# Germann Instruments new DOCter Impact-Echo Test System for Non-Destructive Detection of, e.g.

- **Delaminations, voids and honeycombing in walls or slabs with or without asphalt overlays.**
- **Debonding between two layers**
- **Debonding of reinforcement by corrosion**
- **Air in cable ducts**
- **Integrity of protective membrane below an asphalt overlay**
- **ASR and freeze-thaw attack**
- **Depth of surface opening cracks**
- **Thickness**
- **Early age strength development**

Requiring access only from one side, the DOCter allows the wave speed to be measured for further evaluation of, e.g. thickness as outlined in ASTM C 1383-98 "Standard Test Method for Measuring the P-wave Speed and the Thickness of Concrete Plates Using the Impact-Echo Method", or for position of flaws.
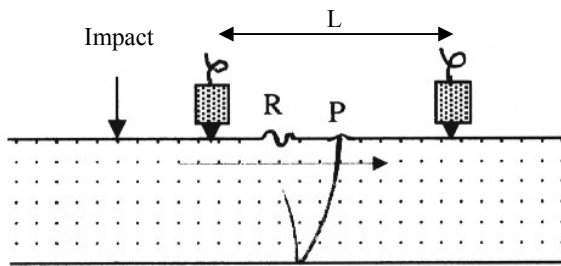
$$C_P = 0.96 \cdot \frac{L}{\Delta t}$$
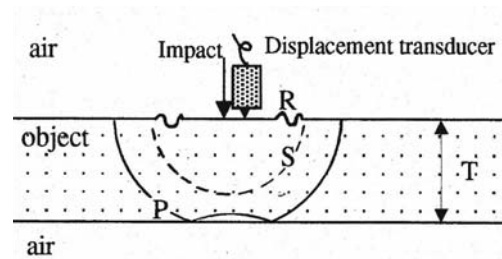
$$T = \frac{C_P}{2f}$$

For estimation of the wave speed C_p the time difference) t, between arrival of the P-wave to the two transducers, is recorded and divided into the distance L between the transducers..

Testing for thickness T or flaw depth is subsequently performed by means of the second equation, illustrated. The frequency "f" is obtained by Fast Fourier Transformation analysis of the transducer displacement signal in the time domain.

With the new Viking software, version 6.0, the time spent for analysis is minimized by introducing automated removal of the R-wave during testing or analysis of only a special portion of the transducer displacement signal in the time domain. A large number of tests can be made quickly in an organized manner by storing the test records in a 2D grid, and a report summary is available right after testing, minimizing the time spent at the office for reporting.

The new DOCter components used for upgrading an existing unit with one transducer consists of:

- **The Pentium field computer with one PCMCIA-cards and Viking software, version 6.0.**
- **Cable for connection of transducer to computer**
- **Operation and software manuals, Notes on impact-echo testing and Testing Cases**

The DOCter field computer with one PCMCIA-card, and Viking software shown together with an Mark IV transducer mounted a Star Support with 3 impactors.
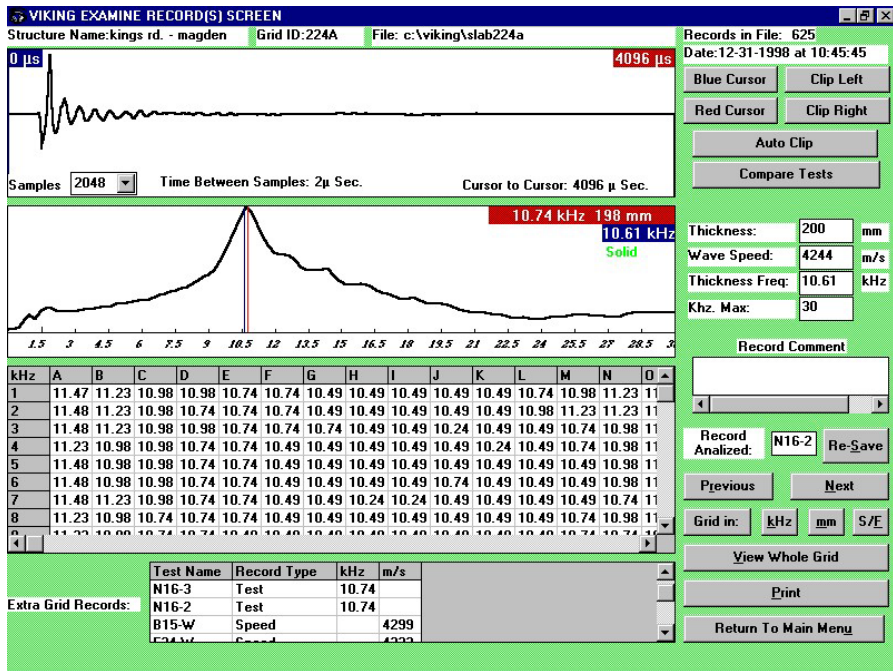

*The Mark IV mounted on the Star Support*

The Mark IV mounted with attached Spider

The VIKING software, version 6.0, is supplied as an integral part of the DOCter. The following figures illustrate examples of the Viking screen layout for testing for thickness or flaws, the 2D grid, and estimation of the depth of surface opening cracks.

A Viking Test Record. The example is from testing the thickness of a slab. For C_P = 4244 m/s and a measured frequency f = 10.74 kHz, the thickness is $T = C_P/2f = 4244m/s/(2·10.74kHz) = 198mm$.
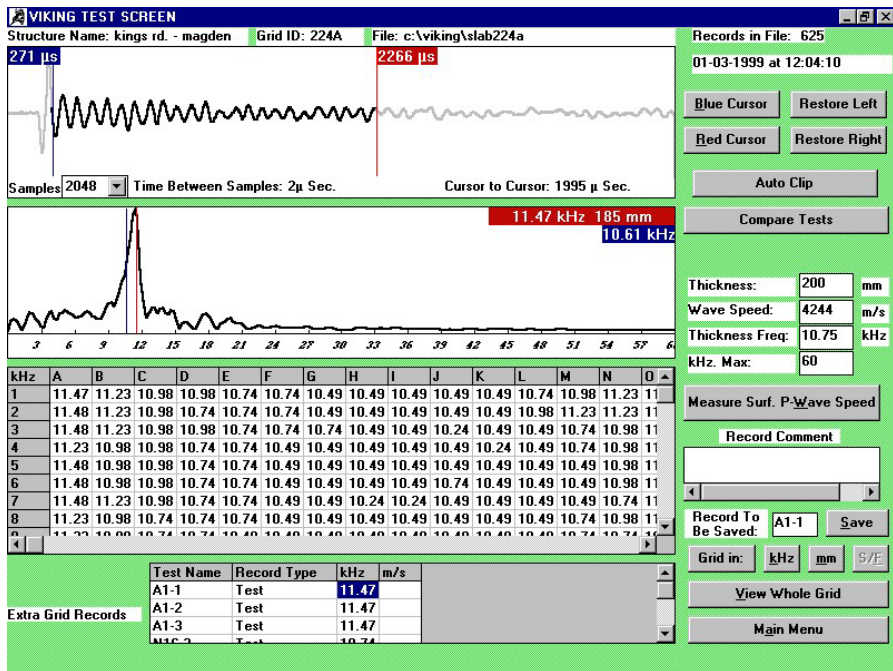
Viking Test screen illustrated after removal of the R-wave and reflections above 2266 : s in the transducer displacement signal. Automatic analysis can be made by clicking the "Auto Clip" button.

VIKING VIEW WHOLE GRID SCREEN

VIKING GRID VIEW, Measurements are given in mm.

Structure Name: kings rd. - magden	Thickness in mm: 200
Grid ID: 224A	Wave Speed in m/s: 4244
File: c:\viking\slab224a	Thickn. Freq: 10.61
Records in File: 603	Instrument. ID: 33545
Date: 12-30-1998	Tested By: PI-AH

| kHz | mm | Solid/Flaw | Return To Testing Screen |

mm	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	184	188	193	193	197	197	202	202	202	202	202	197	193	188	184
2	184	188	193	197	197	197	202	202	202	202	202	193	188	188	184
3	184	188	193	193	197	197	197	202	202	202	202	202	197	193	188
4	188	193	193	197	197	202	202	202	202	202	207	202	197	193	188
5	184	193	193	197	197	202	202	202	202	202	202	202	202	193	184
6	184	193	193	197	197	202	202	202	202	197	202	202	202	193	184
7	184	188	193	197	197	202	202	207	207	202	202	202	202	197	188
8	188	193	197	197	197	202	202	202	202	202	202	202	197	193	188
9	188	193	197	197	202	202	202	202	202	202	202	202	197	197	193
10	185	193	197	197	202	202	202	202	202	202	202	202	202	197	188
11	181	193	197	202	202	202	202	202	202	202	202	202	202	197	193
12	181	189	197	202	202	202	202	202	202	207	207	202	202	197	193
13	181	185	193	202	202	202	202	202	202	207	207	202	202	197	193
14	185	189	197	202	202	202	202	202	202	207	207	202	202	197	193
15	189	189	193	197	202	202	202	202	202	202	207	202	202	197	193
16	193	193	197	202	202	202	202	202	202	202	202	202	197	197	193
17	193	197	202	202	202	202	202	202	202	202	202	202	202	197	197
18	193	197	202	202	207	207	207	207	207	202	202	202	202	202	197
19	193	197	202	202	207	207	207	207	212	202	202	202	202	202	197
20	193	193	193	202	207	207	207	207	207	202	202	202	202	197	197
21	193	193	197	202	207	207	207	207	207	202	202	202	202	197	197
22	193	197	202	207	207	207	207	207	207	202	202	202	202	202	202
23	193	197	202	207	207	207	207	207	207	202	202	202	202	202	202
24	193	202	202	207	207	207	212	207	207	202	197	202	202	202	202

Viking View Whole Grid screen. The grid is given in "mm" thickness. Alternatively, the options are the measured "kHz" or "Solid/Flaw" indication. Max 600 test records can be contained in one 2D grid.

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