

ABSTRACT

An Iowa D.O.T. Laboratory built machine was constructed for the chloride permeability testing of concrete by measuring electric current through a specimen between a salt solution and a base solution.

This study had two purposes. The first was to evaluate the machine's performance. To do this, three concrete mixes were made consisting of different cement factors and water/cement ratios. Each mix was tested for chloride ion content by the 90-day salt ponding method and for chloride permeability at a 28-day cure by the permeability machine. The results from each test were evaluated to see if there was correlation between chloride ion content and the chloride permeability. It was determined that there was a correlation and that the permeability machine was satisfactory for determining chloride permeability in concrete.

The second purpose of this study was to examine the effects that pozzolans have on the chloride permeability of concrete. Four mixes were made: one without any pozzolans as a control, one with class C fly ash, one with class F fly ash, and one with silica fume. Specimens from each mix were evaluated for chloride ion content by the 90-day salt ponding test and by the laboratory built machine for chloride permeability after curing 28 days. Specimens from these mixes were also taken from the salt ponding slabs after completion of the ponding test to examine the effect

CONCLUSIONS

Based on the data gathered in this study, the following conclusions are obtained:

1. The rapid determination of the chloride permeability of concrete by the Iowa D.O.T. laboratory built machine is a valid method to determine the chloride permeability of portland cement concrete in the laboratory.
2. The 28-day curing time for the concrete specimens tested in the chloride permeability machine appears to be an adequate time period to obtain satisfactory results for most concrete mixes. Concrete containing Class F fly ash caused

a significant drop in chloride permeability between 28 days and 180 days as measured by the permeability machine.

3. The addition of class C fly ash, class F fly ash, and silica fume to a concrete mix lowers the chloride permeability of concrete as measured by the permeability machine.

RECOMMENDATIONS

1. Consideration should be given to and including the chloride permeability test as an Iowa D.O.T. test method based on the testing procedures listed in this study and in AASHTO T 277-83.
2. The machine should be modified to test two or more specimens at the same time. This would be more efficient and allow for averages to be made between specimens to increase accuracy.
3. More study is needed to determine the concrete chloride ion content that would affect the chloride permeability test results.
4. An evaluation of chloride permeability of bridge decks and bridge deck overlays containing different types of pozzolans should be done.

5. Section 3.3 of AASHTO T277-83 states that care should be taken when interpreting the chloride permeability results of surface-treated concrete. Limited testing should be done to examine the effects of bridge deck sealers on the chloride permeability test.