elconews e-zine
international
Issue 2

A caravan of concrete pipe sections moves across the shimmering sands of Libya.

Man-made river

For more than two decades, SNC-Lavalin of Canada has been active in Libya, helping to build the so-called Great Man-Made River. This project is to supply all the regions of Libya with water for drinking and to irrigate fertile plains for food production. The size of this project is amazing.

A series of pipelines transport fresh water to the north of the country from 129 wells in the south. Six million cubic metres of water per day are carried through a long network of huge pipes (aqueducts) made of armoured concrete. The water pours into several huge reservoirs located close to towns and fertile areas from which it is distributed locally by more pipelines, mainly of stainless steel.

To construct the main pipelines, SNC-Lavalin manufactured 15,000 pre-stressed concrete pipes close to site. Each piece of pipe, 7.5 metres in length and mainly 4m diameter, consists of a steel cylinder embedded in a concrete core, which is then wrapped with high tensile steel wire and coated with cement mortar to protect it. The wire induces a compressive stress in the concrete core that enables it to resist the internal pressure.

The pipes are placed in trenches, approximately 10m wide by 7m deep. They are bonded to make the whole pipeline electrically continuous so cathodic protection can be used.

Other parts of this huge project that SNC-Lavalin have worked on have steel structures. They are coated to protect them in this harsh environment, not only from corrosion but from sand erosion too. For the measurement and inspection of these coatings, the company uses various Elcometer gauges, including those for climatic testing and coating thickness measurement.

Thanks to www.snc-lavalin.com

Elcometer awards

At the end of every financial year, Elcometer presents an award to those distributors and Elcometer offices that have performed exceptionally well.

Andy Foo of Elcometer Asia

"I would like to thank everyone for the hard work they have done and I am pleased to announce the winners of the E-Awards for 2007/08", said Michael Sellars, Managing Director of Elcometer.

Elcometer Office Award

Winner:	Elcometer (Asia) Pte Ltd
Runner-up:	Elcometer Inc, USA

Value Growth Award

Winner:	NDT Equipment, Russia
Runner-up:	Samwon Instruments Trading Co, South Korea

Percentage Growth Award

Winner:	TEC Engineering, Ukraine
Runner-up:	Macrolab S.A. de C.V., Mexico

product of the month

Elcometer 3034

Even soft coatings are tested with a hardness tester. A classical method is the Pendulum Tests by Persoz and König in which the coating absorbs energy from a ball rolling on the surface. This causes the swing of the attached pendulum to gradually reduce. On a hard surface such as glass, the amplitude of the oscillations decreases more slowly.

This is a very sensitive test so to prevent interference from local air currents, a plastic cabinet is provided to surround the pendulum. The Elcometer 3034 can perform either test, depending on which pendulum is used.

For further information on the Elcometer 3034 and the individual Elcometer 3030 Persoz and Elcometer 3040 König testers, or any of the other hardness testers available from Elcometer, visit www.elcometer.com or BAMR : sales@bamr.co.za.

coatings on site

Keeping the Navy afloat

A ship's ballast tanks help keep its hull stable in the sea but the water in there quickly corrodes any exposed steel. The US Navy found the protection of their tank walls was failing within a couple of years. The anti-corrosive primer and a topcoat of epoxy were expected to last at least seven years.

There are over 2900 ballast tanks in the US Navy and re-preserving these had been costing the fleet about $75 million annually. It was the most expensive item in their budget. So, what went wrong?

A ship's ballast tank corroding after only 3 years in service

An investigation came up with two key contributors to premature failure. One was the lack of adequate surface preparation prior to coating, both during new build and repair. The second was the inability of the coating system to maintain thickness over sharp corners and welds, compared to that over adjacent flat areas.

So, the original coating system that was solvent-based was replaced by a solvent-free system that stays thick over corners. Due to the high solids content, the coatings do not pull back from a sharp edge while curing and maintain about 70% of the thickness of the nearby flat area. Less solvent in the formula also means less VOC (volatile organic compounds) during painting.

However, even an excellent coating will fail if the substrate is not prepared properly. Procedures were put in place to comply with surface preparation standards (ASTM, NACE, SSPC) as well as the mechanical rounding of sharp edges and welding. Measurement of the salt on the surface was added to confirm washing was removing it, not just spreading it around. Then the ambient conditions were monitored from before coating to after, as a record to confirm humidity was ideal for the job.

The extra monitoring and recording of each stage ensures everything is correct before the next layer is applied. Finally, dry film thicknesses are recorded at the rate of 5 per 100m^2 of surface. When the coating system hardens, only then are the tanks filled with water. The same process is applied to new construction.

A big improvement with the new coating system

The new procedures have already resulted in a noticeable extended protection of the ship's internal tanks from corrosion. The target is a 20-year life, which would mean more time afloat rather than being repaired in the shipyard and a big reduction in cost.

Test equipment that is used for this specification (US Navy PPI 63101-000) includes, profile gauge, pictorial cleanliness standards, dust sampling tape, Bresle patches, humidity meter and coating thickness gauge. All the measurements are collected for future reference.

Thanks to www.nstcenter.com

coatings in the lab

Trendy stylish enamel

Metallic surfaces, special effect colours and reflective finishes have increasingly found their way into product design. With the metallic trend, the demand for stainless steel and copper has caused dramatic increases in metal prices. Designers are looking for more-economical materials such as porcelain-enamel coatings, which have been adapted to give trendy metallic looks but with a substantially lower price tag.

Cost savings per square foot for a typical kitchen range serves as an example. With porcelain-enamel coatings, designers can fabricate from plain steel instead of 300 Series stainless. The coating goes on as a 50 microns ground coat and a 100 microns cover coat. Using general market prices from May 2007, the enamel cuts costs by nearly 60%. The coating also withstands scratches that would relegate many stainless steel parts to the scrap heap.

Porcelain enamels are glassy coating materials. They bond to metals (carbon steel, stainless steel, cast iron or aluminium) at temperatures from 540~870°C. Test samples of enamel have shown its advantages over stainless steel. The ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test covers the hardness of organic paints. This test assesses the force required to gouge a coating with a drawing lead of calibrated hardness. Enamel was off the scale and could not be scratched with the hardest 9H pencil, while a softer 5H pencil did scratch the stainless steel sample.

The ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser evaluates abrasion resistance. Panels experienced 2,000 cycles under the hardest CS-17 wheels with a 1kg load. Technicians measured the weight loss. Stainless steel lost about as much weight as the enamel but was visually scratched and damaged.

Unlike stainless steel, enamel does not show noticeable fingerprints, does not discolour from heat and is resistant to stains, scratching and chemical cleaners. Modern colour and metal combinations are helping this traditional coating continue to be specified for stylish domestic appliances and cooking pans.

Measuring the thickness of enamel can be done with an Elcometer 456FNF when the metal substrate has cooled.

Thanks to Ferro Corp. Ohio

Exhibitions

24-26th June:
Asian Pacific Coatings Show, Kuala Lumpar, Malaysia

23-25th September:
Coatings 2008, Indianapolis, USA

30th September to 2nd October:
Eurocoat 2008, Lyon, France

concrete inspection

New Elcometer 331^2 Half-cell Meter

To survey an existing concrete structure for rebar corrosion, you only need a Half-cell meter and probe. Such an instrument is now available as part of the Elcometer 331 series.

The new Elcometer 331^2 Half-Cell Meter is available in two models. Both provide a quick assessment of the condition of rebars and steel structures within concrete by measuring the corrosion potential (voltage) at the surface.

To test concrete contaminated with salt, such as that near the sea, plug in a Silver probe. Otherwise, use a Copper one. Connect the return lead to some exposed rebar to complete the circuit. Then wet the surface of the concrete and simply place the end of the probe on it.

By working in a methodical way, according to a line or grid of squares, a structure can be mapped. The HM model has data-logging capabilities and can store up to 240,000 Half-Cell voltage readings in either linear batches or grid batches.

A map of the survey is particularly useful in a report to show the extent of the corrosion, probable and actual. Such a report is produced by CoverMaster® software, which is included with each HM-type gauge. Data uploaded from the memory can appear in a standard report or in one you design yourself. Tools are provided to quickly create detailed, professional reports.

The other version of the Elcometer 331^2 is Model H, a basic, entry-level gauge. Yet, it has the same illuminated display, four-key selection and intuitive menu in several languages. Both can be used straight from the box.

Note that the Model H and Model HM only measure the corrosion voltage. If you need to measure the thickness of concrete covering the rebars, use one of the Elcometer 331^{2}B Covermeters or choose the Elcometer 331^{2}BH with both the cover and the corrosion potential functions.

For more information about these instruments, visit www.elcometer.com and select the Concrete and Civil Engineering section.

Product training

Are you or your colleagues involved in distributing or using Elcometer products?

Do you need to improve your knowledge of the products in Elcometer's catalogue and how they are used?

Why not come to one of our training events? To find out more, please send me an e-mail: stevep@elcometer.com.

standards news

ISO 25178

Geometric product specifications - Surface texture: areal

A measure of some property of a surface is called an 'areal' parameter. Similar to the measurement of a rough surface as the variations along a straight line, areal measurements are variations over an area. This three-dimensional (3D) representation is obviously closer to real life but the definitions and mathematics are only just being standardised. The new standard ISO 25178 is at the start of this process.

Running parallel to this are other projects to make the measurements in a repeatable way. Friction and abrasion resistance of nearly smooth surfaces are very important in many industries. But even blast cleaning and painting could use 3D measurement parameters to describe them more effectively.

At present, ISO 8503-1 (Elcometer 125) is a physical representation of standard profiled surfaces. However, many people prefer to work with numbers. Even if they don't understand the calculation of that number, with it they can compare more easily. Testing with Testex Tape (Elcometer 122 with 124) provides such a number and its value is similar to the new 3D parameter Sz, which defines the maximum peak-to-valley height of the profile in an area.

Another new parameter is Sq. This is the root-mean-square height distribution of peaks (or depth of valleys) in the area. It's a measure of consistency and is similar to the Standard Deviation calculated by the Elcometer 224 Digital Profile Gauge.

Many inspectors would agree that an ideal measurement system for use on site would be something placed on the surface that gives the result of a group of readings in one go, leading to a quick decision. It looks like this wish may become reality in the near future, using optical technology. Taylor-Hobson's CCI 3000 does it now but it's not the size and price we want.

So, for now, we will have to continue using the existing linear gauges and physical replicas to collect our data and to generate test records.

Pipeline standard

The existence in the international petroleum and natural gas sectors of different standards for pipeline coatings has posed problems for suppliers, manufacturers and end users. A solution is now available, ISO 21809-2:2007, Petroleum and natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 2: Fusion-bonded epoxy coatings, which provides in a single document a consistent and unified approach to requirements worldwide. A part of it is a specification for inspection and coating thickness.

Amazing!

The fifth most popular of all the ASTM standards is one for coatings: "Standard Test Methods for Measuring Adhesion by Tape Test". ASTM D 3359 and other standards can be bought from your local standards house or from the Internet at ansi.org.

applications: industrial coatings

In this series of articles, we look at specific applications, answer some of the most commonly asked questions and provide practical advice. This month, we look at industrial coatings applied indoors.

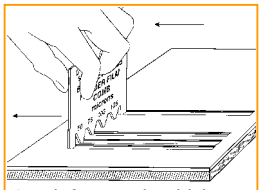
Solvent-free coatings and solvent-based coatings

Most films can be put into one of two main groups: those formed after evaporation of a solvent and those formed after an input of energy. Although the two types of film have some useful differences, they also have many properties in common, especially when cured. This means they can be tested the same way.

Coatings are selected at the design stage of a product, based on their characteristics as determined by the lab of the paint company. In production, some of the lab tests must be repeated, to confirm the film is ready for its career of protection and decoration.

THICKNESS AS APPLIED

The final thickness of a powder coating can be determined before heat is applied to cure it. This allows adjustments to the process without generating scrap. A gauge such as Elcometer 155 Powder Film Comb can measure the sprayed on powder before the items go to the oven. Large-volume work is better tested with the Elcometer 550 Non-contact Powder Thickness Gauge, which leaves no marks and displays the final cured thickness. Both gauges can be used in accordance with ASTM D7378.



Comb for powder thickness

For UV-cured coatings and liquid paints, we use Wet Film Combs such as the Elcometer 112. Although these are similar to the Powder Comb, in use they are pressed into the coating rather than pulled along the substrate.

HARDNESS

The paint lab technicians will have used a Clemen tester (Elcometer 3000) to determine the final hardness of a finish. As curing and hardening is mainly a function of energy and time, either of which could vary on the production line, a simpler gauge (the Elcometer 3092 Sclerometer) will determine if the coating is still soft inside. Another method is pushing pencils of different hardness (Elcometer 501) along the surface in a controlled way.

Clemen test in progress

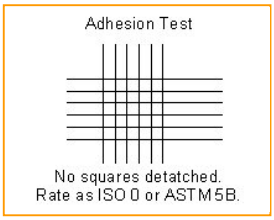
FLEXIBILITY

When flat, coated sheet (or coil) is bent to shape, the coating must bend with it and remain connected to the substrate. What actually happens is the convex surface is stretched more as the radius is reduced. Cylindrical (Elcometer 1500) or conical (Elcometer 1510) mandrels are mainly used in the lab to see up to which point a particular formulation of the coating resists bending, rather than testing samples from the production line.

IMPACT RESISTANCE

Powder coatings can become over-hard or brittle if cured too quickly or at too high a high temperature. A severe knock can then cause this brittle coating to shatter, overcoming the adhesive bond. A test for this is to drop a rounded weight from a controlled height (Elcometer 1720) onto the sample, to see if the coating bends or breaks from the energy being suddenly applied.

ADHESION



Modern coatings are very good at forming strong continuous films but we must be sure they actually stick to the substrate. Degreasing and pre-treatment usually precede coating but if these are not done well, the coating will simply 'sit there'. The way to check the adhesion is to cut the coating into small squares according to the Crosshatch test (Elcometer 1542). If any of the corners break or if the squares come off, this shows how bad the adhesion is. This test, combined with a falling weight test, is used to assess coatings on coil or sheet metal.

CURED THICKNESS

The thickness of the coating is measured with Elcometer 415 and 456 gauges, described in previous articles in Elconews. The exact type depends on the substrate.

GLOSS

An important attribute of a manufactured item is its appearance. One part of this is how well it reflects the light. For office furniture, it is more important how little it reflects light. Either way, the property to be measured is the same: gloss.

Glossmeter with statistics

A variation in gloss also appears to our eyes to be a change in shade, even when the same coating is applied. This could be caused by over baking or not enough time in the oven. Eyes will see the difference, especially when two extreme samples are placed side by side. But eyes and opinions vary, so for an independent consistent measurement we use a glossmeter (Elcometer 407).

PINHOLES

A strong continuous coating can provide good anti-corrosion. But checking a large area of it for any tiny holes needs the help of a detector such as the Elcometer 270. The water in its sponge will complete a circuit to the substrate only through a pinhole. No pinhole, no corrosion.

Should you require any further information on testing industrial coatings or if there is a subject you would like to see mentioned in Elconews e-zine, please e-mail us at: editor@elcometer.com