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OFFICE MEMORANDUM

DATE: March 12, 1982

TO: L. T. Oehler
Engineer of Research

FROM: R. W. Muethel

SUBJECT: Petrographic Analysis of Combined Crushed and Natural Gravel Coarse Aggregate: M. Glancy Pit No. 60-29 (Testing Laboratory Sample No. 81 A-1994). Research Project 78 TI-510, Research Report No. R-1190

On September 28, 1981, a sample of combined crushed and natural gravel coarse aggregate was received by the Department's Testing Laboratory Section. Information accompanying the sample stated that the material was obtained from a stockpile at the M. Glancy Pit No. 60-29, location NE 1/4 Section 28, T30N, R1E, Montmorency County. 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
Igneous	Hard, fresh to moderately weathered, and non-porous to slightly porous	26.7
Metamorphic	Hard, fresh to slightly weathered, and non-porous	24.3
Sedimentary	Hard to soft, fresh to highly weathered, and non-porous to porous	49.0

Approximately 18 percent of the sample was found to be composed of material having absorption values greater than 2.0 percent. The sample was found to contain low-gravity chert.

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 the noted sieve fractions 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 of the rock types analyzed. The following sheets contain the rock type descriptions.

TESTING AND RESEARCH DIVISION

R. W. Muethel

Geologist - Materials Research Unit

RWM:bt

Attachments

cc: K. A. Allemeier
M. L. O'Toole
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J. W. Burge
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TABLE 1
PETROGRAPHIC COMPOSITION
Testing Laboratory Sample No. 81 A-1994

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	
Igneous					
Granite	16.0	16.7	11.4	9.7	13.5
Diorite	1.7	1.3	1.3	1.0	1.3
Gabbro	10.3	9.0	5.3	6.7	7.8
Basalt	2.3	2.0	4.3	4.3	3.2
Felsite	0.7	0.3	2.0	0.7	0.9
Metamorphic					
Quartzite	23.7	19.7	16.0	18.6	19.5
Metasediments	3.0	2.7	1.7	1.7	2.3
Tillite	3.0	2.7	2.3	2.0	2.5
Sedimentary					
Limestone	15.3	18.0	23.7	18.6	18.9
Porous and Argillaceous Limestone	7.7	3.3	6.0	3.3	5.1
Dolomitic Limestone	2.7	3.3	2.3	1.7	2.5
Dolomite	8.0	11.4	13.3	13.0	11.4
Porous and Argillaceous Dolomite	2.3	4.3	5.7	6.0	4.6
Sandstone	0.3	0.3	0.0	1.0	0.4
Siltstone	1.3	1.3	0.3	0.7	0.9
Shale	0.0	0.0	0.7	2.3	0.8
Chert	1.7	3.7	3.7	8.7	4.4
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. 81 A-1994

Rock Type	Specific Gravity			Absorption, percent	Composition, percent by weight
	Bulk, dry	Bulk, ssd	Apparent		
Igneous					
Granite	2.62	2.63	2.66	0.56	15.1
Diorite	2.83	2.84	2.86	0.49	1.3
Gabbro	2.97	2.98	3.01	0.45	10.8
Basalt	2.89	2.90	2.92	0.37	2.9
Felsite	2.74	2.75	2.75	0.12	0.8
Metamorphic					
Quartzite	2.62	2.64	2.66	0.43	21.8
Metasediments	2.71	2.72	2.73	0.35	3.3
Tillite	2.71	2.72	2.73	0.23	3.5
Sedimentary					
Limestone	2.61	2.63	2.68	0.98	15.8
Porous and Argillaceous Limestone	2.49	2.55	2.65	2.45	6.0
Dolomitic Limestone	2.58	2.65	2.78	2.78	2.8
Dolomite	2.65	2.70	2.79	1.92	9.4
Porous and Argillaceous Dolomite	2.45	2.56	2.74	4.35	2.8
Sandstone	2.64	2.68	2.74	1.28	0.2
Siltstone	2.41	2.54	2.76	5.34	1.1
Shale	2.25	2.39	2.62	6.18	0.1
Chert	2.36	2.45	2.60	3.98	2.3
Total Sample	2.65	2.68	2.73	1.10	100.0

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

IGNEOUS ROCKS

Rock Type	Granite	Diorite	Gabbro
Color	mottled pink, white to buff; and dark green to black	mottled white and dark gray to black	mottled white to buff or yellowish brown and dark green to black
Texture	medium to very fine grained	medium to fine grained	medium to fine grained
Luster	dull	dull	dull
Hardness	Mohs 6 to 7	Mohs 6 to 7	Mohs 5-1/2 to 6
Porosity	non-porous	non-porous	non-porous to slightly porous on weathered surfaces
Particle Shape	angular to rounded	angular to rounded	angular to rounded
Particle Surface	fresh to slightly weathered, rough to moderately smooth, and dented to ridged	fresh to slightly weathered, rough to moderately smooth, and dented to ridged	fresh to moderately weathered, rough to moderately smooth, dented to ridged

IGNEOUS ROCKS (Cont.)

Rock Type	Basalt	Felsite
Color	dark gray or green to black; and mottled black and yellowish brown	reddish brown; gray; and dark green
Texture	very fine grained to microcrystalline	very fine grained to microcrystalline
Luster	dull	dull
Hardness	Mohs 5-1/2 to 6	Mohs 6 to 7
Porosity	non-porous	non-porous
Particle Shape	angular to rounded	angular to rounded
Particle Surface	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to slightly weathered, moderately smooth, dented to ridged

METAMORPHIC ROCKS

Rock Type	Quartzite	Metasediments	Tillite
Color	white, pink, gray, green, purple; and mottled white to pink and gray to green	dark green to gray, and mottled gray or green and purple	greenish gray
Texture	coarse to very fine grained	fine grained to micro-crystalline	microcrystalline groundmass with a porphyritic appearance
Luster	dull to subvitreous	dull	dull
Hardness	Mohs 7	Mohs 4 to 7	Mohs 4 to 7
Porosity	non-porous to slightly porous	non-porous	non-porous
Particle Shape	angular to rounded	angular to rounded	angular to rounded
Particle Surface	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to smooth, dented to ridged

SEDIMENTARY ROCKS

Rock Type	Limestone	Porous and Argillaceous Limestone	Dolomitic Limestone
Color	tan to dark brown	tan, yellowish brown, and mottled tan and yellowish brown to dark brown	buff; tan; and gray
Texture	fine grained to micro-crystalline	fine grained to micro-crystalline	fine grained to micro-crystalline
Luster	dull	dull to earthy	dull to earthy
Hardness	Mohs 3 to 3-1/2	Mohs 2-1/2 to 3-1/2	Mohs 3 to 4
Porosity	non-porous to slightly porous	finely porous to slightly porous	slightly porous
Particle Shape	angular to rounded	angular to rounded	angular to rounded
Particle Surface	fresh to moderately weathered, rough to smooth, dented or pitted to ridged	fresh to highly weathered, rough to moderately smooth, dented or pitted to ridged	fresh to highly weathered, rough to smooth, dented or pitted to ridged
Remarks	Some particles have small exposures of fossils or argillaceous material.	Some particles are fossiliferous or cherty.	Some particles contain argillaceous exposures.

SEDIMENTARY ROCKS (Cont.)

Rock Type	Dolomite	Porous and Argillaceous Dolomite	Sandstone
Color	tan; buff; gray; and mottled tan and gray	buff; tan; gray; and mottled tan and gray	buff
Texture	fine grained to micro-crystalline	fine grained to micro-crystalline	medium to fine grained
Luster	dull	dull to earthy	dull
Hardness	Mohs 3-1/2 to 4	Mohs 2-1/2 to 4	Mohs 7
Porosity	non-porous to slightly porous	finely porous to slightly porous	slightly porous
Particle Shape	angular to rounded	angular to rounded	angular to subangular
Particle Surface	fresh to slightly weathered, rough to smooth, dented or pitted to ridged	fresh to highly weathered, rough to smooth, dented or pitted to ridged	fresh to slightly weathered, rough, dented to ridged
Remarks		A few particles have small chert exposures.	

SEDIMENTARY ROCKS (Cont.)

Rock Type	Siltstone	Shale	Chert
Color	tan, and buff	dark brown	tan, gray, and mottled tan and gray
Texture	very fine grained to micro-crystalline	very fine grained to micro-crystalline	very fine grained to micro-crystalline
Luster	dull to earthy	dull	dull
Hardness	Mohs 2-1/2	Mohs 2-1/2	Mohs 7
Porosity	finely porous	non-porous to slightly porous	finely porous to slightly porous
Particle Shape	angular to rounded	tabular to discoidal	angular to subangular
Particle Surface	highly weathered, moderately smooth, dented to ridged	slightly weathered, smooth	fresh to highly weathered, rough to smooth, dented to ridged