INVITATION

4th International Educational Workshop

Athens, Greece, May 7-10, 2024

Presenting

Concrete technology and advanced test systems for evaluation of concrete structures, their scientific background, demonstration of the operation of the test systems and opportunity for hands-on exercises, With emphasis on Deteriorating Bridges and Collapsed Structures

Professor Adam M. Neville, UK

"It could be postulated that there exist two excellent construction materials, concrete and steel. The combination of the two, one inside the other, may be catastrophic".

Strands/tendons in Cable Ducts

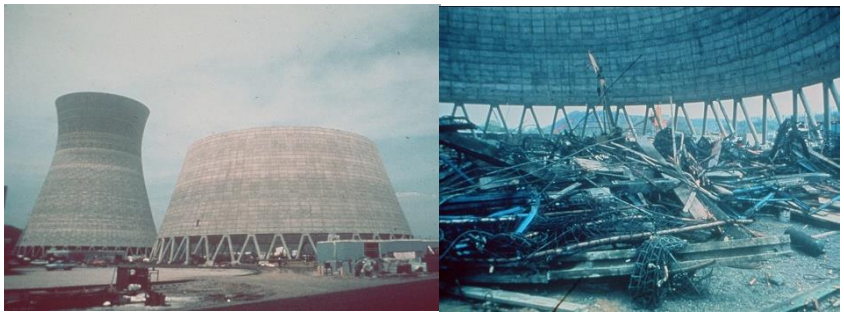
Italian, Czech and UK bridges collapsed due to corrosion of strands in cable ducts

More bridge collapses caused by corrosion of cable duct strands, Italy & Taiwan

CORROSION of Reinforcement

Reinforcement corrosion caused by chlorides/carbonation and bad cover layers, Middle East, Norway and USA

Collapses caused by erroneous in-situ testing



Cooling tower collapse, USA, and to the right collapse of beams, Russia
Below collapse of textile factory, Bangladesh, high-rise collapse in USA and collapse of beam during post-tensioning, Denmark.

4th International Educational Workshop

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Concrete technology and advanced test systems for evaluation of concrete structures, their scientific background, demonstration of the operation of the test systems and opportunity for hands-on exercises,
With emphasis on Deteriorating Bridges and Collapsed Structures

Featuring scientific lectures, case studies and on-site bridge testing by NDTitans, an international group of experienced specialist and consulting engineers with a life-long experience in testing of concrete structures

Highlighting

Durability (Design - Materials - Mixture Proportions - Construction Practice & Resistance to Penetration of Water and Harmful Ions)

Curing (evaluation by pullout and conductivity tests and implication on service life)

Service life (chlorides, diffusion of harmful ions, start of corrosion and remaining service life)

Grout injection (of post-tensioned cable ducts and structural joints by impact-echo and ultrasonic-echo) on a separate slab with fully injected and not-injected cable ducts

Corrosion (half-cell potentials, electrical resistance, and corrosion rate)

In-place concrete strength (cores, pullout, pull-off, rebound hammer, UPV and maturity)

Integrity of structures (impact-echo, ultrasonic-echo and impulse-response) for delaminations and honeycombs

Test of fresh concrete (air-voids, rheology, autogenous shrinkage, heat of hydration and simulations)

Subjects

1. **Bridges**
   - *1.1 Concrete Technology and Pathology*
   - *1.2 Evaluation of Post Tensioned Bridges Tendon Ducts by NDT*
   - *1.3 NDT of bridges, emphasizing bridge deck´s testing*
   - *1.4 Service life estimation*
   - *1.5 Cover layer quality*
   - *1.6 Rapid Chloride Permeability Test*
   - *1.7 Water penetration*
2. **Evaluation of in-place concrete strength**
   - *2.1 Cores*
   - *2.2 Pullout test*
   - *2.3 Pull-off*
   - *2.4 Maturity*
3. **Location of reinforcement**
   - *3.1 Covermeter*
   - *3.2 Ground Penetrating Radar*
4. **Evaluation of reinforcement corrosion**
   - *4.1 Chloride content and chloride profile*
   - *4.2 Carbonation*
   - *4.3 Potentials and Corrosion rate*
5. **Flaw detection based on stress waves**
   - *5.1 Ultrasonic pulse velocity*
   - *5.2 Impact-echo method*
   - *5.3 Impulse-response method*
   - *5.4 Ultrasonic-echo method*
6. **Tests of fresh and maturing concrete**
   - *6.1 Air-void structure*
   - *6.2 Rheology*
   - *6.3 Autogenous shrinkage*
   - *6.4 Heat of hydration*
   - *6.5 RAT (Rapid Alkali Test)*

On-Site Demonstrations, GEFYRA (https://www.gefyra.gr/) – RIO ANTIRIO BRIDGE.

Attendees of the 3rd NDT workshop on the 10 m x 15 m, 30 cm thick slab for demonstrations, below the Rio Antrion Bridge, Greece, 2023

Demonstrations covering Coring, Bond-Test, CAPO-TEST, LOK-TEST, GWT, Profile Grinder and RCT, GalvaPulse, Rainbow Indicator, Surfer, Pulsar, DOCter Impact-Echo, s´MASH Impulse Response and MIRA 3D-Tomographer.

And, testing of cable ducts on the slab with cable ducts. The slab is also used for detection of delaminations and voids using different NDT systems.

The Lecturers

Dr. Nicholas J. Carino

Concrete Technology Consultant - USA.
ncarino@roadrunner.com

The major part of the theoretical basis of concrete and the test systems were lectured by **Dr. Nicholas J. Carino**, independent consultant, internationally recognized, expert and teacher on NDT and standard test methods, multiple times awarded from ACI and ASTM during his work in research and standards development. He has served in several leadership positions at ACI and ASTM Committees. Todays he is an honorary Member of ACI and a Fellow of ASTM.

Dr. Andrzej Moczko

Professor at Faculty of Civil Engineering
University of Science and Technology Poland
andrzej.moczko@pwr.wroc.pl

Specialist in Non-Destructive Testing and evaluation of building structures. He has more than 25 years of experience in the practical application of DOCter Impact-Echo system for flaws and thickness, and the s'MASH Impulse Response system for rapid screening of flaws, Lok-Test and CAPO-Test for in-place compressive strength assessment; the Bond-Test for bond strength evaluation. maturity method for estimation of strength development; GWT water permeability testing, Rapid Chloride Test and corrosion.

Mr. Guy Rapaport

Ramboll Finland OY – Finland
guy.rapaport@ramboll.fi

Mr. Rapaport covering the topics related to practical experience in bridge testing, specialized in detection of voids in cable ducts with MIRA ultrasound and DOCter Impact-Echo. He has 25 years of professional experience in the field of bridge engineering. He is acting at present as a Leading Consultant, NDT Business Manager and Project Manager in Ramboll Finland Oy. He is specialized in bridge repair planning, bridge- and concrete structures inspections and in state- of-the-art Nondestructive Testing (NDT) of concrete structures / bridges, including validation of NDT

Mr. Nichos Zoides

GEOTEST SA – Greece
nzoidis@geotest.gr

After finishing his M.Sc. from the Technical University of Crete, he started his professional career in the Construction Industry as QA/QC quality control engineer on large infrastructure projects in Greece. In 2003 he co-founded Geotest SA with main activities in the quality control of construction materials, non- destructive test and inspections of concrete structures, not at least especially industrial floors with s´MASH Impulse Response and DOCter Impact-Echo, and has been the company CEO´s ever since. Specialist in drones

Mr. Hugo Orozco

Germann Instruments A/S, Denmark
hugo@germann.org

Civil Engineer and MBA with 16 years of experience in the assessment of reinforced concrete structures. He is specialized in various NDT techniques, the science of concrete deterioration, and the implementation of strategies for damage prevention, protection, repair and structural strengthening, especially with fiber reinforced polymers (FRP composites). He worked for Sika Mexico as a Product and Market Manager in charge of the marketing, development and technical support for the portfolio of solutions for concrete repair and protection, grouting, structural bonding, chemical anchoring and structural strengthening with FRP.

Mr. Claus Germann Petersen

Germann Instruments A/S,

Claus Germann Petersen founded Germann Instruments in 1974, operating out of Copenhagen and Chicago, and In-Situ Test of Copenhagen in 1980. Mr. Petersen holds a B.Sc. diploma from the Danish Engineering Academy and is M.Sc. in economics from the Copenhagen Business School (CBS).

Mr. Petersen designed the LOK-TEST pullout instrument and invented the CAPO-TEST pullout system. He has been the central person in development and marketing of Germann Instruments test systems, including RCT (Rapid Chloride Testing), RCPT, RAT (Rapid Alkali Test), GalvaPulse for corrosion rate, DOCter Impact-Echo, s´MASH Impulse-Response, MIRA tomography, GWT Water Permeability, AVA Air Void Analyzer and ICAR Rheometer.

He has 25 years of practical testing experience on-site. He is a member of ACI committee 228 on Nondestructive Testing of Concrete and has received a number of awards for his work in the NDT field, e.g., the Professor Ostenfeld Gold Medal from the Danish Society for Structural Science and Engineering. Mr. Petersen has lectured and conducted workshops on NDT methods worldwide.

PROGRAM

May 7-10, 2024

Stavros Niarchos Foundation Cultural Center, Athens, Greece

	Topic	Start	End	Speaker
	May 7 - 1st day			
	Registration	08.30	09.00	
	Welcome and Introductions	09.00	09.20	Carino
	Theme 1—In-place strength			
1	Overview	09.20	09.30	Carino
2	EN Standards on In-place Strength	09.30	09.50	Moczko
3	Obtaining and Testing Cores	09.50	10.10	Moczko
4	Introduction to stress waves	10.10	10.30	Carino
5	Uniformity (rebound hammer and UPV)	10.30	11.00	Carino
	Coffe Break	11.00	11.15	
6	The true story about Schmidt Hammer, the old and the new one	11.15	11.30	Moczko
7	Pullout Test (LOK-Test, CAPO-Test) with cases Canadiían high rises (LOK-TEST) Great Belt Link (LOK-TEST & CAPO-TEST)	11.30	12.20	Petersen
8	Polish Bridges case (CAPO-TEST & Cores)	12.20	12.40	Moczko
9	Pull-off Test (BOND-TEST) Anchorage Airport, Akaska (BOND-TEST)	12.40	13.10	Petersen
	Lunch	13.10	14.10	
	Theme 2—Durability			
10	Durability	14.10	14.40	Carino
11	Water Permeabilty	14.40	15.00	Carino
12	AVA air void structure of fresh concrete	15.00	15.20	Carino
13	ICAR Rheology Case Burj Khalifa, Dubai	15.20	15.40	Carino
	Coffe Break	15.40	15.55	
14	Thermal Control	15.55	16.15	Carino
	Theme 3—Corrosion and service life			
15	Corrosion evaluation	16.15	17.00	Carino
	May 8 - 2nd day			
16	Profile of chlorides and service life estimation Cover layer quality control (LOK-TEST & Merlin)	09.00	09.50	Orozco
17	Electrical methods for evaluation of concrete mixes	09.50	10.40	Orozco
	Coffe Break	10.40	10.55	
	Theme 4—Internal defects			
18	Cover meter and GPR	10.55	11.20	Carino
19	Impulse-Response Method (sMASH)	11.20	11.45	Carino
20	Impact-Echo Method (DOCter)	11.45	12.10	Carino
21	Ultrasonic-Echo Method (MIRA)	12.10	12.35	Carino
22	Case: Evaluation of Joints (DOCter & MIRA)	12.35	12.50	Petersen
23	Case: Evaluation of Warehouse Floor (s´MASH & DOCter)	12.50	13.10	Zoides
	Lunch	13.10	14.10	

	Theme 5—Evaluation of Post-Tensioned Bridges			
24	Use of drones and AI software for visual inspection	14.10	14.40	Tasos
25	Petrography, background and test examples	14.40	15.20	Eriksen
	Coffe Break	16.25	15.35	
26	Evaluation of Post-Tensioned Bridges, injection of cable ducts, (DOCter & MIRA)	15.35	16.25	Rapaport
27	Evaluation of Bridge Decks (s´MASH)	16.25	16.55	Rapaport
28	Description of the mock-up at the RION-ANTRION Bridge	16.55	17.10	Tasos
	May 9 - 3rd day			
	Theme 6—Bridge visit and mock-up for testing			
	RIO -ANTRION BRIDGE www.gefyra.gr			
	Departure from Athens at 7:30 or 8:00	07.30	08.00	All
	Arrival at the bridge		11.00	All
	Presentation of the bridge by Vinci 11:00 to 11:40	11.00	11.40	All
	Lunch	11.40	12.00	
	Demonstration of instruments at mock- up slab: Cable ducts tested by DOCter and MIRA LOK-TEST and CAPO-TEST, BOND-TEST, RCT / Profile Grinder s'MASH, Surfer, Pulsar, etc.	12.00	17.30	All
	Fish Tavern, Retsina and Zorba	17.30	19.30	All
	Arrival in ATHENS		21.00	All
	May 10 - 4th day			
	Review of testing performed on the bridge	09.30	10.00	Carino
29	Bridge inspections in Finland & interaction with NDT	10.00	10.45	Rapaport
	Further demonstrations GalvaPulse, RCT, GWT, etc.	10.45	12.00	All
	Coffe Break	12.00	12.20	
	Participants' projects, discussion	12.20	13.20	All
	Summary	13.20	14.00	All
	Workshop evaluations	14.00	14.30	Participants
	Diplomas hands-out	14.30	15.00	Ms. Lara
	Food and Social Time	15.00	17.00	All

Registration latest March 1st, 2024

Price: 1,500.00 Euro per person

Mail to germann-eu@germann.org with your name, contact details, affiliation, and reference.

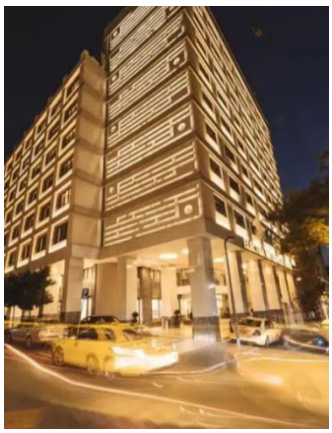
Payment with registration to:

Germann Instruments A/S
NORDEA BANK DANMARK
Account no.: 2191 5036493897
IBAN: DK4620005036493897
BIC: NDEADKKK
Swift Code: NDEADKKKXXX

Invitation letters for people requiring VISA are available upon request. Please consider that processing a short-stay VISA to enter Greece may take between 15 to 60 days depending on the country and specific situation. Carry out the procedures well in advance.

Hotel suggestions:

https://www.cocomatathens.com/



https://www.electrahotels.gr/destinations/athens/

https://house.ergonfoods.com/

Dr. Nicholas Carino, USA

Dr. Andrzej Moczko, Poland

Mr. Claus G. Petersen, Denmark

Mr. Parampreet Singh, India

Dr Alejandro DURÁN, Mexico

Mr. Malcom K. Lim, USA

Mr. Guy Rapaport, Finland

Mr. Nikolaos Zoides, Greece

Dr. Thomas Callanan, Ireland

Mr. Sal Fasullo, Canada

Mr. Oliver Aguirre, Mexico

Mr. Hugo D. Orozco, Denmark

Mr. Todd Allen, USA

Mrs. Kirsten Eriksen, Denmark

Mr. Jesper Clausen, Denmark

NDTitans

MMXX

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Test Right –Sleep Tight

Educational workshops
Training on-site
Implementation support
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Covering the most advanced test systems for concrete and concrete structures

www.NDTitans.com

www.germanninstruments.com

Diploma for the participants

Diploma

Germann Instruments and NDTitans

Certify that

has attended the 2nd International Educational Workshop
"Concrete Science & Advanced Methods for Evaluation of Concrete"
Athens, Greece, May 3rd-6th, 2022

and is hereby presented this Certificate of Completion
awarded this Friday of May 6th, 2022

Dr. Nicholas J. Carino, Ph.D.
Concrete Technology Consultant

Mr. Claus Germann Petersen, M.Sc.
President, Germann Instruments

GOLD MEDALS will be awarded at the 4th International Educational Workshop to selected recipients for long-time Excellence in NDT

Info: www.germanninstruments.com
www.NDTitans.com

1st International Educational Workshop, Athens, Greece, November 2021, Participants

Testimonials and diplomas

"Excellent presentations and very useful demonstrations"

"Best workshop I have participated until now"

"Great job! Congratulations!"

"Excellent! I learned a lot, and would like to come back for the next workshop"

"Very good workshop! The bridge inspection topic was very interesting. This is a large worldwide problem and a very important issue"

"Excellent! However, the length of this workshop was short for the topics we discussed. Maybe is possible to extend it a couple of days more"

2nd International Educational Workshop, Athens, Greece, May 3-6, 2022, Participants

Testimonials and diplomas

Excellent workshop, in general I found all the material to be understandable and comprehensive.

I got a good general understanding, it was very interesting with the theory and the site demonstrations at the bridge.

Thank you, it was an excellent workshop, great presentations, and demo of the NDT methods at a real bridge.

Thank you for your efforts, the site demos were the most important at this workshop, excellent. I enjoyed it.

Would prefer as many case studies as possible following the theory, the site demos were excellent and most important.

Well executed, excellent workshop. However, I would recommend more time for discussions.

Well done, excellent workshop

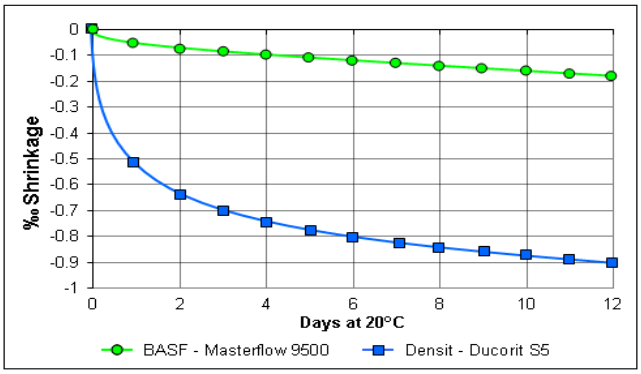
GI Test Systems

www.germanninstruments.com

AUTO-SHRINK

ASTM C1698

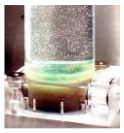
Un-restrained autogenous shrinkage of cement paste or mortar cured under sealed conditions

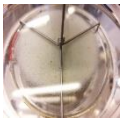


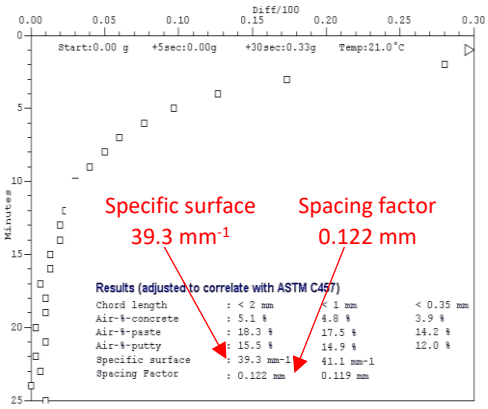
AVA-3000

eqv. to ASTM C 457

Spacing factor and specific surface of fresh concrete´s air entrained bubbles, within 25 minutes



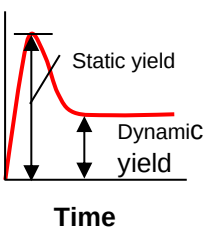


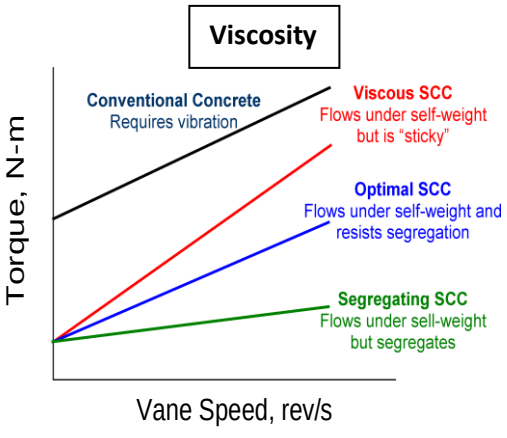


ICAR PLUS

ASTM C1749

Scientific rheological flow properties of fresh concrete, for optimizing the yield and the viscosity properties





PROOVE´it

ASTM C1202 RCPT

ASTM C1760 Bulk Conductivity

NT BUILD 492 Chloride Migration Coefficient

MERLIN

ASTM C1876

Bulk electrical conductivity or resistivity of saturated specimens giving information of the resistance to pentration of ions by diffusion

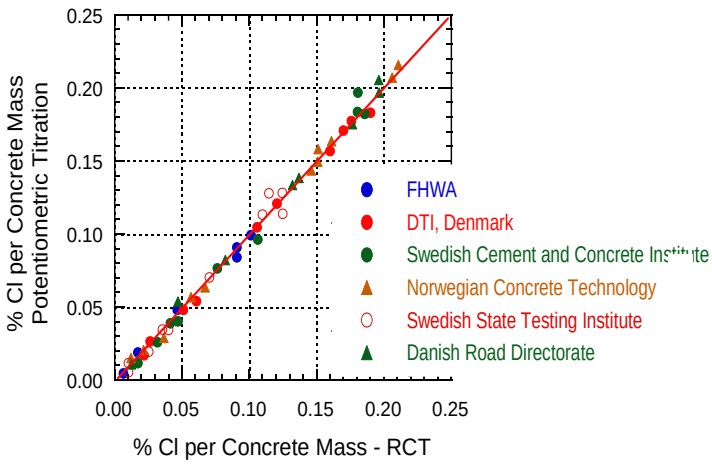
Verification cylinder

RCT

Rapid Chloride Test

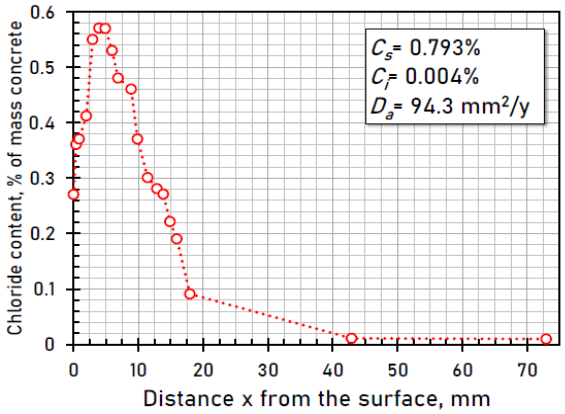
ASTM C1218

Testing of chloride ions reliably on-site or in the lab within 5 minutes



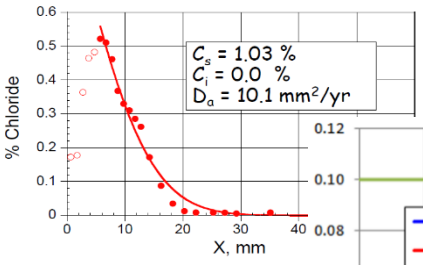
Profile Grinder

Precision grinding at small depth increments for accurate determination of the chloride ion profile with RCT, for service life estimation.

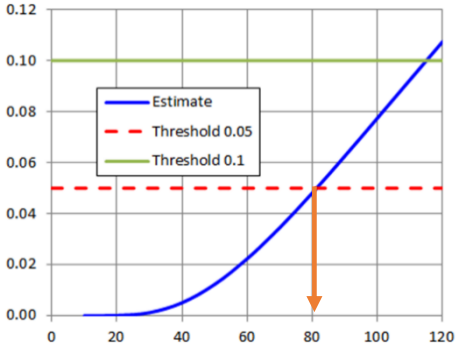


Profile Grinder & RCT

Profiling and testing for chlorides in parallel, for calculation of service life based on diffusion theory, in the lab or on-site

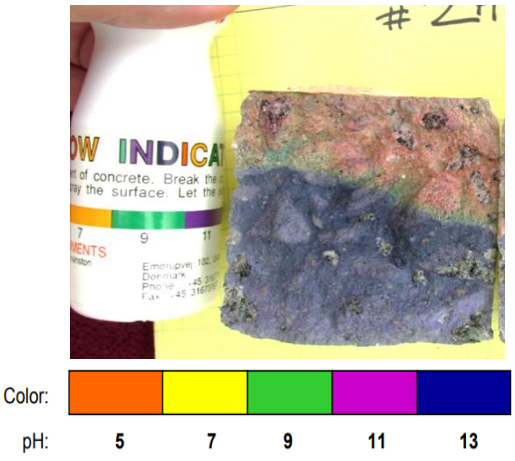


Immediate results without coring, slicing, and pulverizing



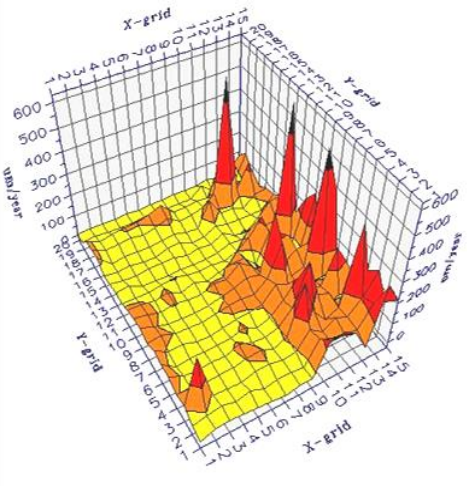
Rainbow Indicator

Depth of carbonation detected by spraying indicator on e.g. a core



GalvaPulse

Corrosion rate
Potentials
Electrical resistance



Corrosion rate example

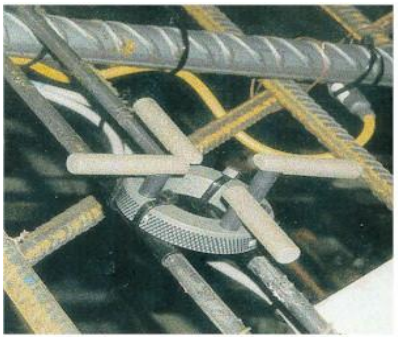
ERE Probe

for long-term monitoring
of half-cell potentials

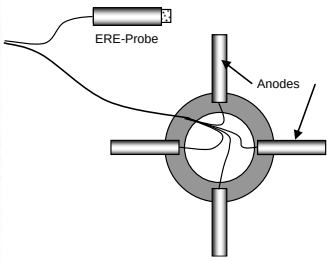
CorroWatch

for long-term monitoring
of onset of corrosion
(service life)

ERE Probe

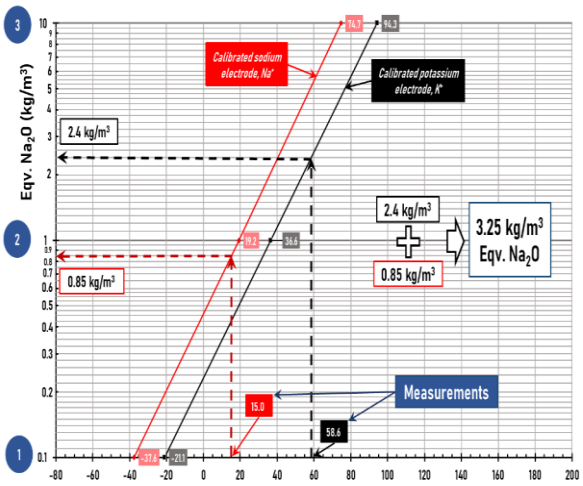


CorroWatch



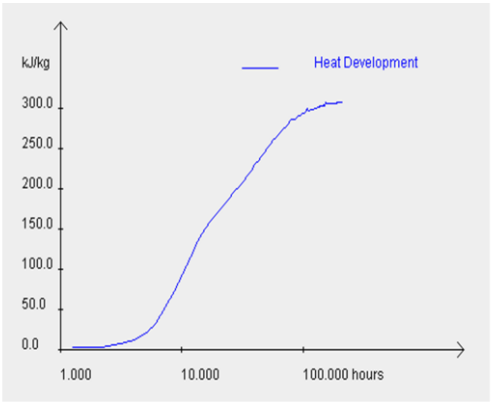
RAT

Rapid Alkali Test measures the amounts of sodium and potassium ions that contribute to alkali-silica reaction (ASR) if reactive aggregates are present.



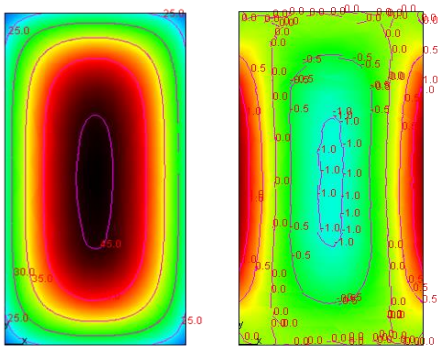
Heat-Box

Adiabatic Heat Development of a concrete mix, input for maturity calculations and B4Cast simulation

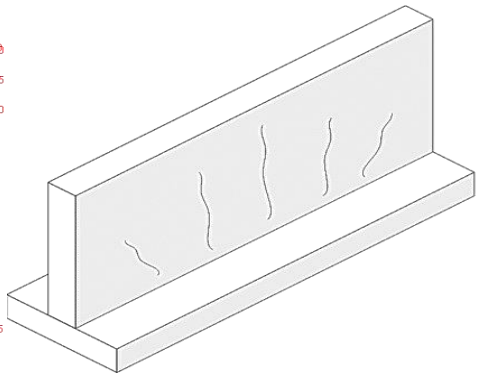


b4cast software

3D simulation of temperatures, stresses, and cracking in hardening structures



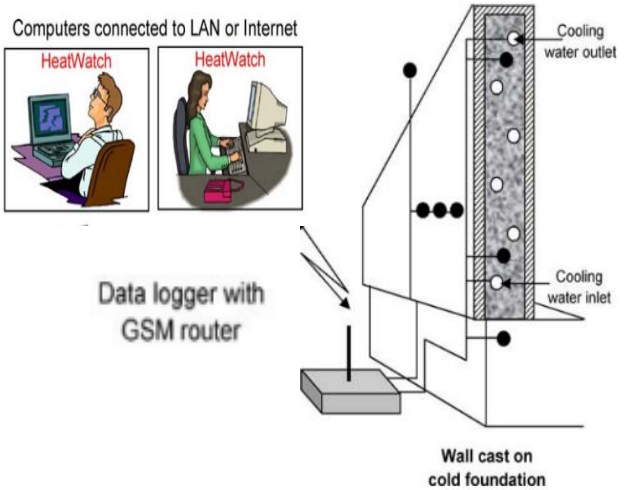
Simulated Max temp and internal restraining of a beam, T=24 hours

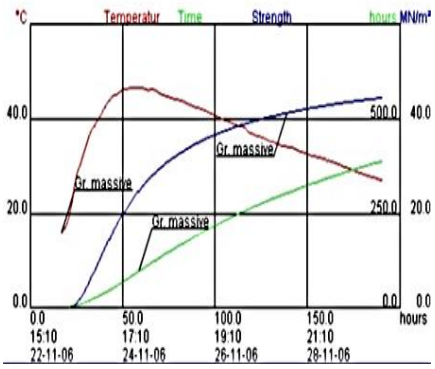


Predicted cracking, wall cast on cold foundation

HeatWatch

Actual temperatures & maturity & estimated strength



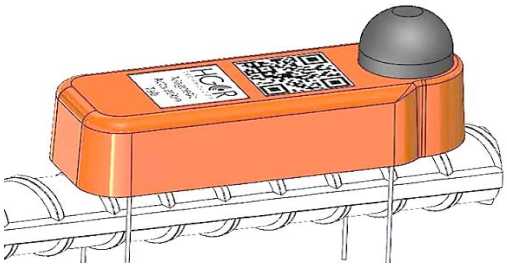


Temperatures and estimated strgnth development (blue curve)

MATURITY

ASTM C1074

Estimation of strength of maturing concrete based on pre-established strength-maturity relationship in the laboratory and the temperature history



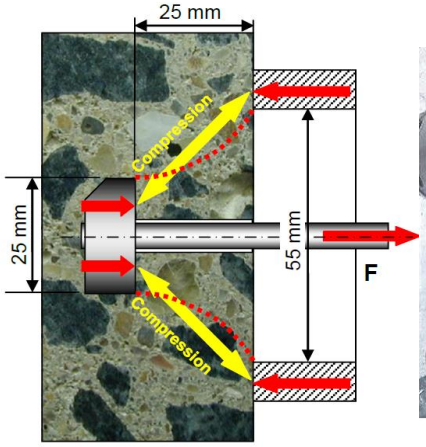
VAKKA sensor for casting-in and transmitting wireless the temperature (and long-term **HUMIDITY)**

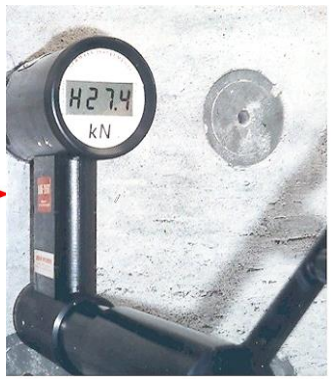
COMA-Meter integrating temperature and time, here showing 1.2 M_{20} days (days at 20°C)

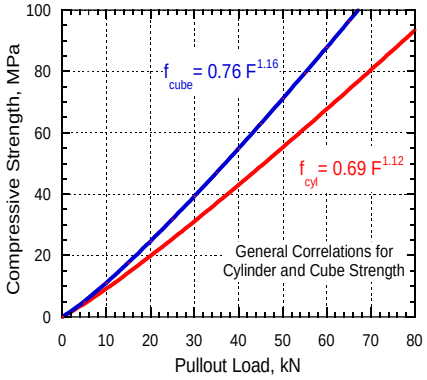
LOK-TEST

ASTM C900
Compressive strength

Cast-in disc loaded against a counter pressure, crushing the concrete in between







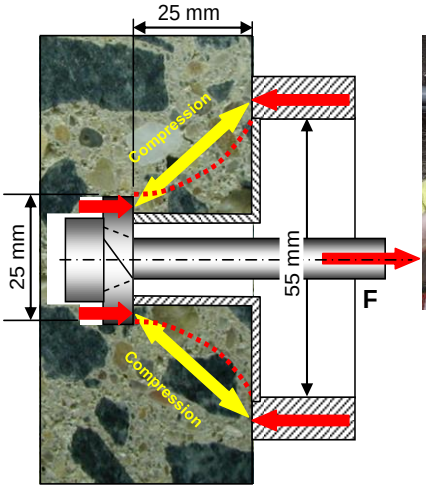
General correlation to standard cube or standard cylinder strength

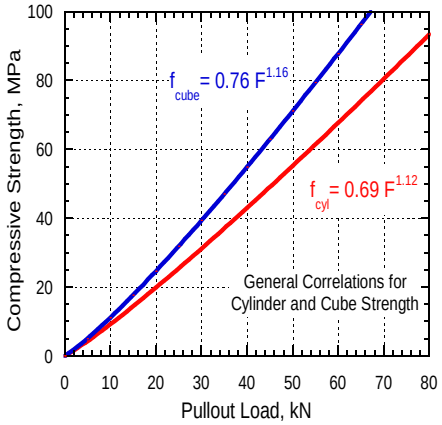
Documentation available showing the advantage of substitution of cores with the more economic pullout, being simpler, producing less damage and providing accurate, immediate strength results, in-situ.

CAPO-TEST

ASTM C900
Compressive strength

Expanded insert in undercut groove pulled out through a counter pressure, crushing the concrete in beween



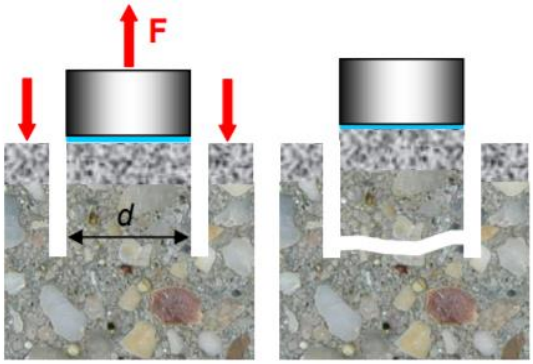


General correlation to standard cube or standard cylinder strength

BOND-TEST

ASTM C1583

Tensile / Adhesion strength
Glued-on disc loaded in tension



$$f_p = \frac{4F}{\pi d^2}$$

CORECASE

ASTM C42
ACI 214.4R

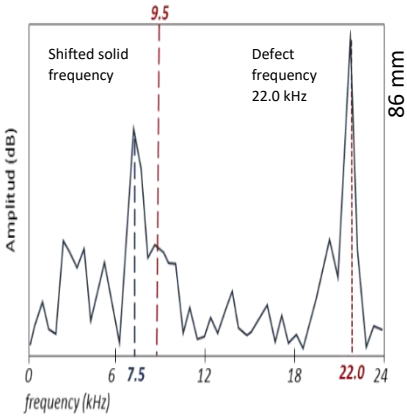
Precision coring using thin section diamond bits. Dia. from 25 mm to 100 mm, max depth 200 mm

DOCter Impact-Echo Viking

ASTM C1383
Voids in grout injection of cable ducts and joints, thickness, honeycombs, cracks and depth of surface opening cracks, ASR

NEW SOFTWARE, THE DOCter VIKING FREYA

Joint tested for voids



Depth to void D = Cp/2f =
(3800 m/s)/(2 x 22.0 kHz)= 86 mm

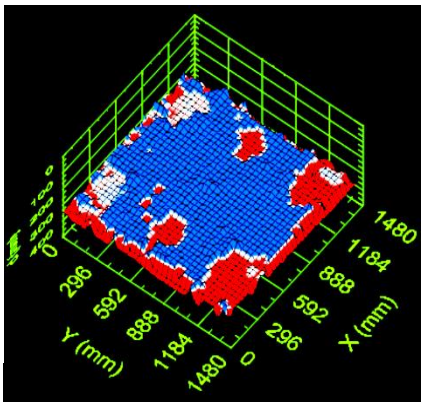
Sound strands in well injected duct

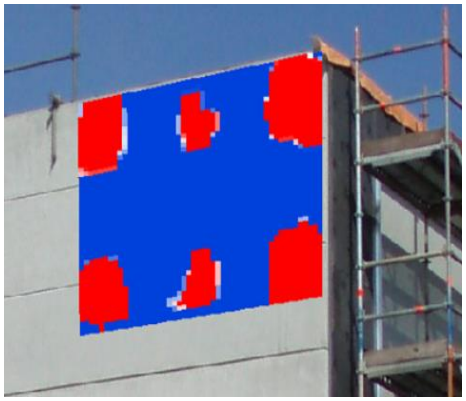
Corroded strands in an empty steel duct

MIRADOR
Impact-Echo

ASTM C1383

3D mapping of defects tested with impact-echo and ECHOLYST software

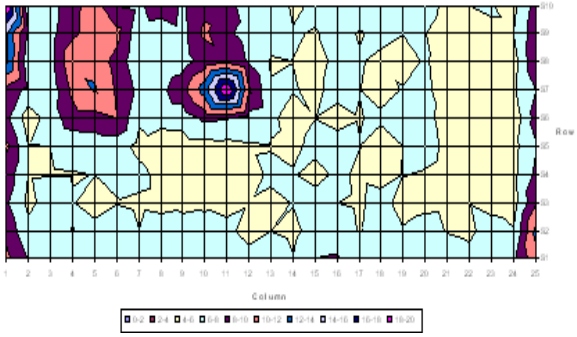




s´MASH
Impulse Response

ASTM C1760
Detecting anomalies in elements found by differenecs in dynamic mobility, stifness and voids index

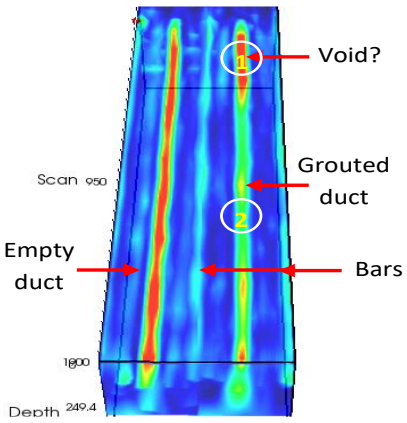
NEW SOFTWARE, THE THOR s'MASH



Example: Dynamic mobility of 300 mm highway slab showing curling at the ends, reduced thickness and a honeycomb

MIRA
Ultrasound Tomographer

Voids in grout injection of cable ducts, thickness, cracks and
honeycombs



SURFER

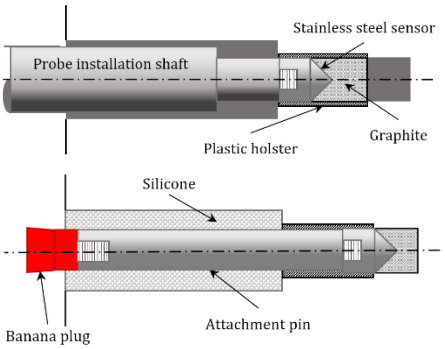
Surface P-wave velocity for uniformity, depth of surface opening cracks and strength estimate based on pre-established individual relationships, e.g to bending flexural strength of marbel or granite panels

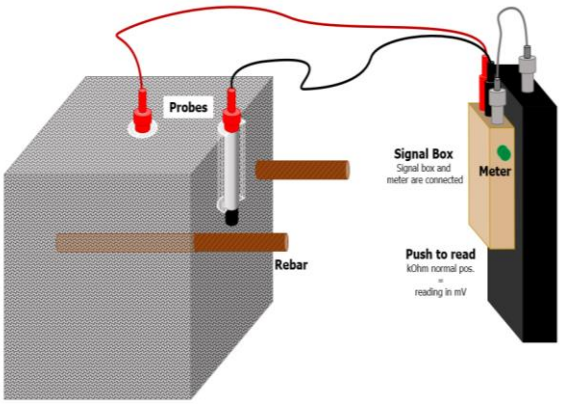
GWT

Germann´s Water-permeation Test

HUM-Meter

Resistivity at different depth related to humidity.





RapidAir

The Rapid Air is an image analysis system for automatic determination of the air void structure parameters on a prepared sample following the linear traverse method (procedure A) or the point count method (procedure B) as per ASTM C457.

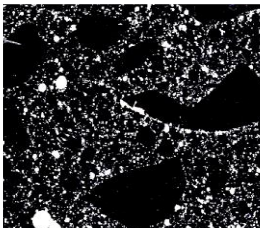
PetroPlaner

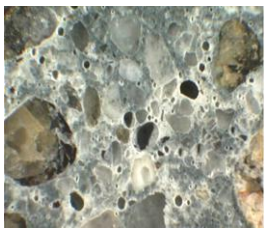
State-of-The-Art polishing machine for preparation of polished plane sections for:

Air Void Analysis according to ASTM C 457

Petrographic, macroscopic examination of polished fluorescent epoxy impreagnated sections

Polishing of thin-sections for SEM / EDS examination





PetroThin

Grinding Machine for production of 20 microns thick Thin Section for experienced petrographers to study the microstructure of concrete, revealing details:

- The Water to Cement ratio (W/C-ratio)
- The cement type, degree of hydration and dispersion of cement particles
- The type of Pozzolan, degree of hydration, cement/pozzolan ratio and the quality
- Recipe control
- Aggregate type and quality
- Crack estimation and characterization
- Air void structure/system
- Surface structure and defects of finished concrete
- Alkali silica reaction (ASR)
- Alkali Carbonate Reaction
- DEF –(Delayed Ettringite Formation)
- Freeze/thaw damages
- Bleeding related problem
- Depth of carbonation
- Deleterious aggregates
- Sulphates

The three basic steps

The rough cut sample
The polished block, impregnated
The 20 micron thick finished thin-section