EVALUATION OF REMOTELY MONITORED BATTERY POWERED SYSTEMS FOR CATHODIC PROTECTION OF REINFORCED CONCRETE

PROBLEM STATEMENT

Previous work conducted by the Florida Department of Transportation (FDOT)[1] has demonstrated the feasibility of using compact, long-life batteries as power supplies to provide cathodic protection to reinforced concrete bridge substructures. The final report for that work observed that to make the system more practical, some means of adjusting the output voltage was needed. It also showed that there was a need to be able to remotely determine when the batteries could no longer provide sufficient voltage and/or current to protect the reinforced concrete structure. Subsequently, a commercial supplier began to develop a wireless Modular Cathodic Protection System (MCPS) that incorporated the recommendations of the report using the already tested batteries.

OBJECTIVES

This purpose of this research was to evaluate the basic performance of a wireless modular cathodic protection system and to identify needs for future development. Developers of the system incorporated the desired features into a system prototype.

Specific objectives included the following:

- develop evaluation procedures
- implement field installations of the system
- analyze the performance of the system

FINDINGS AND CONCLUSIONS

The system was tested under controlled laboratory conditions and at an actual cathodic protection field site. The field site was the Dunn's Creek Bridge in Jacksonville. The field test involved two remote units and one base unit. After initial field and laboratory testing, an improved MCPS design was implemented and field testing continued for a period of seven months.

The two remote units performed equally well with respect to communications, although one unit was positioned in a highly adverse location to successfully transmit data to the base unit. This suggests that the distance between the remote and base units can be increased if necessary, provided the units are kept as closely in a direct line of sight as possible. The findings indicate that the MCPS has the ability to provide adequate cathodic protection to concrete structure components and can provide information on the status of the cathodic protection system wirelessly. Extended testing is necessary to ascertain performance over a time frame representative of actual applications.

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[1] Powers, Rodney, et. al., *Evaluation of Galvanic Battery Power Supply for Cathodic Protection*, 2001.

Improvement of the circuitry efficiency is needed to minimize current drain on the batteries and achieve practical operating periods. Enhancements should also be made to the dependability of the system by the use of two-way communication. Compatibility of the MCPS with data loggers and other support equipment is essential. The system would also benefit from the use of more robust switches and other electronic components than those provided with the prototype. Under normal use, these devices will be mostly used in aggressive marine environments, which are extremely severe on electronic components.

BENEFITS

The MCPS is a prototype of a much-needed monitoring element of battery-operated cathodic protection of FDOT bridge piles at locations where conventional grid-powered corrosion protection is unfeasible or not economical. Without a means of remote monitoring, protection systems may be inadvertently idle for extended periods, during which time the piles may experience undetected levels of deterioration. Repairs to corrosion damaged piles in marine bridge substructure are very expensive, and an efficient monitoring system will enhance protection reliability significantly (i.e., monitoring and maintaining effective protection are less expensive than having to repair damaged piles; in addition to the attendant safety benefits). This investigation demonstrated the feasibility of a wireless monitoring approach and revealed critical performance features that need to be implemented in future production units. The result will be improved performance in the protection of piles that are an integral component of the large inventory of FDOT marine bridges.

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