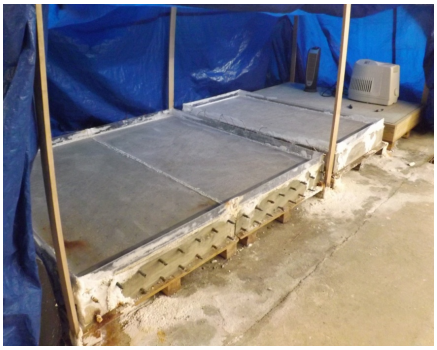
Modeling Half-cell Potential Measurements of Corroded Reinforced Concrete Slabs for Corrosion Detection

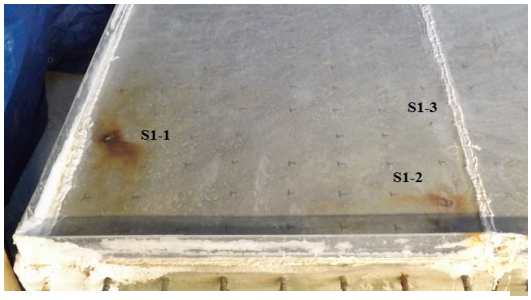
- **Abstract:** Monitoring of steel corrosion in reinforced concrete (RC) structures is one of the greatest challenges facing civil engineers today. The half-cell potential (HCP) method offers a standardized way to estimate the level of corrosion potential in RC structures. A modified Southern Exposure Test was performed and HCP measurements were experimentally collected. Temporal and spatial distribution of HCP data was modeled for better understanding how steel corrosion propagates inside RC structures.

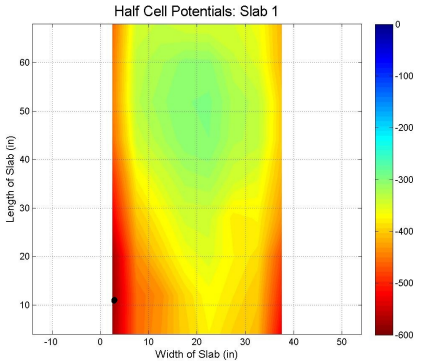
- **Theoretical background:** HCP is the difference in potential created when electrons transfer between a metal and its salt across a boundary. The HCP values are read from a voltmeter, then the likelihood of corrosion can be determined based on the HCP reading [ASTM C876].

HCP sensor used in SERG



- **Results:** Weekly, accelerated artificial corrosion test was carried out for 52 weeks since 2012. Steel corrosion was monitoring using a HCP sensor. Surface rust was also observed at various location on RC slabs. Current density I_i was also calculated.





$$I_i = \frac{1}{B\Delta L_i}\Sigma_{j=1}^{n}\frac{\delta E_{i,j} B\Delta L_j}{w\delta L_{i,j}}$$

- **Conclusion:** i) HCP varies with distance from the voltmeter and location on the slab; ii) Concrete cover significantly affects the current density in the rebars at the time of measurement.

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- **Ref:**

- **Wilson**, J., Master's Thesis, Dept. of Civil & Envir. Eng, UMass Lowell, June, 2013.
- **Wilson** and Yu, *Proc Symp Appl Geophys to Engng Envir Prob (SAGEEP)*, Mar. 17-21, Denver, CO, 2013.

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