OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT

November 17, 1966

To: R. L. Greenman
Assistant Testing and Research Engineer

From: E. A. Finney

Subject: Testing of Waste Lime from Bay City.
Research Project 58 E-17. Research Report No. R-614.

As requested in your memorandum of December 30, 1965, R. C. Mainfort arranged for testing of samples of waste lime from the Monitor Sugar Division of the Robert Gage Coal Company, Bay City, to determine their suitability as soil additives. The lime, a by-product of a beet sugar processing operating, is pumped as a slurry into large ponding areas which are built into stockpiles as the slurry dries. Disposal of these stockpiles is becoming a problem to the producers. Mr. Mainfort reports as follows.

Two 20-lb samples of the lime were obtained, one from the relatively dry material, used in this case as a dike for ponding freshly discharged lime slurry, and the other from the slurry as it was discharged into the pond. In this report these samples are designated as "stockpile" and "slurry," respectively.

Samples of each type of lime were submitted to the Spectroscopy and Photometry Section for chemical analysis. The limes were also tested in the Soils Laboratory with a Detroit Blue Clay, known to react well with normal hydrated lime. For this work five 2- by 2-in. cylindrical samples were molded with the following treatments:

a. no treatment
b. 5-percent stockpile lime
c. 5-percent slurry lime.

All percentages are based on the dry weight of the soil, and the lime samples were oven dried to constant weight prior to weighing. After molding, the samples were moist-cured for seven days and their unconfined compression strengths obtained. Atterberg limit tests were made for all conditions tested.

Table 1 shows the chemical composition of the two lime samples and indicates that they contain no calcium or magnesium oxides. (For normal construction purposes, ASTM specifications for lime require a minimum of 95-percent calcium and magnesium oxides.) All the calcium and magnesium present in these waste samples are in the form of carbonates, which are essentially non-reactive with clay minerals. The high sand content, especially that of 79 percent in the slurry sample, indicate that a substantial portion of the waste lime is sand, possibly mixed with silt.

The effect of the waste limes on the properties of the Detroit Blue Clay are shown in Table 2. Those results show that the Atterberg limits were changed only slightly, and resulted in a small increase in the plasticity index. The addition of ASTM specification lime normally exerts a significant influence on the Atterberg limits of a soil and usually reduces plasticity. Results of the compressive strength tests show that addition of waste lime reduced the compressive strength of the clay. Maximum density and optimum moisture of the clay were affected in a manner similar to that found when normal lime is added.

On the basis of chemical analysis and testing with Detroit Blue Clay, it is concluded that the waste lime used in this study has no potential value as a soil stabilizing agent.

H. B. Eldred, Executive Vice President of the Monitor Sugar Division, has requested that we send him copies of our laboratory results, if they can be released.

OFFICE OF TESTING AND RESEARCH

E. A. Finney

E. A. Finney, Director
Research Laboratory Division

EAF:RCM:jcb

TABLE 1
CHEMICAL COMPOSITION OF THE TEST SAMPLES

	Stockpile Sample, percent	Slurry Sample, percent
Acid insoluble material including silicon dioxide	8.9	77.0
Organic material	6.0	2.4
Calcium carbonate	80.1	18.7
Magnesium carbonate	2.1	1.0
Calcium and magnesium hydroxides	essentially none	
Iron and aluminum oxides	1.8	1.1
Calcium sulfate	0.7	0.2

The silica in the direct discharge material was largely sand rather than silicates.

TABLE 2
EFFECT OF WASTE LIME SAMPLE
ON PHYSICAL PROPERTIES OF DETROIT BLUE CLAY

Property	Treatment		
	None	5% Stockpile	5% Slurry
Dry Density at Molding, pcf	120.3	114.4	113.7
Percent Moisture at Molding	16.5	19.0	19.1
Percent Moisture after Curing (at Breaking)	17.4	19.6	19.7
Breaking Strength at 20-percent Deformation, psi	50.1	35.6	22.2
Standard Deviation, psi	3.5	1.4	1.4
Coefficient of Variation, percent	7.0	4.0	6.3
Liquid Limit, percent	31.5	31.8	32.8
Plastic Limit, percent	14.6	14.1	14.9
Plasticity Index, percent	16.9	17.7	17.9