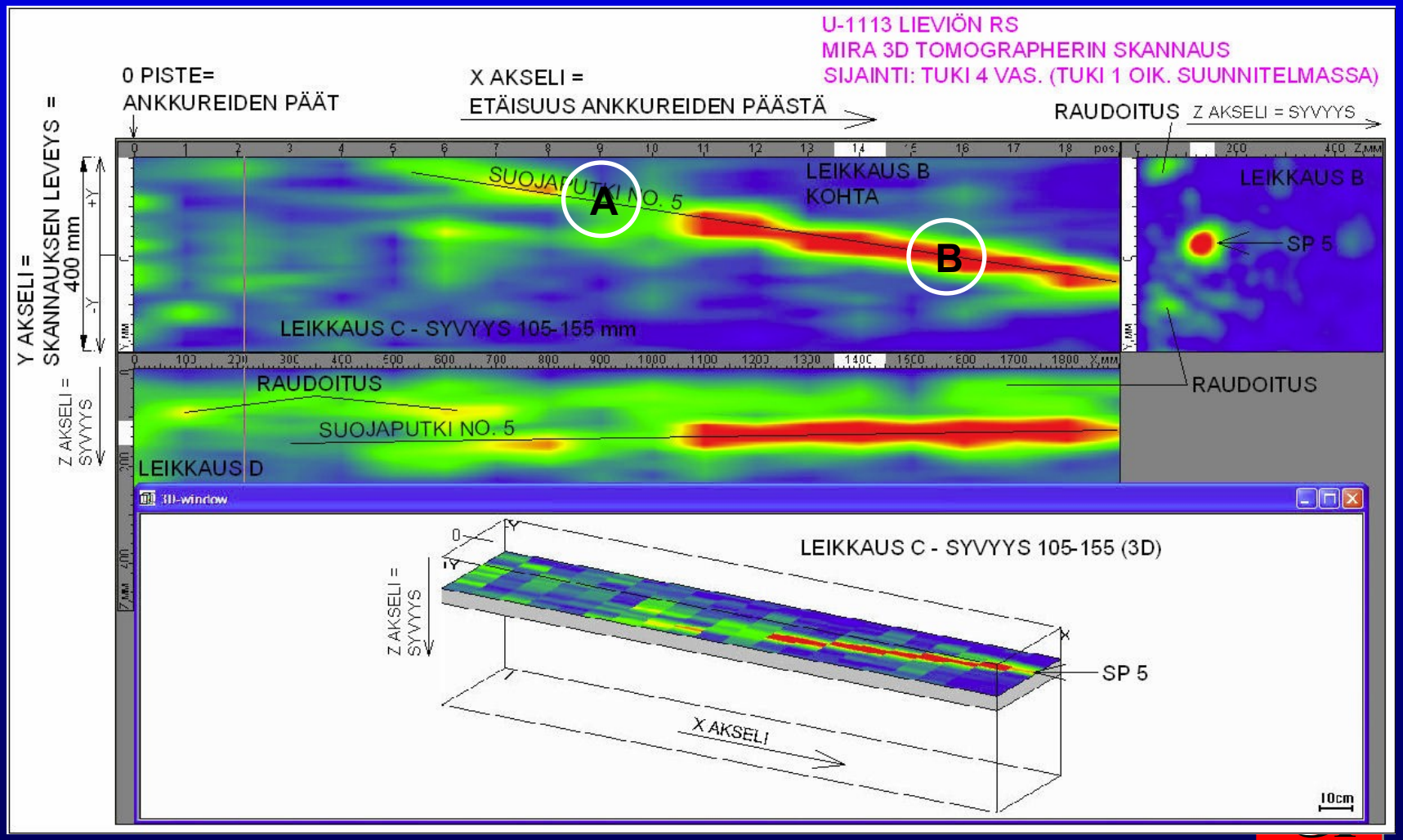
MIRA results



Fully grouted duct, ”A”

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Badly injected ducts, ”B”

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Thank you for your attention
www.germann.org

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