elconews e-zine
international
March 2007

The Golden Gate Bridge

Joe Walker, Elcometer Inc. USA reports on how a salt testing problem on the Golden Gate Bridge was solved.

Constructed in 1937, the Golden Gate Bridge is both the gateway between San Francisco and Oakland, CA and a symbol of man's ingenuity and desire to conquer nature's obstacles through innovation and technology. This year marks the bridge's 70th anniversary as America's gateway to the Pacific Rim. Its distinctive "International Orange" colour serves as an inspiration to those who dare to dream and as a continual challenge to those whose task it is to preserve and maintain this massive structure of steel and concrete.

The task of maintaining this wonder of the man made world falls on Dennis "Rocky" Dellarocca, Paint Shop Supervisor for the Golden Gate Bridge Authority. Rocky oversees the five paint crews whose duty it is to preserve the bridge for generations to come.

In 2006 Rocky was given the challenge of over coating the 1,048 suspender ropes that connect the floor beams and road deck to the massive suspension cables, which attach to the bedrock on each side of the bridge and are suspended from the bridge's two distinctive towers.

Each suspender rope consists of numerous braided cables which in turn are comprised of thousands of individual wires having a class 3 zinc coating and a silicon alkyd topcoat system.

The challenge for Rocky and his crew is to accurately quantify the salt contamination on each of the braided rope systems - after removing the silicon alkyd layer through a proprietary water jetting process.

As the cable braiding does not provide a sufficiently even surface, conventional test patch methods such as the Elcometer 134 Chlor*Test and the Elcometer 135 Bresle methods, simply do not work as there is insufficient surface to contain their respective liquid solutions.

Having discussed these particular issues with Rocky Dellarocca, Elcometer Inc, based in Michigan, developed a solution to the problem.

"By combining the Elcometer 130 Salt Contamination Meter with the Elcometer 225 Surface Profile Putty, we were able to provide a simple, cost effective and repeatable test. It accurately determines the salt contamination levels on this irregular surface profile," stated Joe Walker, Vice President, Elcometer Inc. "We are delighted to have been able to provide a solution for such an international landmark as the Golden Gate Bridge."

The use of this equipment provided the Authority with an easy to use and repeatable Salt Contamination system, which is safe for their workers, suspended hundreds of feet over the treacherous waters of San Francisco Bay.

The procedure is simple: The two part putty system is mixed together and placed over the area to be measured and cures in minutes into a flexible mold. Once cured, the putty is pulled away from the cable and a negative mold of the cable is created within the putty.

The Elcometer 130 sample paper is then hydrated, placed into the negative mold, and applied to the cable surface.

Image courtesy of Wikimedia Commons

The sample paper is then placed on the Elcometer 130 test plate and a reading is taken. If the resulting measurement meets the specified level of cleanliness, the surface is approved for coating.

When asked how the Elcometer 130 was performing, Rocky Dellarocca said "The Elcometer 130 is great! It is fast, accurate, and gives my people the chance to get their jobs done in the unpredictable weather of the San Francisco Bay."

product of the month

The Elcometer 134 CSN Test Kit – Chlorides, Sulphates & Nitrates.

Designed to accurately measure surface chloride, sulphate and nitrate ions in minutes, the Elcometer 134 'CSN Salts' offers trouble free testing in the field.

All components are pre-measured and pre-dosed for complete accuracy and all results are recorded in parts per million (ppm) so no complicated calculations are required. Supplied in a carry case for easy portability around the site, each kit is supplied with full instructions attached to the inside lid.

For further information on the Elcometer 134CSN, or any of our other products, please visit our website www.elcometer.com or contact your local Elcometer distributor.

coatings on site

Keeping floors polished

Highly polished floors in hotel lobbies, shopping malls and office blocks need to maintain their superb appearance while being subjected to high volume traffic.

As many floor polishes are water-bourne, typically 80% of the applied wet film will evaporate, leaving the polymers and other components to form a hard, dry, protective film. If the humidity is too high when the polish is applied, the water solvent will evaporate slowly. If a second coat is applied while the first coat still contains water, a hazy, soft surface will remain. This provides no protection and spoils the appearance of the floor.

If the floor temperature is too low, the rate of evaporation is also reduced. In extreme cases, dew can form on the cold floor. When the temperature is below the minimum for film forming, the applied polish becomes powdery very quickly, again providing no protection to the floor.

These problems can be avoided if humidity and surface temperature of the floor are measured using an Elcometer 319 Dewmeter before applying the polish.

Upcoming exhibitions

For a complete list of exhibitions for the next year, visit our website www.elcometer.com/exhibitons.html

March		
6th - 8th	Elmia Days for Industrie www.elmia.se/dfi/	Jönköping, Sweden
11th - 15th	NACE www.nace.org	Nashville, USA
11th - 14th	MEOS www.aeminfo.com.bh/meos2007	Bahrain
14th – 16th	Lab Africa www.labafricaonline.co.za	South Africa, Johannesburg
21st – 22nd	RVS and Aluminium Show www.rvsalu.nl	Netherlands
28th – 29th	Overfladedage 2007 www.fagmesser.dk/overfladedage	Denmark
April		
14th – 15th	MARUTE Painting Fair	Japan
18th – 22nd	12th International Exhibition of Oil, Gas & Petrochemical Industries & Products – Iran Oil Show www.iranoilshow.com	Iran
19th – 22nd	Expolink 2007 www.expolink-fair.gr	Greece
25th – 28th	PRIMUS: INTERGARBA 2007 www.primus-exhibitions.com	Kiev, Ukraine

coatings in the lab

Coatings on magnets

Magnets are manufactured from crumbly, brittle metals. Used in electric motor and loudspeaker manufacture, sharp edges on the magnets can easily break and fall into the equipment.

Magnets today are made from a variety of materials. Traditionally soft iron was used to manufacture magnets but today powdered metal mixtures are sintered (pressed) into shapes. Ceramics (ferrites) are also used to manufacture magnets.

From lifting magnets to horseshoe magnets – all require coating

Strangely, many metal unmagnetised magnets are non-magnetic and are not attracted by a magnetised magnet. Non-metal magnets are generally always magnetic.

Coating the magnets provides protection and reduces the brittleness of the magnet, making it more durable. It also provides a means of colour coding for the manufacturing process. If a coating is too thin, there will not be enough protection but if the coating is too thick, the strength of the magnet will be reduced.

To measure the coatings on magnets, there are two available methods: non-destructive testing or destructive testing.

Coatings can be measured *non-destructively* if:

- The magnet is unmagnetised AND
- the magnet is made of metal AND
- the metal is magnetic (attracted by a magnet)

Non-destructive testing can be carried out using the Elcometer 456F. The technique required is very straightforward – just zero and calibrate as normal on the bare metal and then measure the coating.

Coatings on non-metallic magnets must use a *destructive* test method.

For destructive testing, the Elcometer 121 Paint Inspection gauge can be used. A cut is made in the magnet coating and viewed through the built-in microscope. The numbers of reticule divisions that are across the coating layer are counted. Using the scale factor (number of µm or mils per reticule division) the coating thickness can be calculated.

Ensuring magnets have not been over coated, which reduces the magnetic properties, or undercoated which makes them susceptible to breaking, is a simple and accurate process with either destructive or non-destructive methods.

For more information visit www.elcometer.com

If you have any story you would like to see in the elconews e-zine

or have any comments or questions, e-mail: editor@elcometer.com

Covermeter for carbon steel & stainless steel rebar

Following the success of the Elcometer 331² Covermeter with Half-Cell, Elcometer are pleased to launch the new Elcometer 331² THD covermeter - the first gauge to accurately measure steel, stainless steel rebars and half-cell readings in a single gauge.

Due to their high resistance to corrosion from chlorides, the use of stainless steel rebars has become more common in recent years. As stainless steel is essentially non-magnetic, traditional covermeters cannot accurately detect them until now.

Alongside the traditional high tensile steel rebars the new Elcometer 331² THD can measure the three most common grades of stainless steel – Type 304 (also known as 18-8), Type 316 and Duplex Stainless Steel.

With the ability to measure corrosion potential, this is a must have gauge for your inspection portfolio.

All Elcometer 331² gauges are designed with intuitive menus in multiple languages and are rugged and waterproof to IP65, making them tough enough to work in the harshest of environments.

Key features of the Elcometer 331² THD include:

- Covermeter and Half-Cell readings from one easy to use gauge – easy to carry and costs significantly less than two separate instruments.
- Accurately locate and measure both high tensile steel and stainless steel rebar.
- Fully interchangeable search heads allow quick changes on site. This enables switching between measuring average cover thickness and a range of bar sizes, to locating tendon ducts and multiple layers of rebar lying up to 100cm (40”) deep within the concrete. The automatic head detection means there is no need to return the gauge to the factory.
- The Half-Cell kits are available as either a silver electrode in a silver chloride solution (Ag/AgCl) or a copper electrode in a copper sulphate solution ($Cu/CuSO_4$).
- Store up to 240,000 readings across 1000 batches of both cover and Half-Cell measurements on the same gauge.
- Stored data can be transferred to PC and into the supplied Covermaster® software, which provides the ultimate data management tool – store Covermeter and Half-Cell readings alongside other associated survey files such as photographs and spreadsheets. Tailor Covermaster® Software to produce professional, personalised and detailed reports that can merge cover and Half-Cell readings in a single report.

For further information e-mail sales@elcometer.com or visit our website at www.elcometer.com

Worldwide standards

Elcometer have identified approximately 330 current world standards for the products in the Elcometer catalogue. Keeping the list up to date is a huge task but essential. Standards and methods change as modifications and new technologies are introduced, while others are made obsolete.

Apart from the very well known organisations such as NACE, SAE and TAPPI there are many private standards too. These include the automotive industry (eg. Renaut, VW) coil coating (ECCA), as well as national standards such as AS, BS, DIN, JIS, NF and NFB.

Many of the smaller national and federal standards organisations are currently reducing their lists of original standards and using ASTM or ISO equivalents.

This can be seen from the ever-extending list of prefixes such as BS DIN EN ISO 8502. This is good for global trade and integration, which is a goal most are moving towards. Some of the rules involved in standards-making still need changing to bring everything together smoothly, but so far, the response has been very positive.

Standards documents have a copyright and they must be paid for. The money helps to compensate for some of the time and effort needed to develop and publish the standard. Anyone who wants to know if their work complies with a given standard, should therefore make a contribution towards it so that these organisations can keep up their good work – so please don’t ask Elcometer for a free copy!

For those times when a brief explanation is helpful, searching the internet provides a great source of information. At www.astm.org, a summary is provided for each standard including some international standards while www.pra.org.uk gives details of standard paint methods.

Elcometer are always here to help, so after searching the internet, if a particular test method cannot be found, send an e-mail to our Technical Support Department (techsales@elcometer.com) who may have some information in their library file.

Viscosity cup batch certificates

Elcometer viscosity cups are now being supplied with Batch Calibration Certificates. The batch certificates certify that each cup is one of a manufacturing batch,

which was tested on a sample basis to determine flow time of a single oil at 23°C. The result is representative of the performance of all cups in that batch.

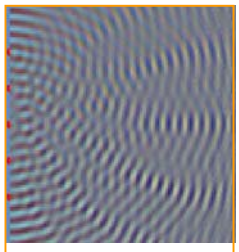
Individual calibration certificates for viscosity cups are also available and can be ordered at the same time as the cup. For more information on Elcometer viscosity cups, visit www.elcometer.com

Thickness of materials

Take the example of a cast metal product formed between two parts of a die. If one part were to move closer to the other during casting, the metal between them may be too thin for safety. In another example, if a pipeline looses metal inside due to erosion or corrosion, it could burst. The way to measure the thickness of these materials is by using ultrasound, which has the advantage of requiring access to only one side of the item.

TECHNIQUE

Ultrasound is in the frequency range above human hearing and is produced by a vibrating crystal of specific size and shape. Pulses of ultrasound form pressure waves, which are guided though ceramic or plastic to the sample. Because air attenuates these waves, a couplant such as a gel, oil or water makes the final connection. The wave continues through the sample until it reaches a change of elasticity or density. Often, this is the other surface of the sample where it is reflected.



Ultrasound from 5 points (often more) combines to form waves moving left to right.

One crystal sends pulses, the other receives echoes

Hardly any sound passes through this interface. The wave returns to the transducer a little later and weaker. A second guide collects it and transfers it to a second crystal, fixed within the same transducer, acting as a receiver.

The time delay between the pulse leaving and its return depends on its speed and the distance travelled. The thickness of the material is calculated from the wave's velocity (speed) and the time taken to return. The result is shown on the display. Calibration adjusts this reading to match actual thickness by varying the velocity factor.

MATERIAL PROPERTIES

The main variables that affect the propagation of ultrasonic waves in a material are elasticity and density. A good material is glass, which behaves rather like steel, often better. Rubber is bad as is low density plastic. Material such as Fibreglass (FRP, GRP) is not homogenous; it scatters the waves and can change their speed.

TYPES OF TRANSDUCER

There is a choice of frequency and size, depending on the application. By far the easiest way to find which transducer is best for a particular job is by trial and error.

Measurement range does not begin at zero for a number of reasons. One is because the receiver cannot 'hear' while the transmitter is sending a pulse of ultrasound. Another reason is that a short way away from the probe, the pressure wave is still forming as the emissions from near one end of the diameter add and subtract with those near the other end (picture, left). At lower frequencies, this can represent some millimetres of un-measurable thickness. At high frequencies, this 'near zone' is much less.

Various ultrasonic transducers

High frequencies travel well in hard rigid materials such as aluminium but are attenuated in thick plastic and scattered in crystalline materials such as cast iron.

Low frequencies can travel further but produce a blunter pulse giving a lower resolution.

The diameter of the face of the transducer controls how much sound enters the material. A large **diameter** produces a more focussed beam but for pipes, a small one helps concentrates more of the energy into the line of contact.

CHOOSING A TRANSDUCER

Sometimes, a variety of these factors affect the way a particular type of transducer works on a given sample. Experimentation is always preferred but a simple starting point for steel is to choose a 5MHz one with a medium face. It will even perform on polyethylene up to about 8mm thick.

Thin plastic is best measured with at high frequency transducer fitted with a graphite delay line, within which the sound pressure forms into a coherent wave. It takes some time for it to come out hence the word 'delay' but this is taken care of in the calibration. For measuring thin metal, an acrylic delay line is used instead.

CHOICE OF GAUGES

Elcometer 205 is a basic thickness gauge and has a Scan Mode, which allows the operator to move or rotate the transducer a little on the test surface. When the probe is lifted, the thinnest value found is displayed.

Elcometer 206 has more. The Alarm Mode indicates readings outside of specification. Each displayed reading can be transferred to a data collecting system. And in the Elcometer 206DL version, readings are stored in a matrix.

Coated metal is measured with Elcometer 208, which ignores up to 2mm on steel. For thin plastic and metal, we choose the Elcometer 207.

If you would like to make a contribution to the **elconews e-zine** or is there is a subject you would like to see covered, e-mail us at: editor@elcometer.com

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