Testing for integrity

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www.germann.org
Integrity Testing

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

Computer

\[ v(t) \]
\[ f(t) \]

\[ M \ (\text{m/s)/N} \]

Mobility Plot

Frequency

Courtesy: N. Carino
s´MASH - Mobility Plot

Average Mobility

Dynamic stiffness

Site:
Test #: 3E-2  03/03/98
Type: SLAB  36 in
Operator: AGD

E´ = 6.31 MN/mm
s´MASH Flaw Signals compared to Solid Signals
IS-bridge slab

Core no 1, Delaminated

Average Mobility

5/10/2008

Testpoint/meter
IS-bridge slab

Average Mobility

5/10/2008

Core no 2, Delaminated
IS-bridge slab

Average Mobility

5/10/2008

Core no 3, Solid
Lindenburg Bridge

Courtesy: Ramboll
Location D, solid
Location D, delaminated
Brick Arch Bridge
s’MASH Impulse Response

Bro 20236

Murværk    Average Mobility     14/4/2009

0-10  10-20  20-30  30-40  40-50  50-60

Test Smart – Build Right
DOCter Impact-Echo

Bro 20236
Murværk Delamineringer 14/4/2009

Rød: 1. lag mursten er løs, Orange: 2. lag mursten er løs, Grøn: Solid

Afstand i m fra sydlige ende

Afstand i m rundt i buen fra vest mod øst

0.0 0.5 1.0 1.5 2.0

0.2 1.2 2.2 3.2 4.2 5.2 6.2 7.2 8.2 9.2 10.2
s´MASH
Application Examples

Courtesy: CTL
s´MASH
Application Examples

Courtesy: CTL
s´MASH
Application Examples
DOCter Impact-Echo
Impact-Echo Method

Contact time

Time

Force

Displacement transducer

Displacement

Time

Amplitude

Frequency

\[ d = \frac{C_p}{2f_T} \]

Displacement

Force

Flaw

Courtesy: N. Carino
Test record
DOCter Impact-Echo
Surface wave speed
Wave speed record
DOCter Application
Injection quality of cable ducts
DOCter Applications
Delaminations
Impact-echo for voided ducts

Courtesy: Ramboll
Confirmation of Voided Duct

16/04/2008
DOCter Application
Honeycombs
MIRA 3D Tomographer
Transducer Array System

Multiple pitch-catch tests

Courtesy: N. Carino
MIRA Antenna

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

C-Scan view

B-Scan End view

D-Scan Elevation view

Courtesy: N. Carino
MIRA testing
MIRA, test example
Cable ducts, injected
MIRA testing
MIRA results
Fully grouted duct, ”A”
Badly injected ducts, ”B”
Thank you for your attention
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