

FIELD EVALUATION OF ACID-TREATED OPEN HEARTH
SLAG BASE COURSE
(I 75 - Dearborn St Interchange)
PROGRESS REPORT

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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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PROGRESS REPORT

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Testing and Research Division
Research Project 68 E-43
Research Report No. R-817

Michigan State Highway Commission
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Lansing, June 1972

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Introduction

Previous studies by the Research Laboratory concerning the suitability of open hearth slag (produced by the E. C. Levy Co.) for highway base construction have indicated:

1. Open hearth slag is subject to volume change due to chemical action and is more susceptible to frost heaving than 22A gravel.
2. Acid treatment of the slag, proposed as a corrective measure by the producers, does not alleviate volume change caused by chemical action and appears to increase susceptibility to frost action.
3. Open hearth slag is variable in composition and inspection control is difficult under present operations.

Although, laboratory and preliminary field testing indicate that the acid treatment does not benefit the slag to an appreciable degree, and might even be detrimental from a frost susceptibility standpoint, it was felt that sufficient field testing had not been performed to fully evaluate the acid-treated slag. At the request of M. N. Clyde a significantly large test section was constructed during October of 1971 in which an acid-treated slag base was compared with a base of standard construction using a modified 22A aggregate.

The test areas, shown in Figure 1, were located in and around a traffic island located at the interchange of I 75 and Dearborn St in Detroit. This site originally contained open hearth slag which had experienced severe distress and required reconstruction. Reference elevation points were carefully located and measured at the conclusion of construction so any horizontal or vertical movement of the control and slag sections could be measured periodically. The general appearances of the test areas as built is shown in Figure 2.

Field Test Results

The general appearance of the test area after one winter of exposure (March 29, 1972) is shown in Figure 3. Elevation data through March, 1972 are shown in Figure 4. These observations show that, to date, there has been no severe heaving of the slag area as was experienced on some previous jobs. These data do show, however, that the slag areas heaved through a range of $\frac{3}{8}$ to $1\frac{1}{4}$ in., values about two to three times those measured for natural aggregate. Figures 5 and 6 show local heaving areas in the slag section, some of which indicate possible future trouble. Such heaving appeared greatest near the interface of the aggregate and slag areas and in the narrow, more confined part of the test area. Gradation curves for the aggregate and slag are shown in Figure 7. It should be noted that the natural aggregate contained 10 percent minus 200 material.

Laboratory Test Results

Both volume change (at room temperature in the presence of moisture) and frost susceptibility tests were performed in the laboratory on samples of the slag and natural aggregates used in the field test sections. Results of these tests, shown in Figures 8 and 9 indicate greater volume change for slag samples in both tests. The data, however, show changes in the volume of the slag samples to be much less than similar test values obtained from previous studies. In fact, slag expansion, in the present study, using newly produced acid-treated slag, is no greater than the values obtained with aged slag in the earlier studies (Fig. 9). Because past laboratory tests have shown no improvement due to acid treatment the reduced volume change found in these studies might be due to the use of aged slag which was also present in the stockpile.

Conclusions

Because this job was constructed in October it has, so far, not been exposed to prolonged warm weather, a condition thought to accelerate expansion due to chemical action in the slag. For this reason significant conclusions concerning field performances of the slag section may not be available until this Fall. Furthermore, aging of the slag during the cooler months might have prevented expansion that could have taken place had the slag been placed during hot weather. Results, to date, do show, however, that volume change in the slag test area is greater than that in the natural aggregate section (a 22A material containing 10 percent loss-by-washing) and that this condition is duplicated by laboratory tests. Although there has been no severe heaving of the slag area, as was found in some previous construction, there are localized areas where future trouble is indicated.

It is recommended, therefore, that no changes in our present policy concerning the uses of open hearth slag as a base material be made until further observations on these test sections can be made, extending at least through the summer season and, preferably, through one more winter.

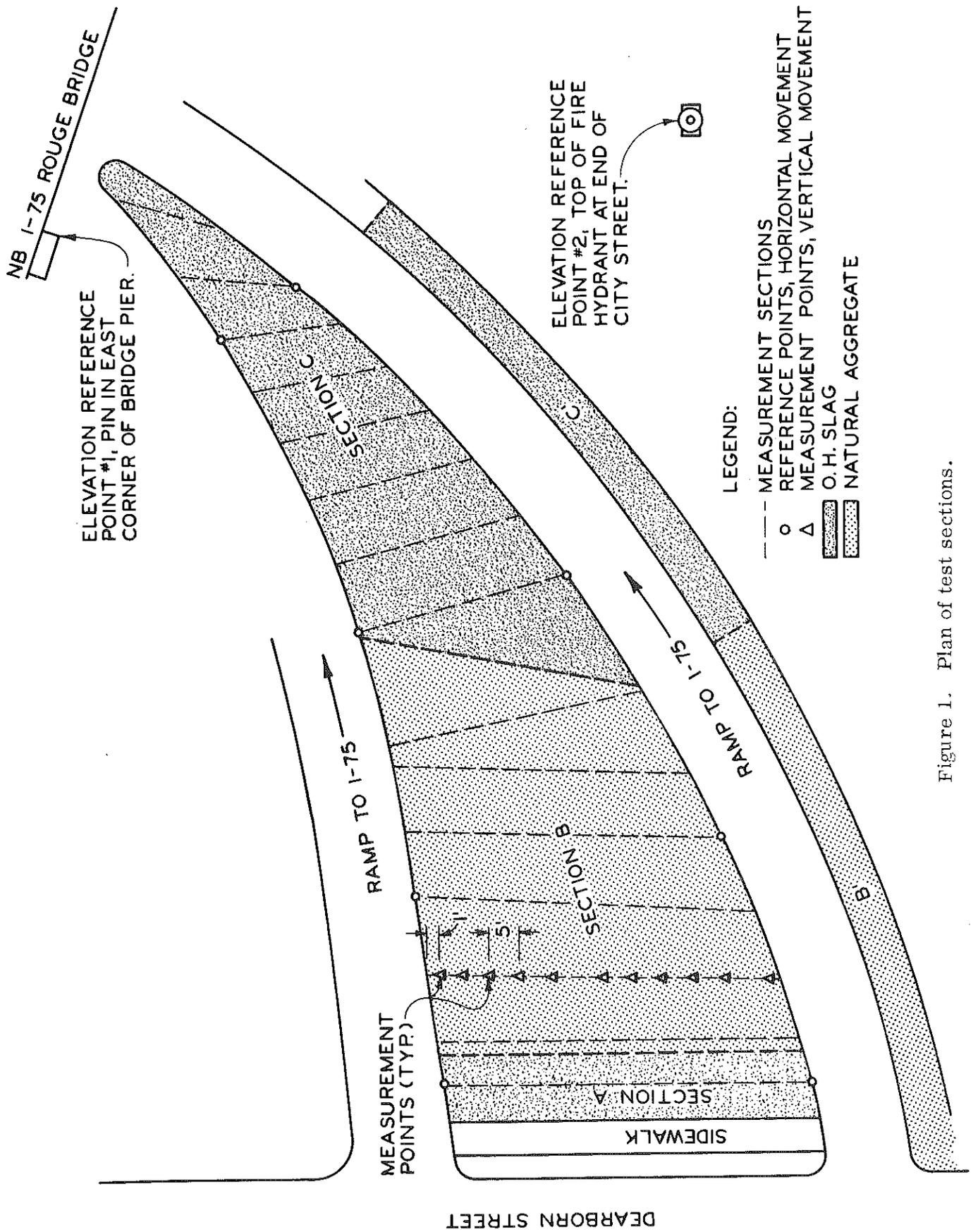


Figure 1. Plan of test sections.



Figure 2. General appearance of the test area after construction.

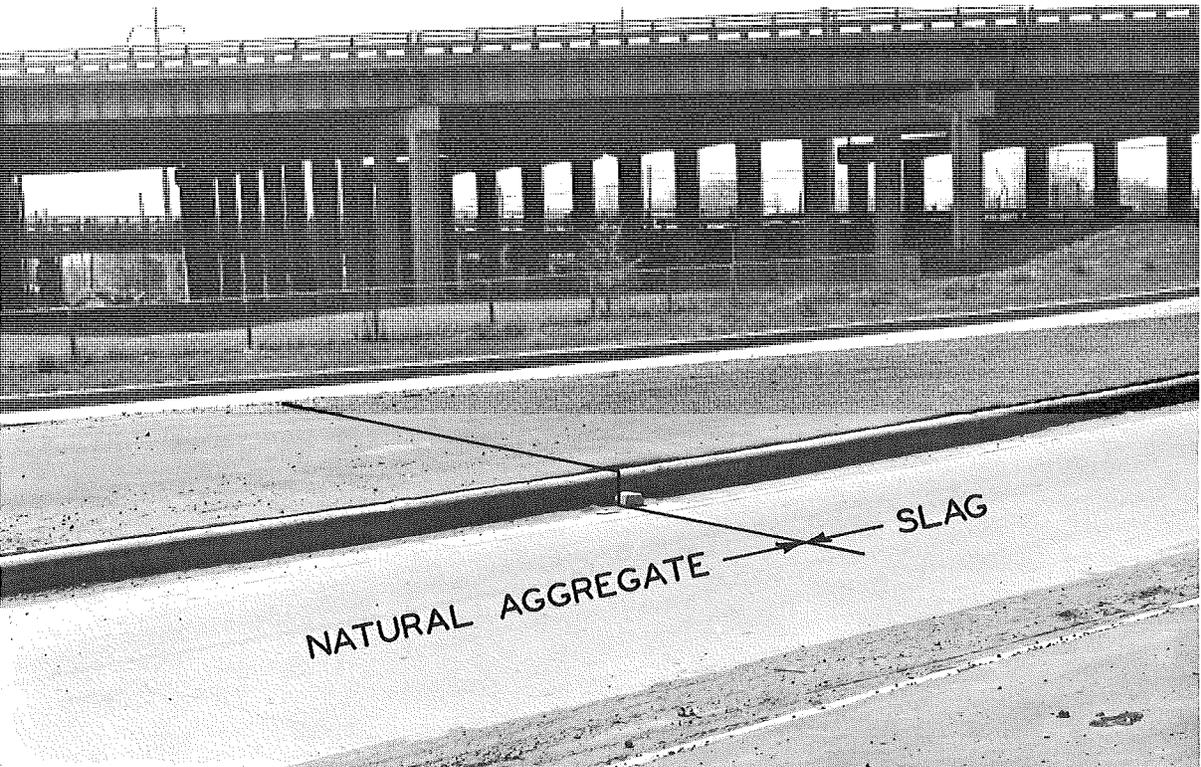


Figure 3. General appearance of the test area after one winter's exposure.

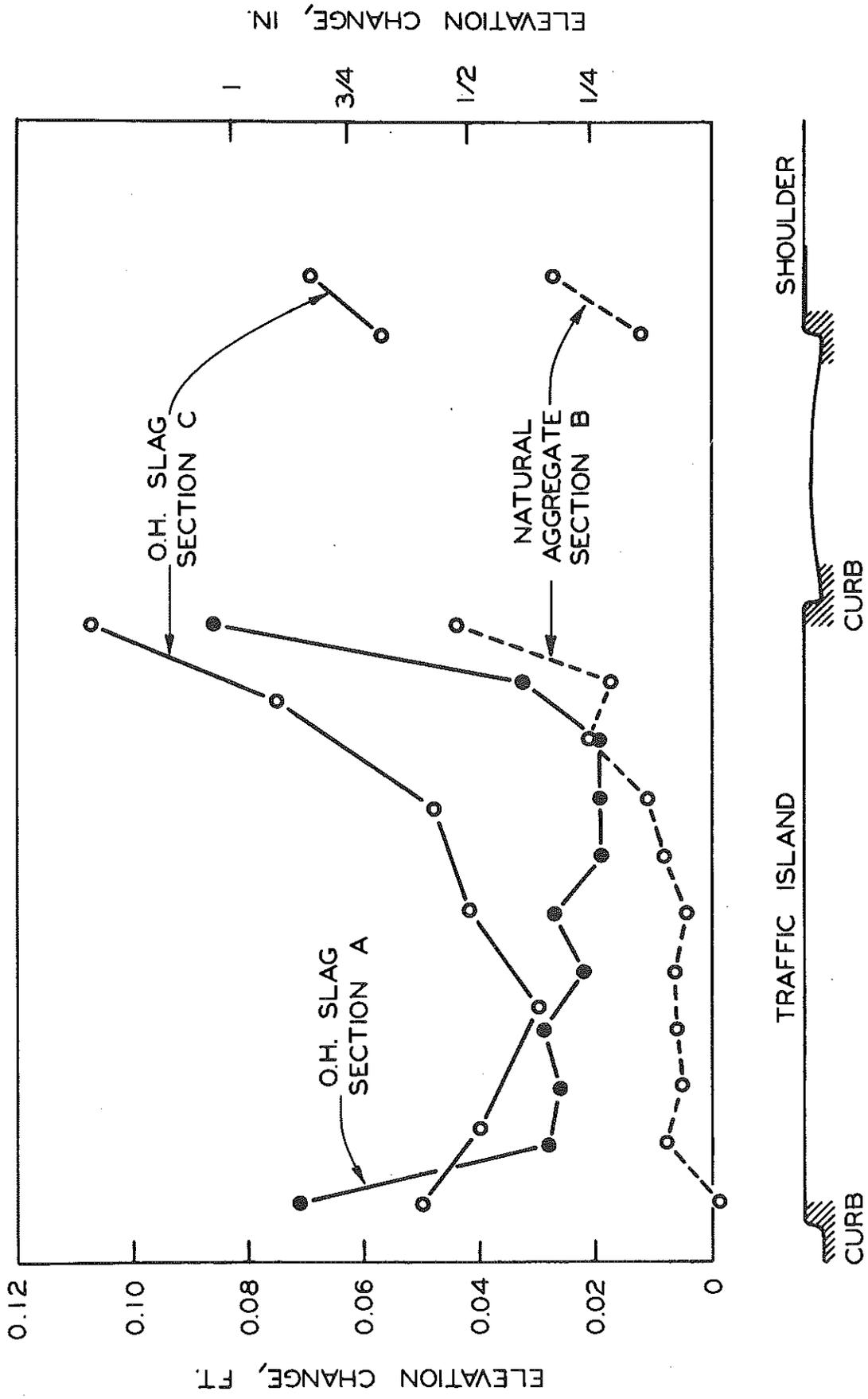
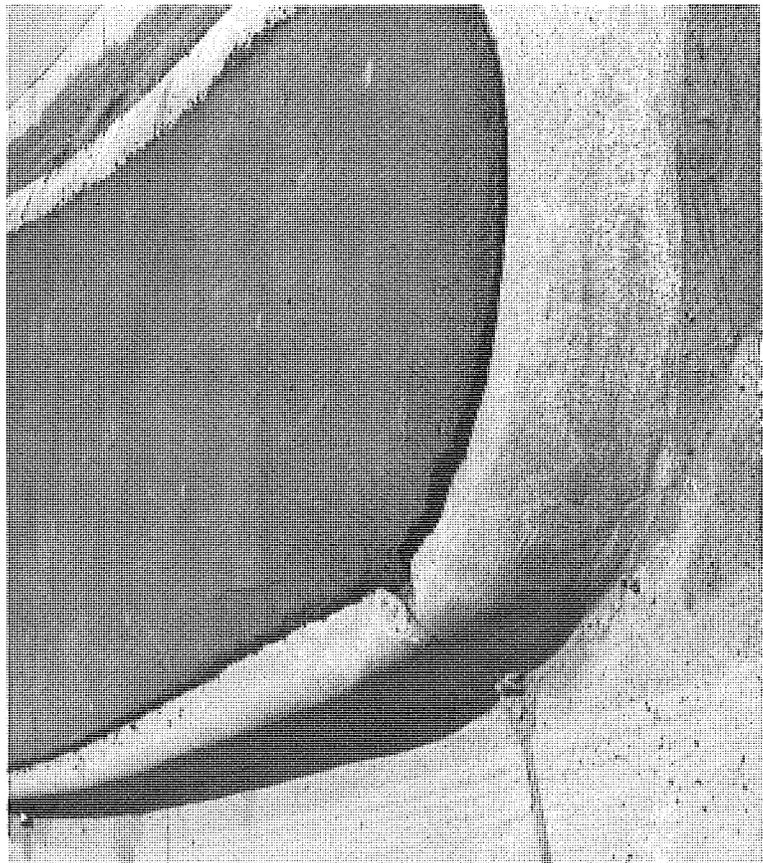
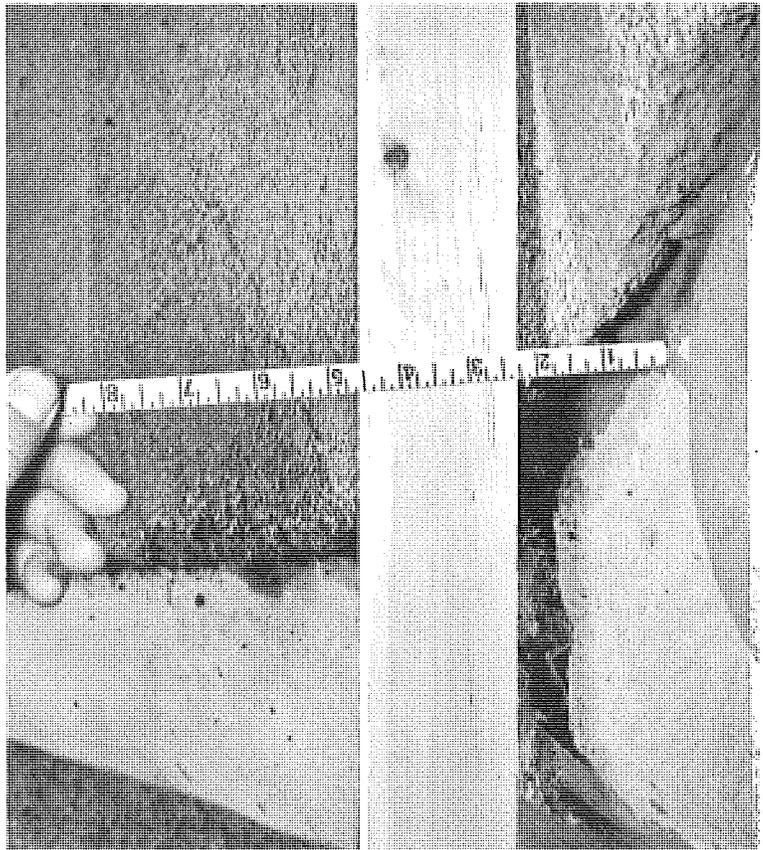
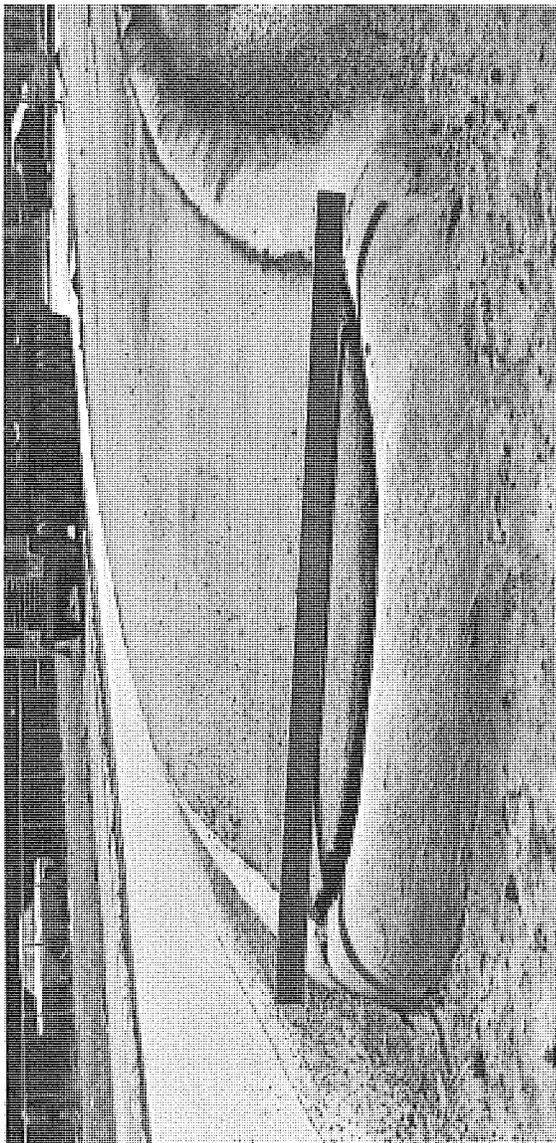


Figure 4. Maximum winter elevation changes (Oct. 1971 - March 1972).



Figure 5. Local heaving area in slag section at aggregate - slag interface.

Figure 6. Local heaving area
in slag section.



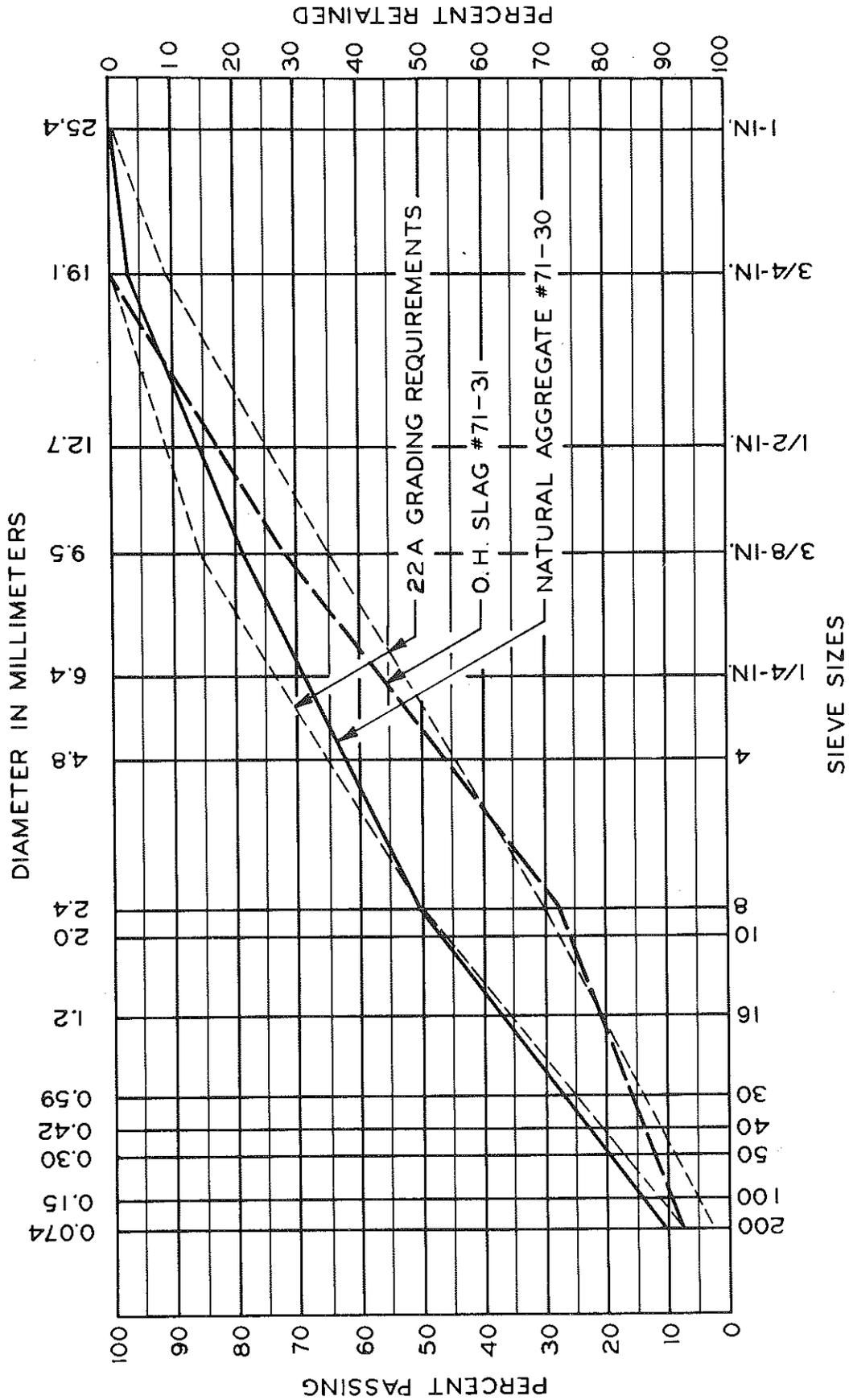


Figure 7. Gradation of the test aggregates.

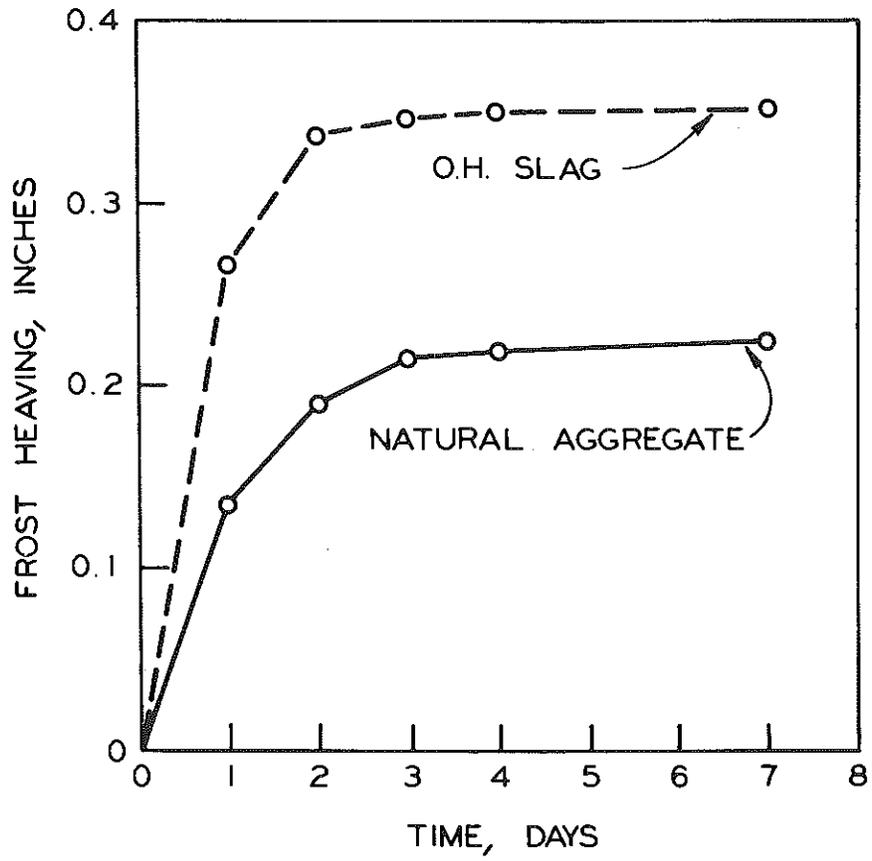


Figure 8. Laboratory frost susceptibility of base aggregates, Dearborn St. Island.

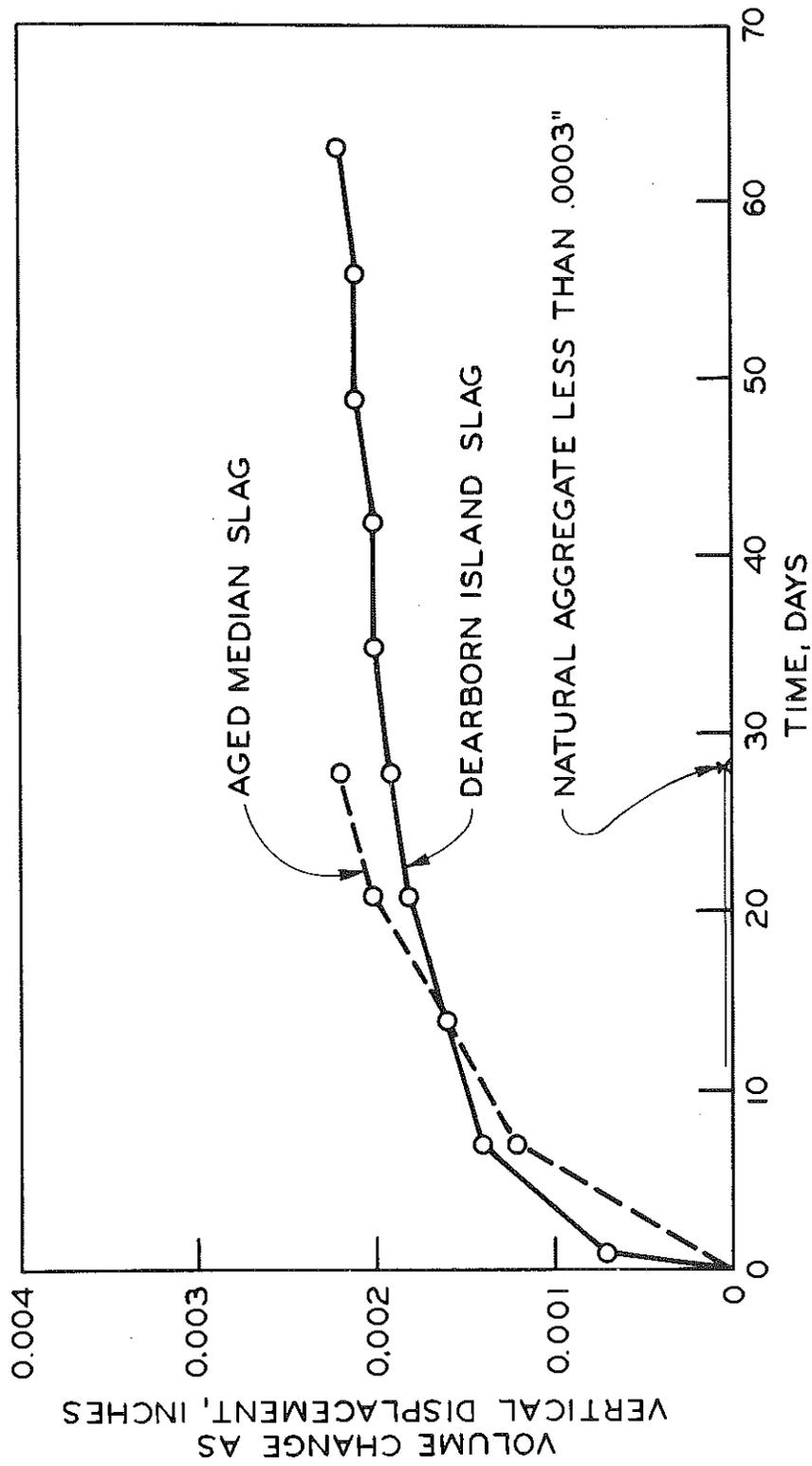


Figure 9. Laboratory volume change tests.