

ICOR™ - A NOVEL WIRELESS CORROSION RATE MEASUREMENT DEVICE

“iCOR™ is based on more than eight years of research and development at Giatec. We have been overwhelmed with the global interest from the industry to use iCOR for various condition assessment projects. We are excited to see that our customers are saving time in their projects and can offer a more accurate measurement of corrosion activity using this novel NDT device.”

– Dr. Pouria Ghods,
President of Giatec
Scientific Inc.

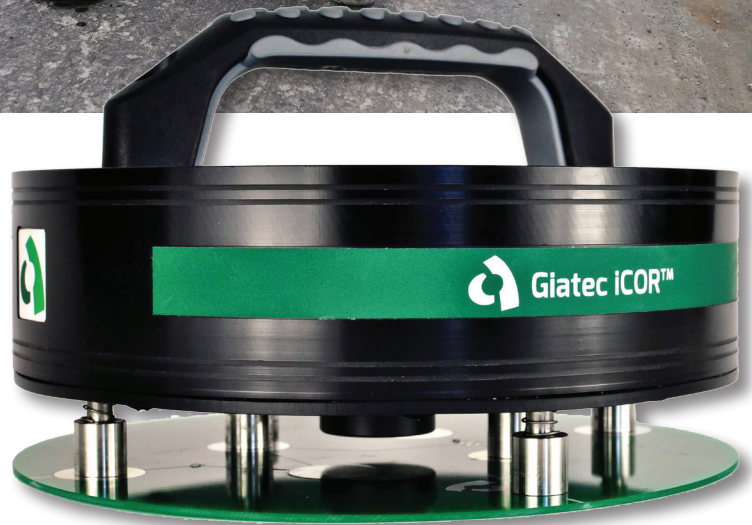


BY SHAYE-LYNNE DODD,
GIATEC SCIENTIFIC INC.

The iCOR™ device, invented by the Giatec Scientific Inc., is a novel compact and comprehensive NDT tool (or non-destructive testing) for detailed corrosion evaluation of reinforced concrete structures. iCOR™ is unique in its ability to perform a three in one measurement. It is capable of measuring the corrosion rate of the rebar, half-cell corrosion potential, and in-situ electrical resistivity of concrete without the need to drill a hole to connect to the rebar directly.

This is especially advantageous in countries such as Japan, where iCOR™ is in high demand because this wireless technique ensures that their critical structures, such as nuclear facilities, are not damaged when performing measurements.

These measurements are critical in a successful rehabilitation project or the repair of concrete structures. Getting all three measurements with one



device is not only a huge time saver, but reduces the overall cost in the condition assessment of concrete structures and resources needed when other methods are used.

iCOR™ is able to be perform directional rebar corrosion measurement in both X and Y axis independently. It is also wireless, and as such, communicates the results via Bluetooth to a custom android application. The application processes the information and subsequently outputs the results in a very user friendly way. iCOR™ can generate real-time corrosion contour maps, then save and share this data with everyone

ABOVE

To take measurements the user simply needs to press on the point for which they want to perform the measurement and press run. The device only takes a few seconds (three to 10) to output the result.

INSET

The iCOR™ device is a non-destructive testing tool that reports detailed corrosion evaluations of reinforced concrete structures.

“This is my first experience performing corrosion detection and I am very happy with iCOR™. All the results obtained from iCOR™ have shown consistent results compared with other non-destructive testing methods. The application is very user-friendly, providing me very clear and useful information on-site, which allows me to perform time effective measurements.”

— Milad Moghaddas
- QuakeWrap Inc.
United States

There is no need to record anything on paper; the iCOR™ app saves all the data for reviewing and sharing at any time.

on the team. Data can be shared in PDF reports or CSV file formats, and exported by email or added to Dropbox.

How it works

iCOR™ measures the electrical response of the rebar inside the concrete, which is determined from the surface of the concrete with the use of four probes. Moreover, the technique that is used to measure the corrosion rate and concrete electrical resistivity makes iCOR™ inimitable in that it does not necessitate a rebar connection. This patented technology is called CEPPRA, which stands for Connection-less Electrical Pulse Response Analysis.

The technique is based on the different voltage responses that the corroded and non-corroded rebar have at low frequency impedance. Note that electrical impedance is the measure of the opposition, which a circuit presents to a current when a voltage is applied. That is to say, it is the complex ratio of the voltage to the current in an alternating current (AC) circuit.

The method consists of applying narrow DC/AC pulse currents through two outside electrodes and subsequently measuring the voltage response through the two outside electrodes. Note that the voltage response of a corroding rebar is different from that of a non-corroding rebar. The voltage of a non-corroding rebar increases in the low frequency zone of the plot, but it is almost invariable for a corroding rebar. The basis of this concept has been utilized in iCOR™ technology to detect the corroding areas of reinforced concrete structures from the surface of concrete. By using the input current, the recorded voltage value and a very complex algorithm, iCOR™ device is able to calculate the state of corrosion in the reinforcement.

From a user standpoint, the operator first needs to define a grid on the reinforced concrete structure. The next step would then be to create a grid on iCOR™ pre-installed application which is downloaded onto their Android



device, and input the required information about the rebar size and cover thickness.

To take measurements the user simply needs to press on the point for which they want to perform the measurement and press run. The device only takes a few seconds (three to 10) to output the result.

Research and statistics

To date, there is no standard in place for corrosion rate measurement. The only standard that is available for corrosion detection is for the Half-Cell Potential test (ASTM-C876). This being said, Giatec is currently collaborating with various university research groups in order to compare iCOR™ results with the real mass loss testing and in turn, provide a basis for a standard on corrosion rate measurement.

Other researchers have shown that in comparison to other devices currently on the market or other measurement techniques, iCOR™ had demonstrated superior spatial accuracy. That is, the results were not affected by having very closely spaced reinforcement—unlike other NDT techniques. iCOR™ has proven to be very efficient in localizing low/passive corrosion in the reinforced structures.

It has been observed that iCOR™ does not polarize the reinforcement that it is analysing so you are able to repeat measurements over the same point directly after one another. Comparatively, other techniques can take hours before one has the ability to make a new measurement over a same location.

Why choose iCOR™ for your corrosion rate measurement needs?

As noted, iCOR™ provides a great deal of advantages over other devices in the market. The biggest selling point is that unlike any other device available, iCOR™ does not require a connection to the reinforcement. This makes iCOR™ the most convenient corrosion rate measurement device in the field, as well as offering an innovative research tool for laboratory studies. iCOR™ uses wireless technology in order to transmit data to a tablet. This data can then be stored, analyzed and visualized.

The tablet app that is used, which is conveniently pre-installed on the tablet, offers a powerful post-processing tool and an easy way to share the results with other team members. There is no need to record anything on paper and the app saves all the data for reviewing and sharing at any time. It is by these means as well that iCOR™ can significantly save time, human resources and cost in the condition assessment of concrete structures. Further, since iCOR™ is an application-based device, any improvements or upgrades can be easily implemented through the upgrade of the application itself.

This unique NDT device allows engineers to have a very comprehensive understanding of the concrete quality and corrosion activity, which assists in the decision-making process with regards to the rehabilitation and repairs that are required for concrete structures. Though very comprehensive, iCOR™ is extremely easy to use and as such requires minimal training! ●

YOUR INNOVATION HERE

Do you have an innovation that you want building science professionals to know about? If yes, email editor@matrixgroupinc.net and put “Western Exteriors” in the subject line. We may feature your innovation in our next issue or on our Facebook page.