



# OFFICE MEMORANDUM

DATE: June 4, 1976

TO: L. T. Oehler  
Engineer of Research

FROM: R. W. Muethel

SUBJECT: Petrographic Analysis of Coarse Aggregate: Caspian Lumber Co. #2, Pit No. 36-40 (Testing Laboratory Sample 75 A-291). Research Report No. R-1006.

On March 21, 1975, a sample of combined crushed and natural gravel coarse aggregate was received by the Department's Testing Laboratory at Ann Arbor. Information accompanying the sample stated that the material was obtained by M. Stockinger from the Caspian Lumber No. 2 Pit No. 36-40, location S 1/2 of SW, Section 22, T43N-R35W, Iron County. The sample 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

Petrographic analysis was completed on March 26, 1976. The sample was found to have the following general petrographic composition:

Rock Class	Condition of Particles	Percent of Sample
Igneous	Hard to soft, fresh to highly weathered, and non-porous to slightly porous on weathered surfaces	53
Metamorphic	Hard to soft, fresh to highly weathered, and non-porous to porous	44
Sedimentary	Hard to soft, fresh to moderately weathered, and non-porous to finely porous	3

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

TABLE 1  
 PETROGRAPHIC COMPOSITION  
 Testing Laboratory Sample No. 75 A-291

Rock Type	Sieve Fractions 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	
Granite	13.8	14.2	12.0	14.0	13.5
Diorite	1.4	2.4	1.6	1.4	1.7
Gabbro	7.0	9.8	9.4	7.2	8.3
Basalt	19.8	22.6	14.4	18.8	18.9
Felsite	8.6	9.8	11.2	12.0	10.4
Quartzite	6.6	7.6	11.0	11.4	9.1
Metasediments	8.4	6.2	6.8	9.0	7.6
Schist and Slate	14.8	7.0	9.4	7.0	9.6
Greenstone	18.4	17.8	20.2	15.6	18.0
Dolomite	0.2	0.2	0.4	0.4	0.3
Conglomerate	0.4	--	0.4	0.4	0.3
Sandstone	0.6	2.0	1.6	1.0	1.3
Siltstone	--	0.4	1.4	1.2	0.8
Chert	--	--	0.2	0.6	0.2
Total Sample	100.0	100.0	100.0	100.0	100.0

NOTE: Computed sample composition is based upon counts of 500 particles contained in each of the sieve fractions noted.

TABLE 2  
 SPECIFIC GRAVITY AND ABSORPTION DATA  
 Testing Laboratory Sample No. 75 A-291

Rock Type	Specific Gravity			Absorption, percent	Composition, Percent by Weight
	Bulk, dry	Bulk, ssd	Apparent		
Granite	2.63	2.64	2.68	0.73	12.8
Diorite	2.82	2.84	2.87	0.53	1.6
Gabbro	2.94	2.95	2.98	0.51	8.1
Basalt	2.83	2.86	2.91	0.90	20.9
Felsite	2.66	2.68	2.72	0.93	9.2
Quartzite	2.61	2.62	2.64	0.47	7.2
Metasediments	2.68	2.69	2.71	0.43	7.9
Schist and Slate	2.65	2.67	2.71	0.91	12.2
Greenstone	2.66	2.68	2.71	0.65	18.4
Dolomite	2.66	2.69	2.76	1.38	0.2
Conglomerate	2.56	2.59	2.63	0.97	0.4
Sandstone	2.43	2.50	2.60	2.65	0.8
Siltstone	2.28	2.40	2.59	5.34	0.2
Chert	2.12	2.16	2.20	1.52	0.1
Total Sample	2.71	2.73	2.76	0.75	100.0

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

Detailed Petrography

Petrographic examination was conducted in general conformance with ASTM C295, "Petrographic Examination of Aggregates for Concrete." Representative portions — 500 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. The following pages contain the rock type descriptions.

TESTING AND RESEARCH DIVISION



Geologist

Materials Research Unit

IGNEOUS ROCKS

Rock Type	Granite	Diorite	Gabbro
Color	mottled white to buff, pink to reddish brown and dark green to black	mottled white to buff, gray, or pink, and dark green to black	mottled gray to green, black
Texture	coarse to very fine grained	medium to very fine grained	medium to fine grained
Luster	dull to subvitreous	dull to subvitreous	dull
Hardness	hard: Mohs 6 to 7, general hardness 6	hard: Mohs 6 to 7, general hardness 6	hard to soft: Mohs 6 to 2-1/2, general hardness 6
Porosity	non-porous	non-porous	non-porous to slightly porous on weathered surfaces
Particle Shape	angular to subrounded	angular to subrounded	angular to subrounded
Particle Surface	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to highly weathered, rough to moderately smooth, dented to ridged
Remarks	A number of syenite particles are included in this category.		A number of particles are highly weathered.

IGNEOUS ROCKS (Cont.)

Rock Type	Basalt	Felsite
Color	dark gray or green to black; reddish brown or black and white to pink	pink; gray to green; buff; and mottled pink and buff to white
Texture	medium to fine grained	very fine grained to micro-crystalline
Luster	dull	dull
Hardness	hard to soft: Mohs 6 to 2-1/2, general hardness 6	hard: Mohs 6 to 7, general hardness 6
Porosity	non-porous to slightly porous on weathered surfaces	non-porous to slightly porous on weathered surfaces
Particle Shape	angular to rounded	angular to rounded
Particle Surface	fresh to highly weathered, rough to smooth, dented or pitted to ridged	fresh to moderately weathered, rough to smooth, dented to ridged
Remarks	Many particles are amygdaloidal. Many particles are deeply weathered.	Many particles are porphyritic with orthoclase feldspar or quartz

METAMORPHIC ROCKS

Rock Type	Quartzite	Metasediments	Schist and Slate
Color	white to buff or transparent; pink; green; gray; and mottled white; buff; or gray and green to gray	gray to green; and buff to reddish brown	greenish gray to gray
Texture	medium to very fine grained; and massive	very fine grained to micro-crystalline	very fine grained to micro-crystalline
Luster	vitreous to dull	dull	silky to dull
Hardness	hard: Mohs 7	hard to moderately hard: Mohs 7 to 5, general hardness 6	moderately hard to soft: Mohs 4 to 2-1/2, general hardness 3
Porosity	non-porous	non-porous	non-porous to porous
Particle Shape	angular to subrounded	angular to rounded	angular to subrounded; and tabular to discoidal
Particle Surface	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to highly weathered, rough to smooth, dented to ridged
Remarks	A number of vein quartz particles are included in this category.		Most particles are chloritic to micaceous. A few particles are deeply weathered.

METAMORPHIC ROCKS (Cont.)

Rock Type	Greenstone
Color	greenish gray to black
Texture	very fine grained to micro-crystalline
Luster	dull
Hardness	moderately hard to soft: Mohs 4 to 2-1/2, general hardness 3
Porosity	non-porous
Particle Shape	angular to subrounded
Particle Surface	fresh to moderately weathered, rough to smooth, dented to ridged
Remarks	Particles have the same general characteristics as schist but are massive to poorly foliated.



SEDIMENTARY ROCKS

Rock Type	Dolomite	Conglomerate	Sandstone
Color	buff	reddish brown	buff to reddish brown
Texture	very fine grained	pebbly	fine to very fine grained
Luster	dull	dull	dull
Hardness	moderately hard: Mohs 3-1/2	hard: Mohs 6	matrix: soft to hard: Mohs 2-1/2 to 7: grains hard: Mohs 6 to 7
Porosity	non-porous to slightly porous	non-porous	non-porous to slightly porous
Particle Shape	angular	subangular to subrounded	angular to rounded
Particle Surface	fresh, rough, dented to ridged	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to moderately weathered, rough, dented to ridged
Remarks		Constituent pebbles are predominantly felsite. Pebble diameters range from approximately 10 to 2 mm.	Particles contain feldspar and quartz grains cemented with argillaceous to siliceous material.

SEDIMENTARY ROCKS (Cont.)

Rock Type	Siltstone	Chert
Color	reddish brown; and buff	white; buff; and mottled buff and gray
Texture	very fine grained	microcrystalline
Luster	dull to earthy	dull
Hardness	moderately hard to soft: Mohs 4 to 2-1/2, general hardness 3	hard: Mohs 7
Porosity	non-porous to finely porous	non-porous to slightly porous
Particle Shape	angular to rounded	subangular
Particle Surface	fresh to moderately weathered, moderately smooth, dented to ridged	slightly weathered, moderately smooth, dented