OFFICE MEMORANDUM

DATE: August 22, 1977

TO: L. T. Oehler
Engineer of Research

FROM: R. W. Muethel

SUBJECT: Petrographic Analysis of Coarse Aggregate: Marblehead Quarry, Marblehead, Ohio (Testing Laboratory Sample No. 77 A-426). Research Report No. R-1070.

On April 20, 1977, a sample of crushed stone coarse aggregate was received by the Department's Testing Laboratory at Ann Arbor. Information accompanying the sample stated that the material was obtained from a stockpile at the Standard Slag Company Marblehead Quarry located at Marblehead, Ohio. The material was submitted to the Laboratory for freeze-thaw durability testing. Petrographic analysis of a portion of the sample was requested by G. H. Gallup.

Summary

Rock Class	Condition of Particles	Percent of Sample
Sedimentary, Carbonates	Moderately hard to soft, fresh, porous to non-porous	100

The material in this sample was found to have a composite absorption of approximately 4 percent. Approximately 50 percent of the material is contained in a sample fraction having an absorption of approximately 5 percent.

Detailed tabulations of petrographic composition, specific gravity, and absorption are included in Tables 1 and 2.

Detailed Petrography

Petrographic examination was conducted in general conformance with ASTM C295, "Petrographic Examination of Aggregates for Concrete." Representative portions--300 particles--of each sieve fraction of the sample were identified megascopically, along with acid testing and a scratch test for hardness, and microscopically with a stereomicroscope. Specific gravity

and absorption determinations were performed in general accordance with ASTM C127, "Specific Gravity and Absorption of Coarse Aggregate." Determinations included all material analyzed.

Due to the abnormally high porosity of material in this sample classification of the carbonate rock subtypes by comparative acid-effervescence was found to be unreliable due to release of entrapped air during acid testing. Such subtypes are reported as combined categories.

The following pages contain the rock type descriptions.

TESTING AND RESEARCH DIVISION

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TABLE 1
PETROGRAPHIC COMPOSITION
Testing Laboratory Sample No. 77 A-426

Rock Type	Sieve Fraction Analyzed				Computed Sample Composition
	1 to 3/4 in.	3/4 to 1/2 in.	1/2 to 3/8 in.	3/8 to No. 4	
Limestone and Dolomitic Limestone (dense to slightly porous)	14.3	16.3	16.0	18.0	16.2
Limestone and Dolomitic Limestone (finely porous to porous)	49.7	56.3	64.7	59.4	57.5
Laminated Limestone and Dolomitic Limestone	13.3	10.7	8.3	5.3	9.4
Mottled Dolomitic Limestone	22.7	16.7	11.0	17.3	16.9
Totals, percent	100.0	100.0	100.0	100.0	100.0

Note: Computed sample composition is based upon counts of 300 particles contained in each of the sieve fractions noted.

TABLE 2
SPECIFIC GRAVITY AND ABSORPTION DATA
Testing Laboratory Sample No. 77 A-426

Rock Type	Specific Gravity			Absorption, percent	Composition, Percent by Weight
	Bulk, dry	Bulk, ssd	Apparent		
Limestone and Dolomitic Limestone (dense to slightly porous)	2.59	2.64	2.73	1.96	16.0
Limestone and Dolomitic Limestone (finely porous to porous)	2.36	2.49	2.71	5.45	50.8
Laminated Limestone and Dolomitic Limestone	2.56	2.62	2.73	2.42	12.3
Mottled Dolomitic Limestone	2.57	2.64	2.75	2.53	20.9
Total Sample	2.46	2.56	2.73	3.91	100.0

Note: Values are computed from determinations made on all sample material contained in the categories noted.

SEDIMENTARY ROCKS

Rock Type	Limestone and Dolomitic Limestone (dense to slightly porous)	Limestone and Dolomitic Limestone (finely porous to porous)	Laminated Limestone and Dolomitic Limestone
Color	buff to light brown; gray; and mottled buff to gray and brown	buff, grayish brown, and mottled buff and gray	banded or mottled buff to brown or gray and dark brown to black
Texture	very fine grained to microcrystalline	fine grained to microcrystalline	very fine grained to microcrystalline
Luster	dull	dull	dull
Hardness	matrix moderately hard: Mohs 3 to 3-1/2 quartz grains hard: Mohs 7	matrix moderately hard: Mohs 3 to 3-1/2 quartz grains hard: Mohs 7	matrix moderately hard to to soft: Mohs 3-1/2 to 2-1/2 quartz grains hard: Mohs 7
Porosity	non-porous to slightly porous	finely to coarsely porous	non-porous to finely porous
Particle Shape	angular to subangular	subangular to subrounded; and angular	angular to subangular
Particle Surface	fresh, rough to moderately smooth, dented to ridged	fresh, rough to moderately smooth, dented or pitted to ridged	fresh, rough to moderately smooth, dented to ridged
Remarks	many particles are slightly argillaceous. A number of particles are arenaceous with rounded quartz grains.	many particles contain small solution cavities. Particles display a sugary texture due to a lack of interstitial cementation. Many particles in this category are readily abraded. A number of particles are slightly arenaceous.	laminations are composed of dark carbonaceous material. A few particles contain stylolite structures. A number of particles are variably arenaceous or argillaceous.

Rock Type	Mottled Dolomitic Limestone
Color	mottled gray and buff to dark brown or black
Texture	fine grained to microcrystalline
Luster	dull
Hardness	matrix moderately hard to soft: Mohs 3-1/2 to 2-1/2 quartz grains hard: Mohs 7
Porosity	non-porous to finely porous
Particle Shape	angular to subangular
Particle Surface	fresh, rough to moderately smooth, dented or pitted to ridged
Remarks	most particles contain stylolite structures or pyritic traces. Many particles are variably arenaceous or argillaceous.