Use of Foundry Sand in Transportation Application

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Abstract

Foundry sand (FS) is a by-product of the metal casting industry. This study focuses on the evaluation of the geotechnical performance of backfills using waste foundry sand from various parts of Texas. Two applications were used for evaluating the use of foundry sand. One is flowable fill and the other is cemented sand. In addition, laboratory tests were conducted on the mechanical and environmental properties of the foundry sands. A detailed evaluation of flowable fill and cemented sand using the FS in Texas was performed by combining laboratory tests and field applications.

1. Introduction

The annually generated waste foundry sand in Wisconsin, Pennsylvania and Indiana are estimated to be 800,000, 365,000 and 450,000 tons, respectively (Tarun and Shiw, 1997; INCMA,1992). A survey undertaken by the authors and Texas Casting Metal Association (TCMA) showed that foundry sand available for reuse is 75,000 tons per year and over 80% of the waste foundry sand was produced by the ferrous foundry. The waste foundry sand used in this study was obtained from many parts of Texas. The physical, mechanical, and environmental properties were tested to evaluate the feasibility of using waste foundry sand in flowable fill and cemented sand applications.

2. Objectives

The overall objective of this study is to investigate the potential feasibility of using foundry sand in transportation application. Specific objectives are 1) to investigate the physical, mechanical, and environmental properties of waste foundry sand; 2) to evaluate the potential of using foundry sand in flowable fill and cemented sand; 3) to develop a design procedure for foundry sand application.

3. Testing program

The testing program was divided into two categories in order to determine the working and engineering properties of the flowable fill. The properties of the flowable fills that were determined are: (1) flowability; (2) unit weight; (3) pulse velocity; and (4) unconfined compressive strength. Changes in physical and engineering properties were studied over one year. The laboratory-testing program for cemented sand is similar to that used for flowable fill. The properties of the cemented sand measured were: (1) unit weight (2) specific electrical resistance (3) pulse velocity and (4) unconfined compressive strength.

4. Results

Based on the limited tests and literature review, relationships between compressive strength and water-to-cement ratio, compressive strength and cement content have been developed as shown in Fig.1, and Fig.2 respectively.

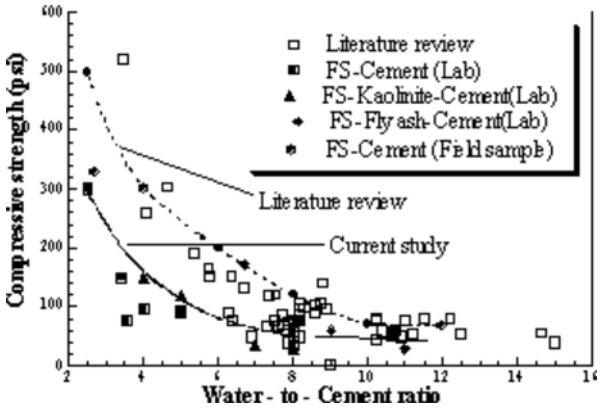

Fig.1. Strength vs. water-to-cement ratio (flowable fill)

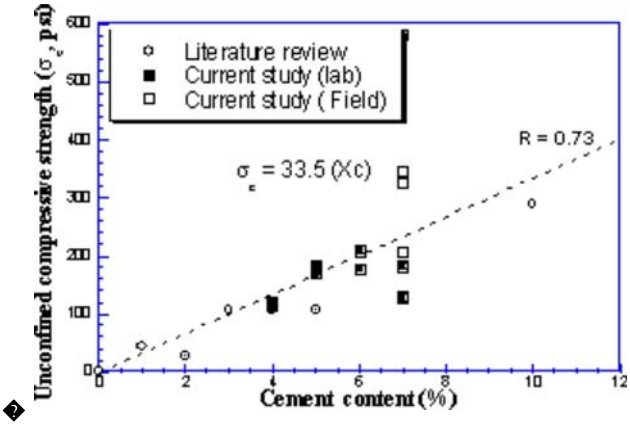

Fig. 2.Compressive strength vs. cement content (cemented sand)

5. Conclusions

This study investigated the potential of using foundry sand in transportation applications. Based on the experimental results and analysis of the test data, the following overall conclusions can be advanced:

1) Laboratory and field test results indicate that the foundry sand can be used in flowable and cemented sand applications.
2) The testing was limited to one year and hence long-term properties must be determined for the flowable fill and cemented sand.

6. Acknowledgments

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7. References

1) Tarun R. Naik, Shiw S. Singh,(1997) Flowable slurry containing foundry sands, Journal of materials in civil engineering, Vol.9, No.2, May, 1997.
2) INCMA, (1992) Indiana Cast Metals Association, Foundry Survey of 1991.
3) G.Wayne Clough, Nicholas Sitar, Robert C. Bachus, and Nader Shafii Rad(1981) Cemented sands under static loading, Journal of Geotechnical Engineering Division, Vol.107, No. GT6, June, pp. 799-817.
4)J.T.Huang, and D.W.Airey (1998) Properties of artificially cemented carbonate sand, Journal of Geotechnical and geoenvironmental Engineering, Vol.124, No.6, June, pp. 492-499.

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