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5.16 CHLORIDE ION TESTING

5.16.1 Introduction

Chloride ions are the major cause of reinforcing steel corrosion in concrete, especially in Wisconsin. Chloride ions are most often provided from road salt, although they may also be available as contaminants in the original concrete mix. Similar to carbonation, chloride ions destroy the passivation layer surrounding the reinforcing steel which protects it from corrosion. Although present, these chloride ions are not likely to cause problems unless they exist in unusually high concentrations. Since corrosion of steel reinforcing is generally considered to begin at a chloride ion content of between 0.025 percent and 0.033 percent by weight of concrete, knowledge of chloride content can aid in determining the likelihood of the onset or presence of corrosion.

In evaluating chloride content, it is recommended that a chloride profile (chloride concentration percentage versus depth measurement below the concrete surface) be developed. This profile is important for assessing the future corrosion susceptibility of steel reinforcing and in determining the primary source of chlorides.

The chloride content in concrete is typically determined through laboratory analysis of powdered concrete samples. The powdered samples can be obtained on-site or in the laboratory. Field collected powdered samples are typically taken by drilling at different depths down to and beyond the level of the reinforcing steel. Extreme care should be exercised to avoid inadvertent contamination of the samples. Alternatively, cores can be collected and powdered samples can be obtained at different depths in the laboratory. The collection of these samples in essence actually destroys a portion of the component making this test procedure similar to Material Sampling as described in Chapter 23 of Part 5. However, since this test can be performed in the field and results obtained quickly, it has been separated from the material sampling section.

The chloride ion content of concrete is usually measured in the laboratory using wet chemical analysis. Although laboratory testing is the most accurate, it is time consuming and often takes several weeks before results are available. As a result, field test kits have been developed. The use of field test kits allows rapid determination of chloride levels to be made on-site. Although the field kits are not as accurate as the laboratory method, they do provide good correlation with laboratory tests when a correction factor is used.

The detailed procedure for chloride sampling and testing is covered in American Association of State Transportation and Highway Officials (AASHTO) T 260-84; “Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials” and in American Society for Testing and Materials (ASTM) C114-00; “Standard Test methods for Chemical Analysis of Hydraulic Cement.” However, both of these publications apply to testing in the laboratory, not in the field.

5.16.2 Applications

Chloride ion testing can be performed on any concrete component. Field kits allow inspectors to perform the test on-site and determine chloride levels immediately.

When samples are collected at different depths and plotted on a chloride profile chart, this method is a very useful tool in determining the depth of deck to be milled off prior to an overlay.

5.16.3 Limitations

Collecting samples to perform this test requires a portion of the concrete member be damaged and the tested area to be destroyed. Therefore, several samples can't be taken from a single location to validate results. This method is also a time consuming process, and requires access to the member. In the case of a bridge deck, the bridge may need to be closed to traffic during the sampling process.

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