EXPERIMENT 7

Non-Destructive Evaluation of corrosion rate

OBJECTIVE

To study non-destructive evaluation of corrosion rate in bare rebar and reinforced concrete using piezo sensors via EMI technique.

OVERVIEW

Corrosion of steel reinforcement is one of the main causes of damage and premature failure of reinforced concrete structures, increasing costs for inspection, maintenance, restoration, and replacement of the infrastructure. Conventional approaches for detecting corrosion are based on electrochemical techniques such as half-cell potential, impedance spectroscopy, and linear polarization. These techniques are affected by a number of factors and require direct contact with concrete/steel interface. To overcome this problem, a new corrosion assessment approach based on the electro-mechanical impedance technique is presented in this animation. Figure 1(a) and (b) presents the experimental setup for NDE of corrosion rate in bare rebar and reinforced concrete respectively.

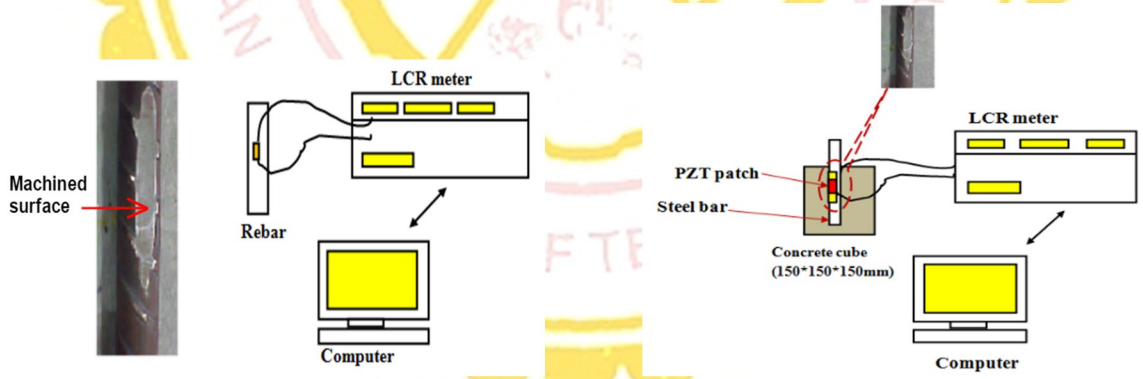


Figure 1: Experimental setup for (a) non-destructive evaluation of corrosion in bare rebar (b) non-destructive evaluation of corrosion reinforced concrete

In non-destructive evaluation of corrosion rate in bare rebar following components are used:

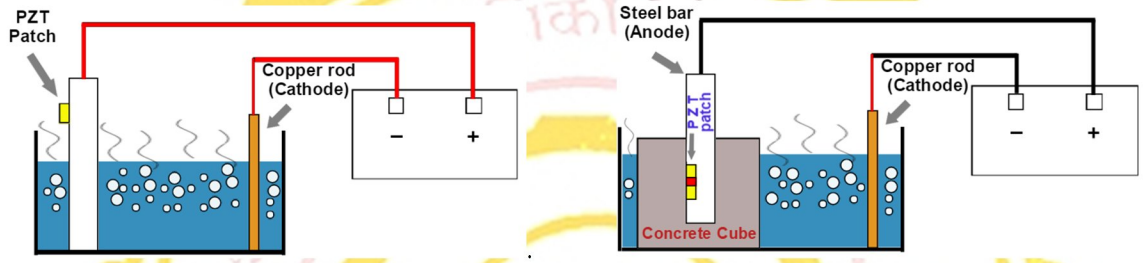
- Copper rod acting as Cathode.
- Bare rebar acting as Anode.
- PZT bonded to Copper rod which is further connected to Voltage meter by elctrodes.

- Beaker containing brind solution. Slightly below than PZT, whose salinity is 35 parts per thousand.

Similarly for non-destructive evaluation of corrosion rate in bare rebar following components are used:

- Copper rod acting as Cathode.
- Concrete cube containing a rebar which is placed inside it in the center acting as Anode.
- PZT bonded to Copper rod which is further connected to Voltage meter by elctrodes.
- Beaker containing brind solution. Slightly below than PZT, whose salinity is 35 parts per thousand.

The setup for accelerating corrosion for bare rebar and reinforced concrete is shown in figure 2(a) and (b) respectively



(a) (b)

Figure 2: (a) Accelerating corrosion for bare rebar (b) Accelerating corrosion for reinforced concrete

The corrosion rate (mm/year) can be calculated as

$$\Delta_c = \frac{(K * \Delta m)}{(a * T * D)}$$

where K is a constant equal to 8.76x104, Δm is the mass loss in grams, a is the area in cm2, T is the time of corrosion exposure in hours and D is the density of steel i.e.,7.8g/cm3.

REFERENCES

Talakokula, V., Bhalla, S., and Gupta, A. (2014) "Corrosion Assessment of RC Structures Based on Equivalent Structural Parameters Using EMI Technique", Journal of Intelligent Material Systems and Structures, Vol. 25, No. 4 (Mar), pp. 484-500.

Literature on piezoelectric sensors: http://ssdl.iitd.ac.in/vssdl/piezo.pdf