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Elcometer 331 solves concrete floor problem

Paul Jenkins, Phillro Industries Australia, reports on solving the problem of concrete movement.

Recently, a Kennard's Hire Company Director came to Phillro Industries seeking a solution to a problem with concrete movement during cure on the floor in a construction of a new building.

The slab reinforcement consisted of 8mm diameter rebar with Heat Crete attached. The Heat Crete is used as an in-floor heating element to provide heating in the finished building. A colour tinted concrete was specified to have a polished finish and it was later found that the colouring agent used caused the concrete cure process to increase rapidly. By the time it was delivered to site and poured, it was already beginning to cure. This resulted in surface shift and contractors unable to achieve an even, smooth finish.

In order to rectify the concrete slab finish, a large depth of the surface would require removal and replacement. However, the contractor had no way of knowing how deep they would be able to cut into the surface without risking damage to rebar and the Heat Crete. If the Heat Crete was damaged, they would need to totally remove the whole slab and start from scratch.

An Elcometer 331 Model B covermeter was used to successfully locate the rebar, measure it's depth and allow the contractors to chalk out the grid location of the rebar as well as the depth. The result was that they were able to minimise the depth of the cutting thus reducing the costs of the repair works dramatically.

Cruising with Elcometer 456

Sabine Lemke, Elcometer GmbH, Germany, tells us how the Elcometer 456 helps to keep the Aida ships afloat.

Meyer Werft shipyard in Germany has been building, repairing and controlling maintenance on both old and new Aida cruise ships since 1994.

Aida is the market leader for sea travel in Germany. Carrying over 233,000 passengers in 2005 and employing 2,400 people in 25 countries, they must ensure their ships are in good condition and meet specifications.

With further cruise ships being built for the 2007 season, Meyer Werft approached Elcometer GmbH for an accurate coating thickness gauge. Coating thickness checks during building and routine maintenance need to be quick and accurate. An Elcometer 456 Ferrous Basic Integral probe was supplied, enabling Meyer Werft to control their coating processes more precisely. They can now ensure that coatings meet specification and are not too thin or too thick. The correct coating thickness extends the service time of the ships reducing coating maintenance work, which is both time consuming and costly.

Finding Nemo with an Elcometer 106/6

Sunny Nietubicz, Elcometer Inc USA, tells us about her latest sale.

Saddleback Waterproofing, a respected waterproofing contractors based in California, were contacted by Disneyland to carry out field investigation and diagnostic studies to determine the waterproofing requirements of a new ride they are building based on the film Finding Nemo.

The requirement was to test waterproofing adhesion in the lagoon where the ride was based. Part of the ride includes a 13ft (3.96m) sectional beam made from carbon fibre about 60mils (1524µm) thick. Working to standards ASTM D4541 and ACI 503-R and requiring a psi range of 200psi, the Elcometer 106/6 Adhesion Tester proved perfect for the application. The easy to operate and fully portable it provides a numerical value for adhesion making testing for consistency simple.

Elcometer built to last

Graham Duk, BAMR South Africa, has an interesting repair.

An Elcometer 250F Coating Thickness gauge purchased in March 1982, was recently returned to BAMR for repair. The probe had become worn and needed to be replaced.

The new ferrous probe was attached and the instrument was as good as new with very accurate readings. Quite impressive for a product almost 25 years old!

product of the month

Elcometer 2300 Rotational Viscometer

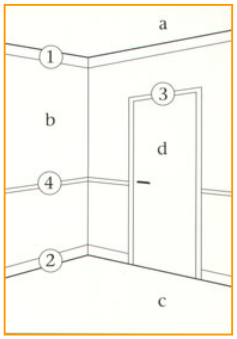
The Elcometer 2300 Rotational Viscometers can accurately measure low to high viscosity samples, displaying viscosity readings in cP or mPa as well as showing rotation speed, % torque, sample temperature, shear rate & shear stress. With quick connect spindles and a wide range of accessories, the Elcometer 2300 range also have a wide range of selectable speeds for flexible testing. All models are supplied with ViscosityMaster™ software for easy reporting and recording of results.

For further information on the Elcometer 2300 Rotational Viscometer or any of our other viscosity products, please visit our website www.elcometer.com or contact your local Elcometer distributor.

Light reflectance

Floor and wall coverings and coatings are now being described in LRV – light reflective values. Architects use this value when they are designing colour schemes, especially for public spaces.

People with poor eyesight can usually distinguish between lightness and darkness but cannot see the details of the shapes. In this instance, a door or the architrave around it should have a different reflectance to the wall immediately next to it, otherwise it is possible that it would not be seen. Having different colours that reflect the same amount of light would not help someone who is colour blind therefore making the contrast of reflectance a very important factor.



According to British Building Regulations Part M, there must be a difference in LRV of adjacent surfaces of 30 units. To measure LRV, a reflectometer is used that reads 0% on black surfaces and 100% on white surfaces.

As an example, a manufacturer of floor coverings may offer a choice of LRVs. The architect chooses one that matches the paint on the skirting board at the base of the wall. The actual colour can be chosen for aesthetics or ergonomics providing that the difference in LRVs is more than 30, conforming to building regulations.

LRV can be measured with a reflectometer such as the Elcometer 6013 or a spectrophotometer displaying CIE-Y value such as the Elcometer 6060/4.

Oil refinery more efficient

An oil refinery's cooling tower water supply was struggling to control corrosion and fouling rates with the phosphate coatings they were using. They were experiencing pH swings and low flow rates, which further accelerated the fouling. This dramatically reduced the life of the heat exchanger and decreased production by increased down time.

It was decided that an epoxy coating system was required to solve these costly problems. The two exchangers were heavily corroded with pit depths ranging from 0.76mm (0.03") to 2.5mm (0.1"). A two stage epoxy coating is normally required, however, due to the severity of the pitting a third coat was required. The final dry film thickness of the coating measured between 255µm (10 mils) to 355µm (14 mils).

To ensure longevity of the coating and reduce future downtime, the coating was spark tested using and Elcometer 236 DC Holiday Detector. No pinholes or flaws were detected in the coating. The new coating dramatically reduced fouling and has halted any corrosion, lengthening the service life of the pipes and exchangers.

Measuring coated metals

Measuring coating thickness is becoming more complex. Changes in formulation of steel, especially for the manufacture of automobiles, requires coating thickness gauges to have the ability to be specially calibrated in order to obtain accurate readings.

The rule for calibrating a coating thickness gauge is to set it on a piece of the same metal without a coating. The metal used for calibrating may not be exactly the same as the coated metal. The coated metal may be from the same roll but from an earlier part of the process. In other words, the metallurgy of the original metal could have been modified by the time it is ready for painting.

A steel alloy with an aluminium coating is sometimes used to strengthen impact areas on a car body. It's tensile strength is increased by heating it before forming. The heat causes iron to be dissolved in the aluminium, making it magnetic. When cool, the magnetic properties of this combination are quite different to the original steel. This means the calibration of a gauge will need to be different too.

The way to ensure measurement accuracy is to calibrate to the same metal. In this case, use the component after pressing but before painting. This needs to be verified because what may look like the same substrate material, may have different characteristics and will need a different calibration to ensure the thickness measurement is accurate.

With these changes in metal processing, thickness of a coating can be measured accurately following the simple rule about using the same substrate for calibration.

Elcometer gauges, such as the Elcometer 456, provide different ways to calibrate in order to get the best and most accurate readings of coatings on metal.

Ultrasonic delay lines

WHAT IS IT?

The face of an ultrasonic transducer, that conducts the sound wave away from the crystal into the sample, is the delay line. Plastic is often chosen because the speed of sound in it is quite slow so the wave comes out a little later.

WHY THE DELAY?

An ultrasonic thickness gauge measures the time between a pulse of sound coming out of the transducer and first echo. This time is very fast in thin samples and the receiver may still be 'deaf' from the loud pulse. This means only the thicker samples are measured. Having a delay gives the receiver the time to recover and so measure thin material.

Delay lines T92016528 (short) and T92016529 (long) can be ordered as required and used with the Elcometer 207 and 207DL. The longer delay line helps measure thicker materials. It also attenuates the received noise, allowing for a better reading of for example, aluminium. The shorter delay line provides a stronger signal to penetrate tough materials.

New concrete repair methods

Reportedly over 50% of Europe's annual construction budget is spent on refurbishing and repairing existing structures. Concrete deteriorates for a wide range of reasons and over time, this figure will continue to increase.

The new EU repair standard is designed to help stop the short-term cosmetic repairs and ensure long lasting repairs are carried out.

The new EU standard EN 1504 *Products and systems for the protection and repair of concrete structures – definitions, requirements, quality control, evaluation of conformity* has been specifically created to ensure short term cosmetic repairs become a practice of the past and to help lengthen the serviceable time of repairs. The standard will be fully implemented by December 2008.

EN 1504 specifies minimum performance levels allowing products to be CE marked for sale across Europe. There are many parts to EN 1504 covering all aspects of repair. For ease of use, Part 9 defines repair principles shown below:

Principle 1 (PI)	Protection against Ingress
Principle 2 (MC)	Moisture Control
Principle 3 (CR)	Concrete Restoration
Principle 4 (SS)	Structural Strengthening
Principle 5 (PR)	Physical Resistance
Principle 6 (RC)	Resistance to Chemicals
Principle 7 (RP)	Preserving or Restoring Passivity
Principle 8 (IR)	Increasing Resistivity
Principle 9 (CC)	Cathodic Control
Principle 10 (CP)	Cathodic Protection
Principle 11 (CA)	Control of Anodic areas

The many related standards for each of the stages of repair can be met by Elcometer products.

For example, controlling moisture and environment can be achieved by using the Elcometer 319 which can monitor climate conditions including air temperature, relative humidity, surface temperature and dewpoint temperature.

The Elcometer 106/6 Mechanical Adhesion Tester is ideal for testing the bond strength of the repair in a simple and accurate way. If a hydraulic adhesion tester is preferred, the Elcometer 1940 and Elcometer 1941 PAT™ Adhesion Testers also comply to relevant standards.

Testing the hardness of the repair can be easily achieved to standard with the Elcometer 181 Mechanical Test Hammer or the Elcometer 182 Digital Test Hammer.

These are just some of the examples of where Elcometer concrete inspection equipment can help standards to be met with accurate, portable and reliable instruments.

Publication update

SSPC (Steel Structures Painting Council) VIS standards provide a visual comparison for surface preparation standards.

Elcometer have now included more publications to their surface standards range. All available publications are listed below.

SSPC VIS 1 standards for steel cleanliness are now published in both English and Spanish.

Model	Description
Elcometer 128/1	**Swedish Standard (ISO 8501, SIS 055900)** Shows degree of cleanliness of 4 different levels of rusted steel cleaned by blasting, hand & power tools and flame. Specified by ASTM 2200 Method A
Elcometer 128/2	**British Standard BS 7079: Part A1** Consists of ISO 8501 & a supplement for cleaning using 6 alternatives to silica quartz, which is prohibited in Britain.
Elcometer 128/3	**SSPC VIS 1-01 Dual Language** Pictures of required final appearances & written descriptions of the US standards. VIS 1-89 includes photographs of surfaces cleaned using metallic & non-metallic abrasives. Specified by ASTM 2200 Method B
Elcometer 128/4	**British Standard BS 7079: Part A1 Supplement** – supplied with Elcometer 128/2
Elcometer 128/5	**SSPC VIS-3** Contains 44 photographs to supplement the written SSPC specifications for hand and power-tool cleaning.
Elcometer 128/6	**SSPC VIS 2** Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces.
Elcometer 128/7	**SSPC VIS 4** Guide & Reference Photographs for Steel Surfaces Prepared by Waterjetting
Elcometer 128/8	**SSPC VIS 5** Guide & Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning

Standardisation of testing equipment

Gauges from different manufacturers and different models may behave differently to one another. It is possible that your gauge may perform differently to that of your suppliers and customers. This can lead to conflicts, so a necessary exercise is to confirm the procedures and equipment and both ends do match.

In the case of a 'comparator' such as the Taber® Rotary Abraser, there is a Calibration Verification Kit. It enables the user to determine if an instrument should be returned to the factory for repair or recalibration.

The Abrasers two wheels seem to work simply enough but this is deceptive. The bearings may be worn and the wheel could be running off track. Special wheels in this kit can identify these problems (see right). As the removal of loosened material affects the result, the vacuum level should be monitored to confirm it is still strong enough. The same principal applies to other test instruments. Such a standardisation check cannot be avoided. The Taber® 5135 & 5155 Calibration Verification Kit can be ordered from Elcometer using order number ST132030.

Bend and Impact testing

Making goods from even thinner metal panels with thinner coatings may bring savings in cost and weight but it can provide a headache for the paint chemist. The performance of the thin coating must be as good as that of a thicker one.

THE COATING

A coating applied to thin metal (0.3 – 1.0mm / 0.012 – 0.039") must be able to remain unbroken as the often more elastic metal is bent. This bending force can be applied slowly in a press or very quickly, such as during an accident. If the coating is applied after forming, it should resist any impact. In both cases, not only must the adhesion be adequate, the coating must be able to stretch as it follows the surface of the moving metal substrate. Any cracking here will look bad and could open the way to corrosion and delamination.

Applying a thick coating after forming might be seen as a possible solution. Though it may provide more protection, it may not be sufficiently flexible and could crack after impact. A thin coating will be the opposite and can be bought already applied to the metal, which saves having a coating line. These factors must be considered as part of the design and manufacturing processes of metal goods.

THE SUBSTRATE

The metal is often from a roll or cut sheet. It can be pre-coated with zinc, sometimes with an inorganic coating, even with both. It will be bent to shape and have holes stamped in it. The finished item could be a washing machine, a car or the external wall of a warehouse. Obviously, it must be able to pass through the manufacturing process without damage to its coating. The coating must be durable and flexible.

The coating chemist has a number of tools to choose from to help evaluate the possible performance of a coating on metal.

BEND TESTS

A bend is taken as a slow deformation of a plane metal panel. For example, to form a flange or lip, some of the metal is bent at 90 degrees to the main surface. The radius of this bend will depend on mechanical engineering and design. It will also depend on the coating, specifically its ability to bend sufficiently.

Elcometer 1500 Cylindrical Mandrels on a Stand.

The paint chemist would have to provide a coating with enough flexibility and stretch-ability to go around the corner without breaking. The process engineer would have to avoid bends sharper than the coating can handle.

OVER A CYLINDER

A simple way to test how a coating will bend is to fold it around a cylindrical mandrel or bar. Two hands usually do the bending (Elcometer 1500) but for a smaller panel over a smaller diameter a system with a lever is easier. By testing a number of panels over various diameters, the one that results in damage to the coating can be determined.

Small panels over small cylinders, bent as the lever is moved left to right

Elcometer 1510 Conical Mandrel Bend Tester

OVER A CONE

A quick way to find the diameter at which the coating breaks is to bend a test panel over a cone. The result is not as precise as with individual cylinders (above) but it is found more quickly and with only one sample.

IMPACT

When a strong impulse force acts on a metal panel, the metal can be stretched beyond its elastic limit, away from its plane. It may not return (completely) after this impulse. Any coating on it is expected to follow the metal, to continue providing protection and decoration after impact. How well it does can be determined by using an Impact Tester, such as the Elcometer 1615 (see right).

Sample after impact. Radial pattern suggests coating is brittle.

The tester comprises a circular hole (die) on which the test piece can be clamped. A mass with a hemispherical end (punch) of known diameter is dropped from a known height and the damage is assessed. Other standards require the test piece to be clamped and the punch dropped, or the punch can be rested on the test piece and a weight dropped onto the punch. The coated side can be up or down, depending on the information required. The impact energy (mass x gravity x height) and the extent of the indentation can be varied.

Cupping Tester pushes a round tool from under the test panel

SLOWLY

It is useful to know how far a coating will stretch before it breaks. Applying a slowly increasing force while observing the coating, monitoring the extent of the deformation, will evaluate if one formula is more effective than another. This equipment is a Cupping Tester, Elcometer 1620. It has some similarities to the Impact Tester but is configured upside down. A motor or hand crank pushes the round tool gradually upward into the clamped sample. A camera can be attached to look down and record the test in progress. The elasticity of the coating can be ranked according to the distance the tool was raised.

Next month we will look at film applicators

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