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

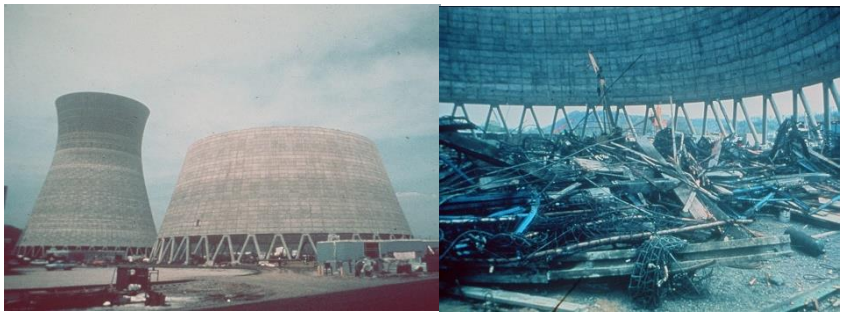
Italian, Czech and UK bridges collapsed due to corrosion of strands in cable ducts

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

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

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 Permeabilitv. AVA Air Void Analvzer 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.

Registration latest April 5st, 2024

Price: 1,500.00 Euro/person
or 1,200 Euro/person for 3 or more registrations.

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

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.

PROGRAM

Educational Workshop on Concrete Science & Advanced Methods for Evaluation of Concrete Emphasizing Bridges and Durability
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	09.25	Carino
	Theme 1—In-place Strength			
1	EN Standards on In-place Strength	09.25	09.55	Moczko
2	Obtaining and Testing Cores	09.55	10.30	Carino
3	Rebound Hammer	10.30	10.55	Carino
	Coffee Break	10.55	11.10	Carino
4	Pullout Test (LOK-Test CAPO-Test)	11.10	11.40	Carino
5	Pullout Test Case Studies High-rise construction and bridge evaluations	11.40	12.20	Petersen and Moczko
6	Pull-off Test (BOND-Test)	12.20	12.45	Carino
	Lunch	12.45	13.45	
	Theme 2—Detection of Internal Defects			
7	Introduction to Stress Wave Propagation	13.45	14.10	Carino
8	Ultrasonic Pulse Velocity Method	14.10	14.35	Carino
9	Impact-Echo Method (DOCter)	14.35	15.15	Carino
	Coffee Break	15.15	15.30	
10	Impulse-Response Method (sMASH)	15.30	16.00	Carino
11	Ultrasonic-Echo Method (MIRA)	16.00	16.35	Carino
12	Case Studies: Joints in precast construction; industrial floor evaluation	16.35	17.10	Petersen and Zoidis

	May 8 - 2nd day			
13	Case Study: Assessement of Slabs by Impulse-Response	08.30	08.55	Callanan
14	Case Studies: Evaluation of P/T Cable Ducts	08.55	09.50	Rapaport
15	Case Studies: Evaluation of Bridge Decks	09.50	10.20	Rapaport
	Coffee Break	10.20	10.35	
	Theme 3—Durability, Corrosion, and Service Life			
16	Durability Principles and Water Penetration Test	10.35	11.05	Carino
17	AVA air void structure of fresh concrete	11.05	11.25	Carino
18	Corrosion basics, chlorides, and carbonation	11.25	12.00	Carino
19	Half-cell Potential and Corrosion Rate	12.00	12.30	Carino
	Lunch	12.30	13.30	
20	Chloride Profiles and Service Life Estimation	13.30	14.15	Orozco
21	Electrical Methods for Resistance to Chloride Penetration	14.15	15.10	Orozco
	Coffee Break	15.10	15.25	
	Theme 4—Additional Tools			
22	Covermeters for Locating Reinforcement	15.25	15.55	Carino
23	Ground Penetrating Radar	15.55	16.30	Carino
24	Visual Inspection Using Drones and AI Software	16.30	17.00	Gkotzamanis
	Description of the Mock-up at the RION-ANTIRION Bridge*	17.00	17.10	Gkotzamanis
	May 9 - 3rd day			
	Bridge Visit and Demonstration of Tests on Mock-Up			
	Departure from Athens	08.00		
	Arrival at the bridge		11.00	
	Presentation of the bridge by Vinci	11.00	11.40	
	Lunch	11.40	12.10	
	Demonstrations of Various Methods on Mock-Up Specimen	12.10	17.30	
	Dinner and Social Time	17.30	19.30	
	Return to Athens	19.30	22.30	
	May 10 - 4th day			
25	Bridge Inspection in Finland-Role of NDT	09.00	09.35	Rapaport
	Additional Demonstrations	09.35	10.35	Petersen
	Questions on Testing Demonstrations	10.35	11.05	Participants
	Coffee Break & Snacks	11.05	11.25	
	Miscellaneous Topics			
26	Concrete Rheology and ICAR Rheometer	11.25	11.50	Carino
27	Thermal Control	11.50	12.15	Carino
28	Early-age Shrinkage and Cracking Potential	12.15	12.45	Carino
	Workshop Summary	12.45	13.00	Carino
	Workshop Evaluations and Open Discussion	13.00	13.35	Participants
	Awarding Certificates, Dinner and Social Time	13.35	16.00	

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. Todd Allen, USA

Mrs. Kirsten Eriksen, Denmark

Mr. Peter Moeller, Denmark

Mr. Jesper Clausen, Denmark

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

NDTitans

MMXX

QUAERERE VERITAS

Test Right –Sleep Tight

Educational workshops
Training on-site
Implementation support
Professional Testing Services

Covering the most advanced test systems for concrete and concrete structures

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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

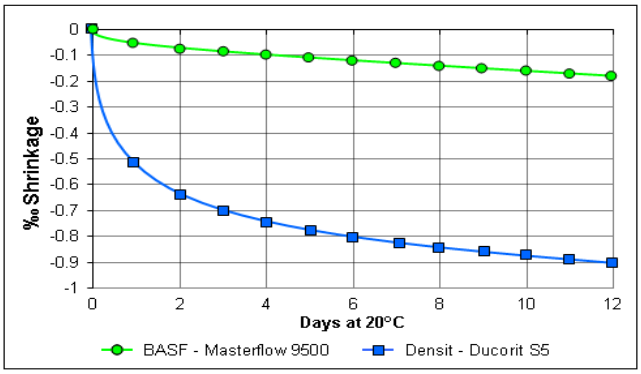
GI Test Systems

www.germanninstruments.com

AUTO-SHRINK

ASTM C1698

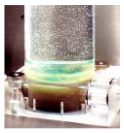
Un-restrained autogenous shrinkage of cement paste or mortar cured under sealed conditions

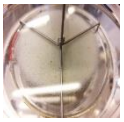


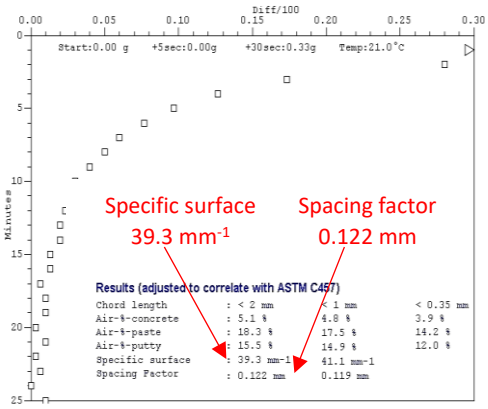
AVA-3000

eqv. to ASTM C 457

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



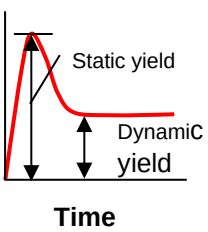


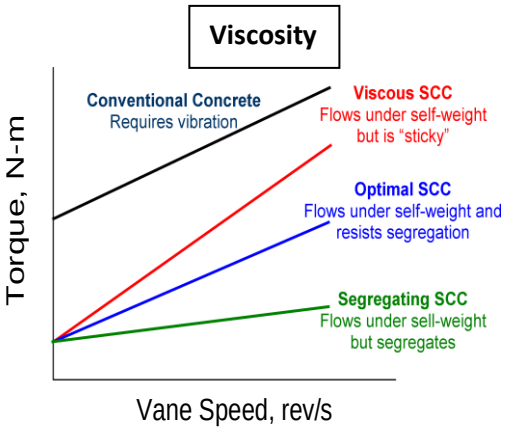


ICAR PLUS

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

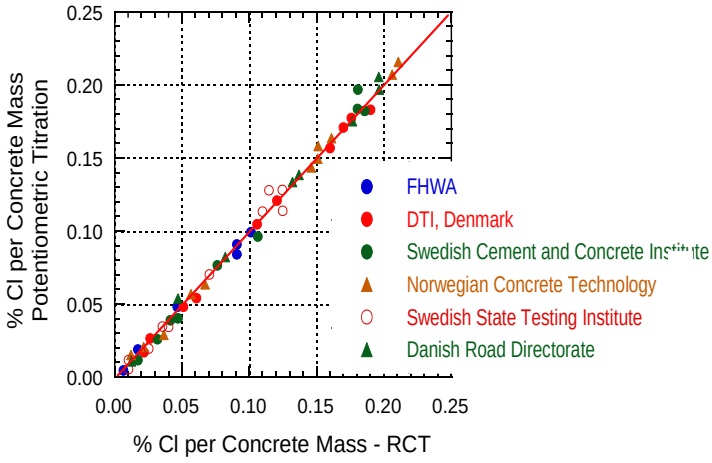
Verification cylinder

RCT

Rapid **C**hloride **T**est

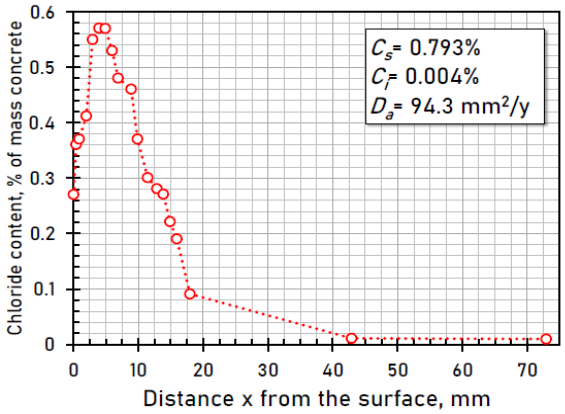
ASTM C1218

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



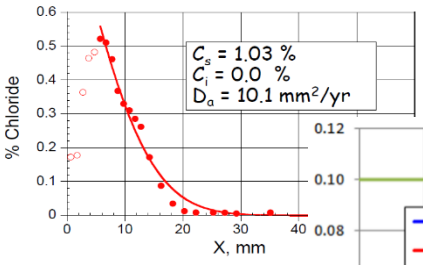
Profile Grinder

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

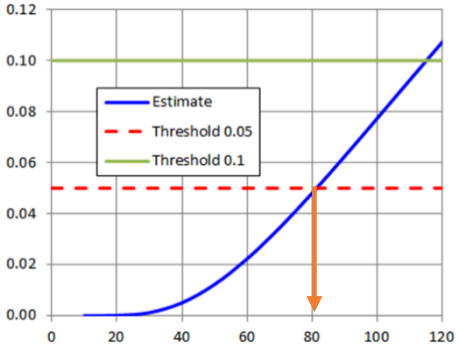


Profile Grinder & RCT

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

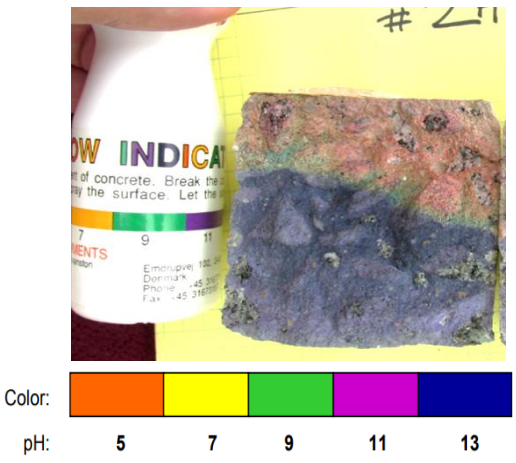


Immediate results without coring, slicing, and pulverizing



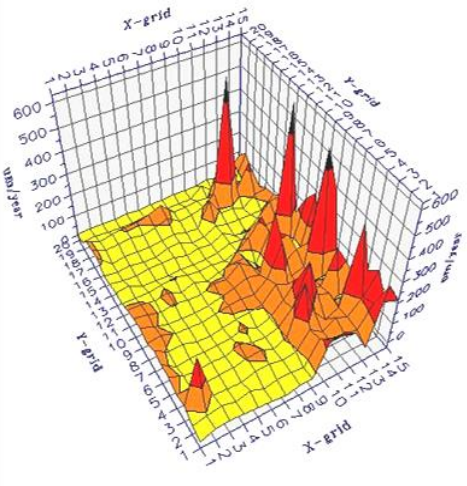
Rainbow Indicator

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



GalvaPulse

Corrosion rate
Potentials
Electrical resistance



Corrosion rate example

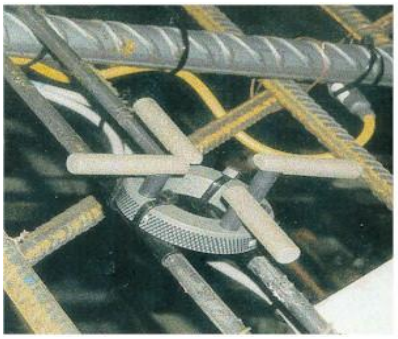
ERE Probe

for long-term monitoring
of half-cell potentials

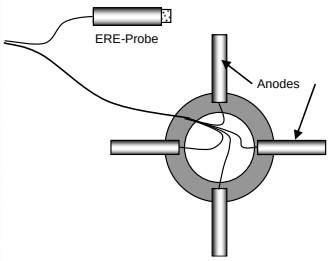
CorroWatch

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

ERE Probe

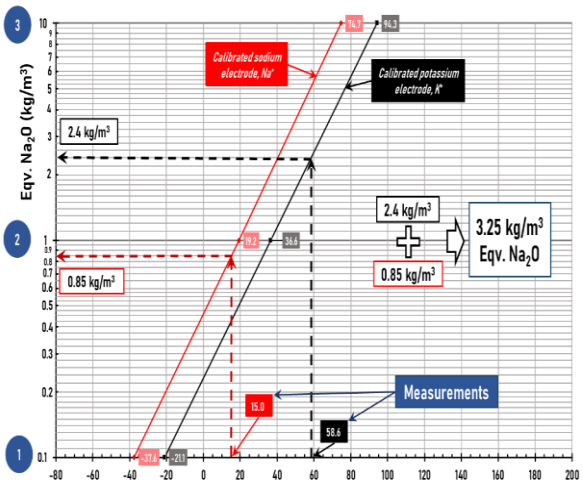


CorroWatch



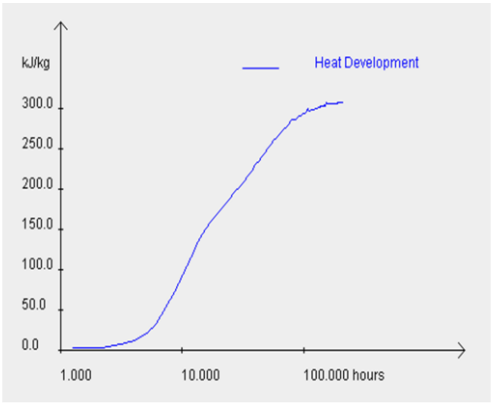
RAT

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



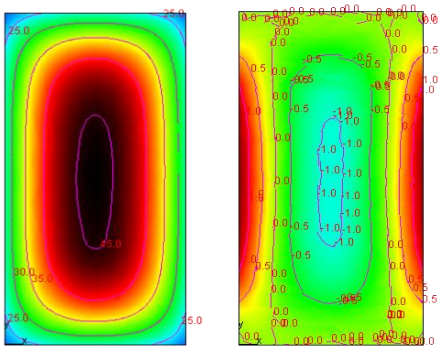
Heat-Box

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

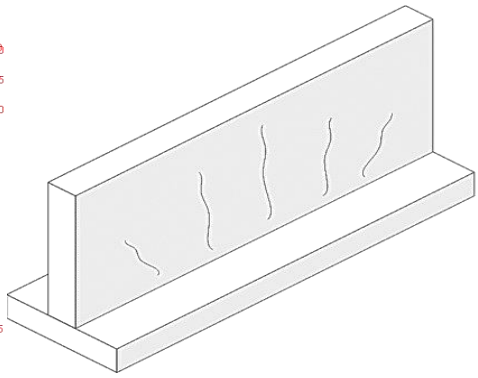


b4cast software

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



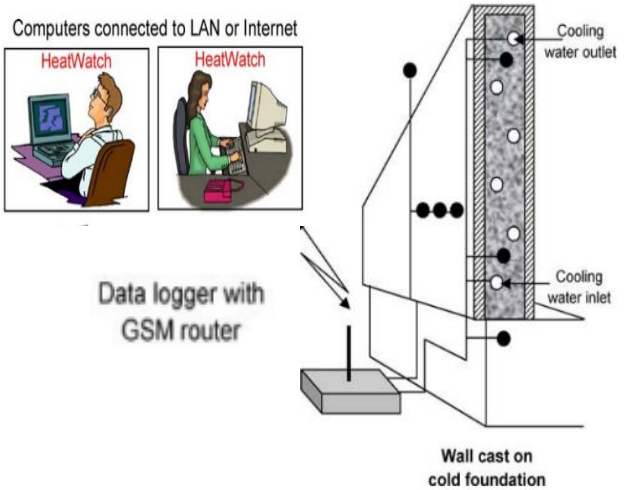
Simulated Max temp and internal restraining of a beam, T=24 hours

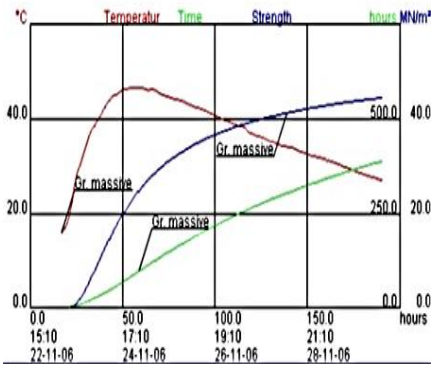


Predicted cracking, wall cast on cold foundation

HeatWatch

Actual temperatures & maturity & estimated strength



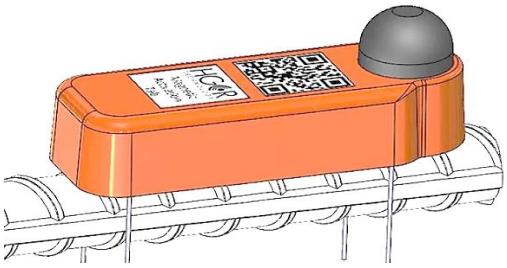


Temperatures and estimated strgnth development (blue curve)

MATURITY

ASTM C1074

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



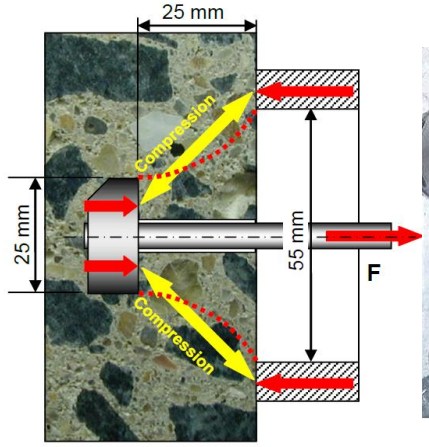
VAKKA sensor for casting-in and transmitting wireless the temperature (and long-term **HUMIDITY)**

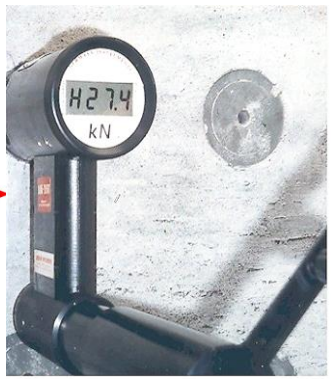
COMA-Meter integrating temperature and time, here showing 1.2 M_{20} days (days at 20^{0}C)

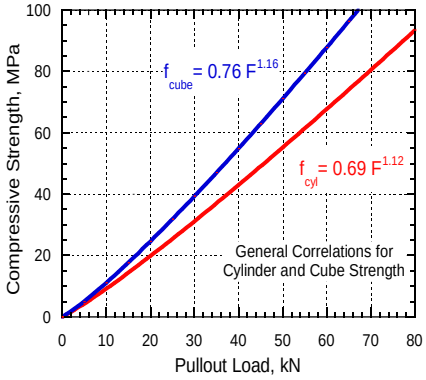
LOK-TEST

ASTM C900
Compressive strength

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







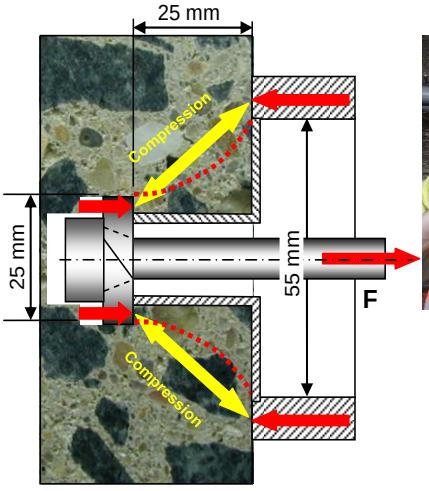
General correlation to standard cube or standard cylinder strength

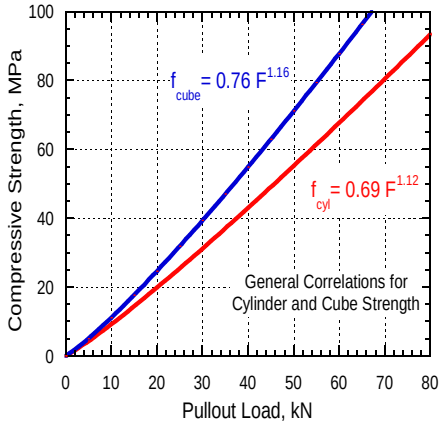
Documentation available showing the advantage of substitution of cores with the more economic pullout, being simpler, producing less damage and providing accurate, immediate strength results, in-situ.

CAPO-TEST

ASTM C900
Compressive strength

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



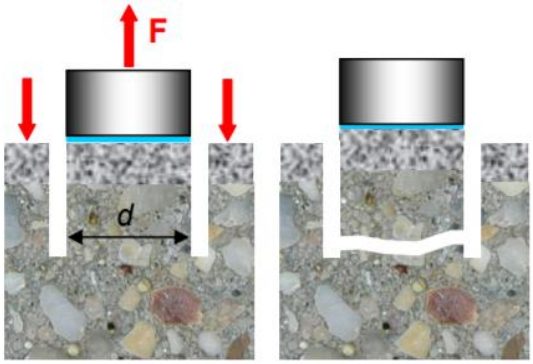


General correlation to standard cube or standard cylinder strength

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

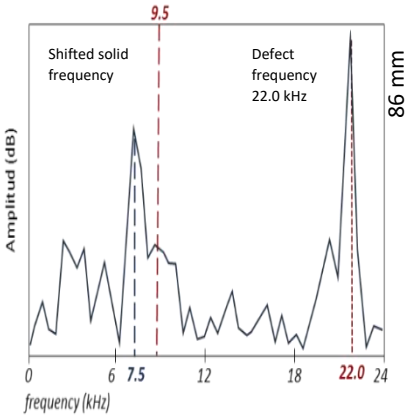
Precision coring using thin section diamond bits. Dia. from 25 mm to 100 mm, max depth 200 mm

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

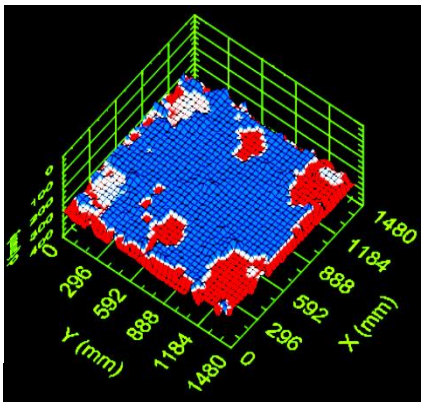
Sound strands in well injected duct

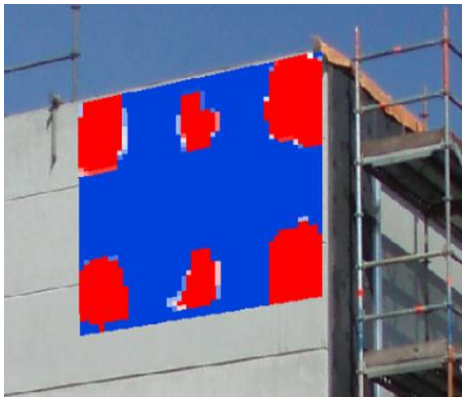
Corroded strands in an empty steel duct

MIRADOR
Impact-Echo

ASTM C1383

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

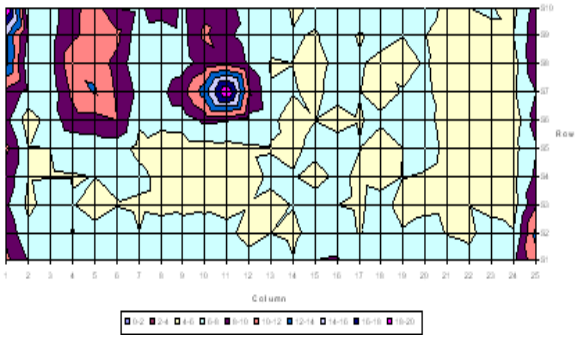




s´MASH
Impulse Response

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

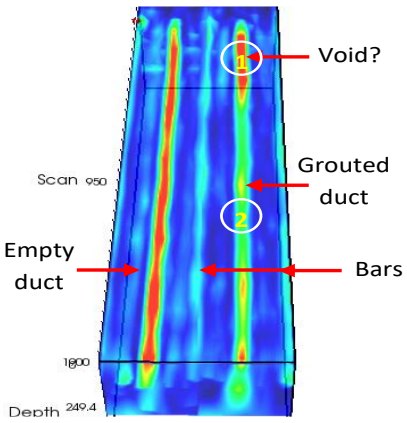
NEW SOFTWARE, THE THOR s'MASH



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

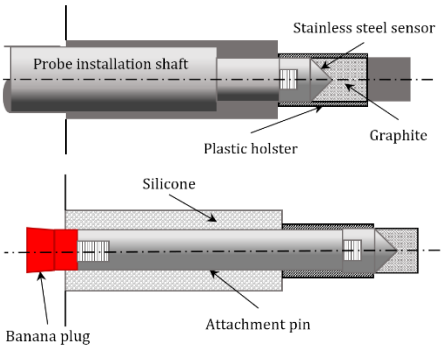
Surface P-wave velocity for uniformity, depth of surface opening cracks and strength estimate based on pre-established individual relationships, e.g to bending flexural strength of marbel or granite panels

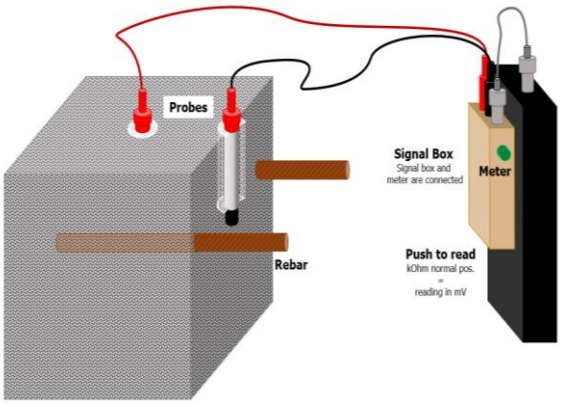
GWT

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.

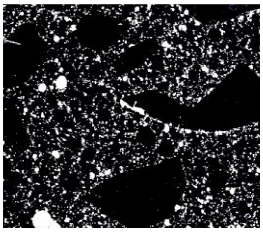
PetroPlaner

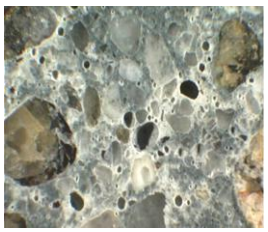
State-of-The-Art polishing machine for preparation of polished plane sections for:

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