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Laboratory Simulation of Subway Dynamic Stray Current Interference with Cathodically Protected Structures

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Abstract : Dynamic stray currents tend to change their magnitude and polarity with time at their source which will create anodic and cathodic spots on a nearby interfered structure. To date, one of the biggest known dynamic stray current sources are DC traction systems. Laboratory simulation is a suitable method to apply theoretical principles in order to identify effective parameters in dynamic stray current influenced corrosion. Simulation techniques can be utilized for various mitigation methods applied in a small scales for selection of the most efficient method with regards to field applications. In this research, laboratory simulation of potential fluctuations caused by dynamic stray current on a cathodically protected structure was investigated. A lab model capable of generating DC static and dynamic stray currents and simulating its effects on cathodically protected samples were developed based on stray current induced (contact-less) polarization technique. Stray current pick-up and discharge spots on an influenced structure were simulated by inducing fluctuations in the sample's stationary potential. Two mitigation methods for dynamic stray current interference on buried structures namely application of sacrificial anodes as preferred discharge point for the stray current and potentially controlled cathodic protection was investigated. Results showed that the application of sacrificial anodes can be effective in reducing interference only in discharge spot. But cathodic protection through potential controlling is more suitable for mitigating dynamic stray current effects.

Keywords : simulation, dynamic stray current, fluctuating potentials, sacrificial anode
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