

## **Testing Protocol for Manhole Coatings**

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**Abstract:** Since coatings are being applied to leaking manholes, it is critical to evaluate the coating performance near field conditions. Hence a test protocol has been developed to test the coating under varying hydrostatic pressure to determine effectiveness of coatings to control leak with minimal deformation and/or blisters. Also the tensile bonding of the coating to the substrate will be quantified.

### **1. Introduction**

Manholes are used to access and also to allow aeration of drain or sewer systems conveying sewage or surface water under gravity. During rainy season, the hydrostatic pressure on the concrete manhole due to raising water table could increase and the manhole should be strong enough to withhold such high water pressure. The bonding between manhole and coating must be high enough to prevent water infiltration into the manhole. For testing the performance of manhole coatings, at present no there is accepted method available. Coatings are used to rehabilitate manholes and other infrastructures and hence will be subjected to the external hydrostatic pressure. Hence the performance of the coatings must be evaluated using full-scale tests. The performance of the coating of manhole could be perfectly evaluated by observing the movement of coating under various hydrostatic pressures. The hydrostatic pressure can be applied gradually up to a pressure of 11 psi.

### **2. Objectives**

To develop a test protocol to evaluate the performance of coatings applied to leaking manholes.

### **3. Literature Review**

ASCE document on Manhole Inspection and Rehabilitation (Hughes, 2009) identifies several methods for repairing manholes such as coating, lining the surface of manholes and chemical grouting. The document recommends a minimum thickness of coating of at least 0.05 inch. For coatings and liners the document recommends the following ASTM standards for surface preparation. (ASTM D 4258 for surface cleaning concrete for coating; ASTM D 4259 for surface preparation of abrading concrete). This document also summarizes a couple of more guidance (SSPC SP-13 & ICRI 03732) for the performance and inspection of concrete surface preparation. For polymer coating thickness measurement, it recommends ASTM D 4414 which specifies standard practice for measurement of wet film thickness by Notch gauges. It also recommends ASTM D 4787 test method for continuity verification of sheet linings applied to concrete substrates. For testing pull-off strength of coatings, it recommends (i) ASTM D 4541 or (ii) ASTM D 7234. EPA document summarizes various products used for manhole rehabilitation (Sterling et al., 2009). However in this report no test method has been recommended to evaluate the performance of the products used. WEF manual discusses about coating systems and structural linings used for rehabilitation of manholes (Oman, 2000). It recommends ASTM C 267 test which deals with standard methods for chemical resistance of mortars, grouts and monolithic surfacing and polymer concretes. Also it recommends ASTM C 321 for testing bonding of coating applied on concrete which is the same method that was used by CIGMAT for the past 15 years. However this manual did not mention any test method for testing the performance of coating under hydrostatic pressure.

### **4. The Summary of the Test Protocol is as Follows:**

- (i) The manhole is kept under water for at least 7 days before applying the coating.
- (ii) Prepare the ends of the manhole to seal the edges for leaks during testing.

- (iii) After applying the coating, the manhole is placed in a full scale test chamber. Hydrostatic pressure will be applied by filling the annular space between the outside chamber and manhole.
- (iv) Initial readings of coating with respect to the steel rods will be taken using a vernier caliper (accuracy of noted 0.001”).
- (v) As specified, the hydrostatic pressure will be gradually increased and the deformation of the coating will be closely observed by measuring the spacing between the steel rod and coating (Figure 1).
- (vi) Leaking of water through the coatings will be quantified.



**Figure 1: Vernier caliper used for deformation measurement**

- (vii) The tensile bonding strength of the coating to the manhole material (example concrete, clay brick) will be determined using the CIGMAT CT-3 testing method.

## **5. Conclusion**

Since this protocol includes full scale pressure testing on coated manholes and quantifying the bonding characteristic of coatings, the performance of manhole coating can be evaluated using this test protocol.

## **6. Acknowledgement**

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## **7. References**

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