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**INVESTIGATION OF CONCRETE MATERIALS
FOR FELSENTHAL AND "CALION" LOCKS
AND DAMS, OUACHITA AND BLACK RIVERS
ARKANSAS AND LOUISIANA**

by

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August 1965

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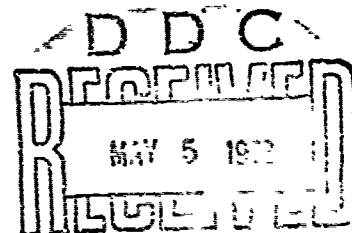
Conducted for

**U. S. Army Engineer District
Vicksburg**

by

**Lower Mississippi Valley Division
Materials and Concrete Laboratory**

**U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi**



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Foreword

The investigation covered by this report was authorized on 12 August 1964 by letter from the District Engineer, U. S. Army Engineer District, Vicksburg, Mississippi, subject, "Ouachita and Black Rivers, Arkansas and Louisiana - Funds for Laboratory Tests."

The work was performed at the Lower Mississippi Valley Division (LMVD) Materials and Concrete Laboratory, U. S. Army Engineer Waterways Experiment Station (WES), under the direction of Mr. Thomas B. Kennedy, and under the supervision of Mrs. Katharine Mather and Messrs. Leonard Pepper and R. L. Curry. The report was prepared by Mr. Curry and Mr. Alan D. Buck.

Directors of WES during the investigation and the preparation of this report were Col. Alex G. Sutton, Jr., CE, and Col. John R. Gswalt, Jr., CE. Technical Director was Mr. J. B. Tiffany.

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Summary

In this investigation natural sand and gravel from five sources and water from two sources were tested for suitability for use in making concrete to be used in construction of Felsenthal and Calion Locks and Dams.

The results of the tests show that the aggregates from all of the sources are potentially reactive with the alkali in cement and would therefore require the use of low-alkali cement. The coarse aggregates from the St. Francis, Pine Bluff, and Ouachita sources showed high sulfate soundness losses, but these losses seemed susceptible of reduction by thorough washing of the aggregates in water. The percentage of clay in the sand from the Monroe source was high, and this sand would also require thorough washing. The mortar-making properties test of the Pine Bluff sand indicated low strength percentages when the sand was tested as received, but the strength was satisfactory when the sand was tested after washing in water. The absorption was high on one of the Pine Bluff gravel samples. The water samples were satisfactory for use as mixing water in concrete.

It is recommended that all of the sources tested be listed as sources from which acceptable aggregate can be produced for the Felsenthal and Calion Locks and Dams, but that it be required that the material actually produced for use on these projects be graded and processed in such a manner as to meet the project specification requirements and that the absorption be less than 1.5 percent.

INVESTIGATION OF CONCRETE MATERIALS FOR FELSENTHAL AND
CALION LOCKS AND DAMS, OUACHITA AND BLACK RIVERS
ARKANSAS AND LOUISIANA

Introduction

1. This investigation was undertaken to evaluate aggregates for possible use in the construction of Felsenthal and Calion projects and possible future structures on the Ouachita and Black Rivers in Arkansas and Louisiana. The results of the investigation will form a part of "Design Memorandum No. 23 - Availability of Construction Materials, Felsenthal and Calion Locks and Dams."

Materials

2. Samples of natural fine and coarse aggregates were obtained from five sources, as follows:

Vicksburg District Source No.	WES Concrete Division Serial No.	Producer, Location	Type of Sample
8	VICKS-26 S-1(2) G-1(4)	Ouachita Aggregate Co., Inc. Hampton, Ark.	Natural sand and No. 4 to 1-1/2-in. gravel
12	VICKS-26 S-2(2) G-2(2)	St. Francis Materials Co. Harrell, Ark.	Natural sand and No. 4 to 1-in. gravel
11	LR-18 S-1(2) VICKS-23 G-1(2) G-1(3)	Pine Bluff Sand and Gravel Co. Pine Bluff, Ark.	Natural sand, No. 4 to 1-1/2-in. gravel, and sup- plemental gravel sample
13	VICKS-39 S-3 G-3	Standard Gravel Co. Camden, Ark.	Natural sand and No. 4 to 1-in. gravel
--	VICKS-39 S-2 G-2	Monroe Sand and Gravel Co. Sterlington, La.	Natural sand and No. 4 to 1-1/2-in. gravel, and 1/2- to 2-in. gravel

3. Concrete mixing water samples were received from two sources, as follows:

<u>WES Concrete Division Serial No.</u>	<u>Location</u>
VICKS-39 W-1	Onachita River, approximately 1 mile east of Calion Lock and Dam site
VICKS-39 W-2	In Grand Marais Lake, approximately 2 miles south of Felsenthal Lock and Dam site

Tests

4. The materials were tested as follows:

- a. Gravel and sand from each source were subjected to petrographic analysis by method CRD-C 127.*
- b. Each size group of aggregate from each source was tested for reactivity with sodium hydroxide by the quick chemical method, CRD-C 128.
- c. Coarse and fine aggregates from each source were subjected to the following tests: sieve analysis (CRD-C 103); bulk specific gravity, saturated surface dry (CRD-C 107 or 108); absorption (CRD-C 107 or 108); soundness using magnesium sulfate (CRD-C 115); and clay lumps (CRD-C 118).
- d. Coarse aggregate from each source was tested for soft particles (CRD-C 130), percent lighter than 2.40 specific gravity (CRD-C 122), percent flat and elongated particles (CRD-C 119), and Los Angeles abrasion loss (CRD-C 117).
- e. Fine aggregate from each source was tested for organic impurities (CRD-C 121), percent lighter than 2.00 specific gravity (CRD-C 122), and mortar-making properties, i.e. compressive strength (CRD-C 115).
- f. Pine Bluff sand and gravel were subjected to the following additional tests. A sample of the sand which was thoroughly washed in water to remove the fine silt was tested for mortar-making properties. The supplemental sample of the gravel, obtained at the site of production from which Felsenthal and Calion aggregates would be shipped, VICKS-23 G-1(3), was tested for magnesium sulfate soundness and Los Angeles abrasion loss.
- g. The two water samples were tested for suitability for use in mixing concrete (CRD-C 406).

* U. S. Army Engineer Waterways Experiment Station, CE, Handbook for Concrete and Cement, with quarterly supplements (Vicksburg, Miss., August 1949).

5. Sand and gravel from Ouachita Aggregate Co. and St. Francis Material Co. had been previously tested for use as construction materials for the Calion Pumping Station, and Pine Bluff sand and gravel for use in the Flat Bayou Drainage Structure. Results of these tests are included in the data reported herein.

Results, Conclusions, and Recommendations

Results

6. The test results are given at the end of this report in the following manner:
- a. The results of the petrographic examination of the coarse and fine aggregate samples are reported in Appendix A and tables A1-A5.
 - b. Results of the chemical tests for reactivity of aggregate with sodium hydroxide are reported in plates 1-4.
 - c. Aggregate test data are reported in plates 5-12 and in table 1.
 - d. Results of the magnesium sulfate soundness tests of the aggregates are reported in plates 13-17.
 - e. Results of the tests of the two water samples are reported in tables 2 and 3.

Conclusions

7. The conclusions derived from this investigation are as follows:
- a. Since one fine aggregate (LR-18 S-1) and all but one (VICKS-26 G-1(2)) of the coarse aggregates showed potential reactivity with sodium hydroxide, low-alkali cement should be used in concrete containing aggregates from the sources tested in this study.
 - b. The aggregate from each source will have to be regraded to meet Corps of Engineers Guide Specification grading requirements for concrete aggregate.
 - c. The Monroe sand will require washing to remove objectionable quantities of clay.
 - d. The Pine Bluff, St. Francis, and Ouachita aggregates will require washing and selective processing to insure that satisfactory sand and gravel are obtained from these sources. The high percentage loss in the sulfate soundness test of unwashed gravel, the low strengths of mortars containing unwashed sand, and the high Los Angeles abrasion loss of the unwashed gravel all showed improvement when washed samples

were tested. The 2.4 percent absorption of the latest shipment of Pine Bluff gravel appeared undesirably high, but the 1.2 percent absorption of the previous shipment indicates that properly selected and processed gravel from this source would have a satisfactory percent absorption.

- e. Based on the strengths of mortars made using the test water samples, water from these two sources would be satisfactory for use as mixing water in concrete.

Recommendations

8. It is recommended that all of the sources given in paragraph 2 be listed as sources from which acceptable aggregate can be produced for the Felsenthal and Calion Locks and Dams, but that it be required that the material actually produced for use on these projects be graded and processed in such a manner as to meet the project specification requirements and that the absorption be less than 1.5 percent.

Table 1
Results of Tests of Fine and Coarse Aggregates

Source	Sample Designation	Coarse and Fine Aggregates				Coarse Aggregate				Fine Aggregate *			
		Bulk Sp Gr	Absorp- tion %	Loss %	Clay Lump %	Reactive with HCl	Soft Particles, %	Lighter than 2.40 Sp Gr, %	Elongated Particles, %	LA Abrasion Loss, %	Organic Impurities Fig. No. **	Lighter than 2.00 Sp Gr, %	Compressive Strength, % 3 Day 7 Day
Monroe Sand and Gravel Co.	VICKS-39 G-2	2.55	1.2	--	0.1	Yes	0.0	6.8	2.8	21.2	--	--	--
	1/2 No. 2 to 1/2 in.	2.55	1.3	2.0	0.1	Yes	0.0	7.2	2.6	21.2	--	--	--
	VICKS-39 S-2	2.60	0.9	3.2	2.2	No	--	--	--	--	2	0.0	133 130
Standard Gravel Co.	VICKS-39 G-3	2.57	1.3	4.1	0.0	Yes	0.0	6.6	3.7	25.5	--	--	--
	VICKS-39 S-3	2.62	0.5	3.2	0.0	No	--	--	--	--	3	0.0	125 125
	VICKS-26 G-1(4)	2.57	1.4	8.7	0.1	Yes	0.0	2.5	2.7	29.8	--	--	--
Quachita Aggregate Co.	VICKS-26 S-1(2)	2.61	0.7	5.5	0.1	No	--	--	--	--	1	0.0	125 121
	VICKS-26 G-1 G-1(2)	2.58	1.3	10.6	--	No	0.2	--	2	27.4	--	--	--
	VICKS-26 S-1	2.60	1.0	7.0	--	No	--	--	--	--	2	--	139 130
St. Francis Material Co.	VICKS-26 G-2(2)	2.57	1.3	12.0	0.0	Yes	0.0	8.0	3.0	30.0	--	--	--
	VICKS-26 S-2(2)	2.61	0.6	6.0	0.1	No	--	--	--	--	0	0.0	119 109
	VICKS-26 G-2	2.56	1.6	16.6	--	--	0.0	4	9	42	--	--	--
Previous shipment	VICKS-26 S-2	2.62	0.6	6.8	--	--	--	1	--	--	2	--	119 120
	VICKS-23 G-1(2)	2.54	2.4	18.7	0.1	Yes	0.0	8.8	2.0	36.0	--	--	--
	LR-18 S-1(2)	2.60	0.9	6.4	0.4	No	--	--	--	--	1	0.0	78 89
Pine Bluff Sand and Gravel Co.	LR-18 S-1(2) washer	--	--	--	--	--	--	--	--	--	--	--	114 112
	VICKS-23 G-1(3)	--	--	10.4	--	--	--	--	--	30.1	--	--	--
	Supplemental shipment	--	--	--	--	--	--	--	--	--	--	--	--
Previous shipment	VICKS-23 G-1	2.56	1.2	7.8	--	Yes	0.0	4.6	--	28.2	--	--	--
	LR-12 S-1	2.60	0.7	--	--	Yes	--	--	--	--	--	--	--

* Mortar-making properties of the fine aggregate are indicated by the compressive strength values.
** This refers to the organic impurities figure used in the test (CRD-C 121).

Table 2

Results of Tests of Water Sample VICKS-39 W-1 for Use in Mixing Concrete

Source of Sample: Ousachita River, approximately 1 mile east of Calion Lock and Dam site

Test Method Used: CRD-C 406

Cement Used: Marquette Type III

<u>Test Age</u> <u>days</u>	<u>Compressive Strength of Specimens Containing Test Water in</u> <u>Percent of Strength of Specimens Containing Distilled Water</u>	
	<u>Test Result</u>	<u>Specified Minimum</u>
3	102	90
7	99	90

Table 3

Results of Tests of Water Sample VICKS-39 W-2 for Use in Mixing Concrete

Source of Sample: Grand Marais Lake, approximately two miles south of Felsenthal Lock and Dam site

Test Method Used: CRD-C 406

Cement Used: Marquette Type III

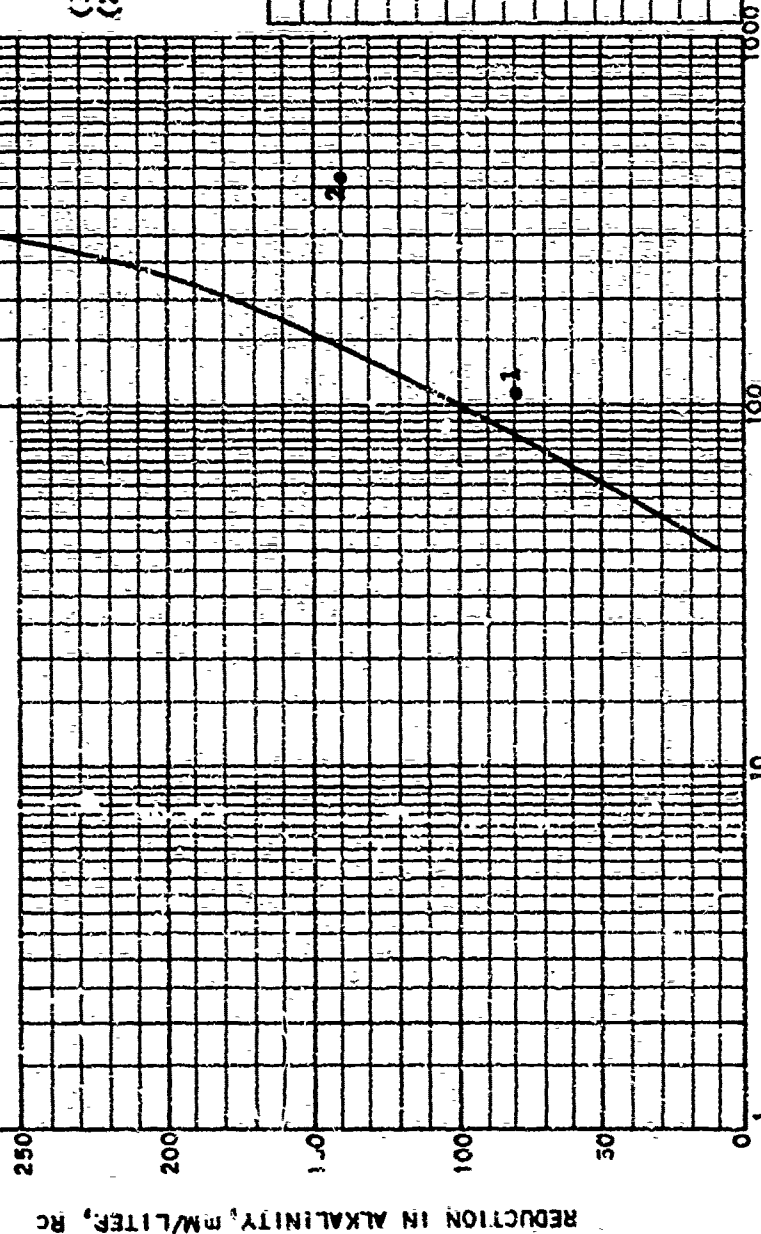
<u>Test Age</u> <u>days</u>	<u>Compressive Strength of Specimens Containing Test Water in</u> <u>Percent of Strength of Specimens Containing Distilled Water</u>	
	<u>Test Result</u>	<u>Specified Minimum</u>
3	91	90
7	91	90

PROJECT
Feinstein and Calton
Locks and Dams
METHOD CRD-C 128

LEGEND

(1) VICKS-26 G-1(4)
(2) VICKS-39 G-2
1.1/2-in. max

LINE INDICATING GENERAL SEPARATION
BETWEEN "INNOCUOUS" (LEFT) AND
"DELETERIOUS" (RIGHT) AGGREGATES

[illegible]

DISSOLVED SILICA, MM/LITER, SC

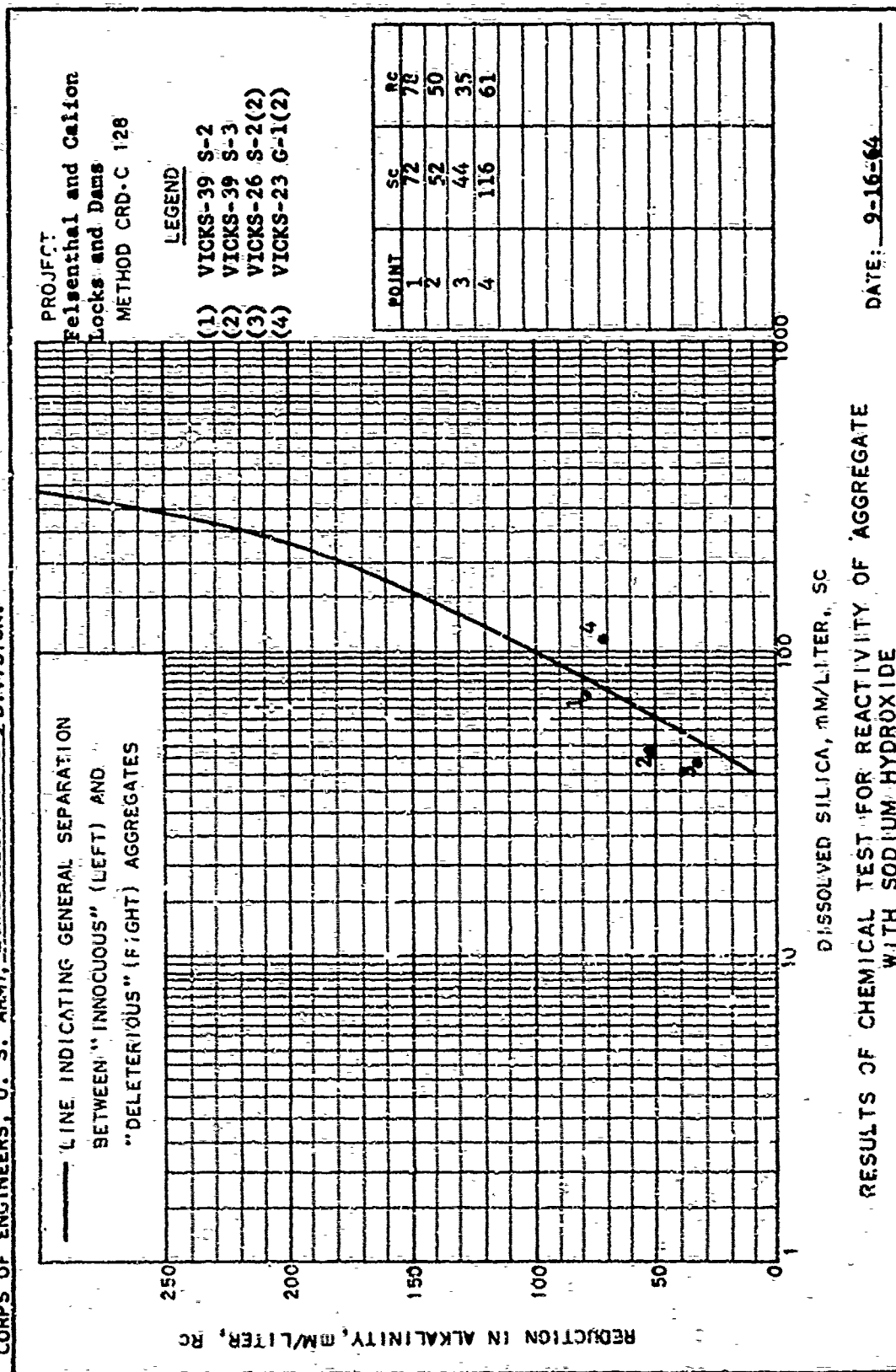
RESULTS OF CHEMICAL TEST FOR REACTIVITY OF AGGREGATE WITH SODIUM HYDROXIDE

DATE: 10-7-64

WES FORM
DEC. '55

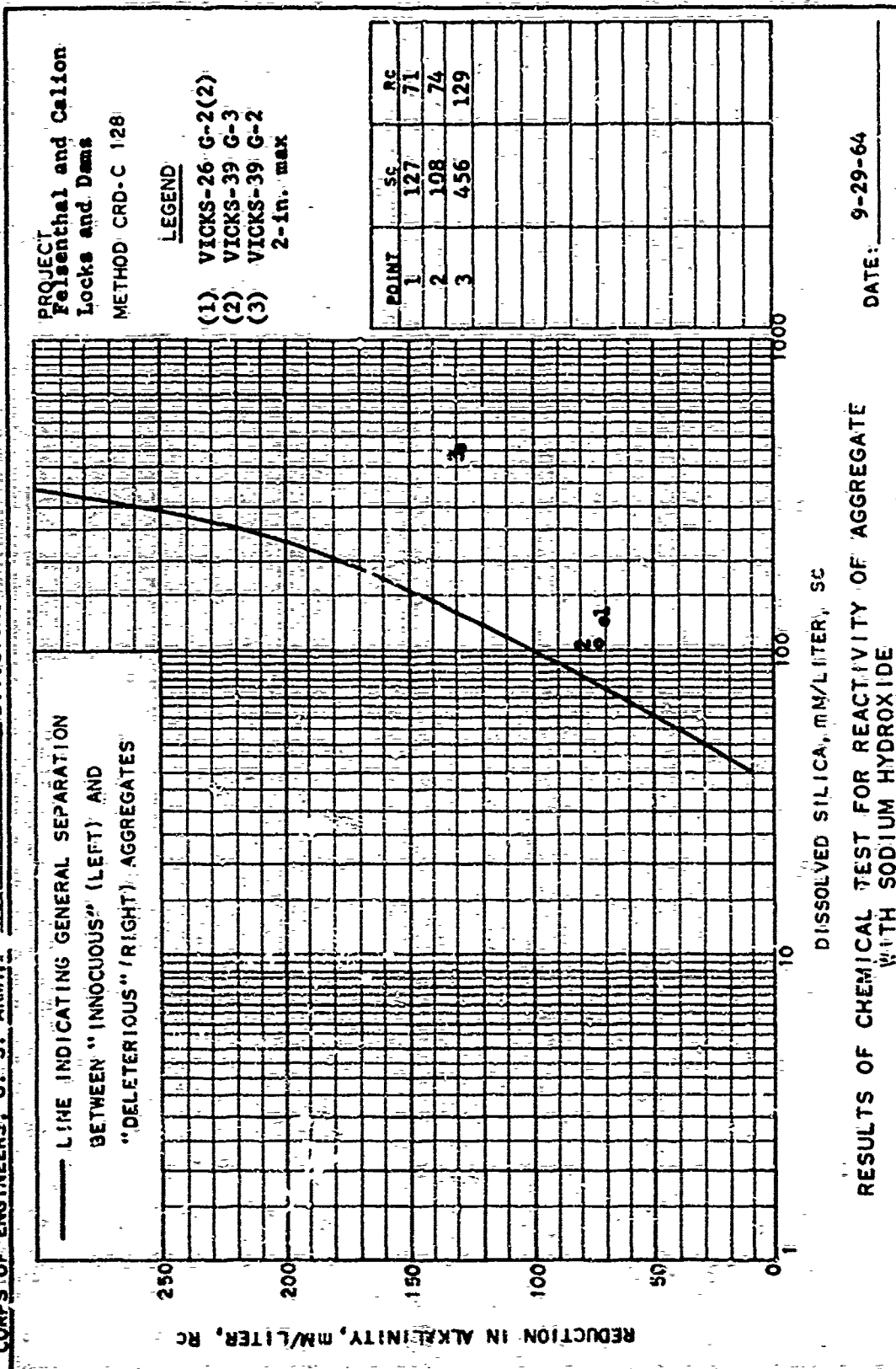
PLATE I

CORPS OF ENGINEERS, U. S. ARMY, Lower Miss. Valley Division.



WES FORM 896
DEC. '55

PLATE 3



WEST FORM 896
MFC 1-64

STATE: Ark.		INDEX NO.:		AGGREGATE		TESTED BY: USAEWES	
LAT.: 33		LONG.: 92		DATA SHEET		DATE: Nov 1964	
LAB. SYMBOL NO.: VICKS-26 S-2(2), G-2(2)				TYPE OF MATERIAL: Nat. sand and gravel			
LOCATION: 3 miles north of Harrell, Ark.							
PRODUCER: St. Francis Materials Co. (Harrell's Pit), Harrell, Ark., Vicksburg District Source No. 12							
SAMPLED BY: USAEWES							
TESTED FOR: Felsenthal and Calion Locks and Dams							
PROCESSING BEFORE TESTING: None							
GEOLOGICAL FORMATION AND AGE:							
GRADING (CRD-C 103)(CUM. % PASSING):				TEST RESULTS			
SIEVE	3-8"	1 1/2-3"	3/4-1"	NO. 4	NO. 10	NO. 20	NO. 40
8 IN.							
5 IN.							
4 IN.							
3 IN.							
2 1/2 IN.							
2 IN.							
1 1/2 IN.							
1 IN.							
3/4 IN.							
3/8 IN.							
3/16 IN.							
NO. 4							
NO. 10							
NO. 20							
NO. 40							
NO. 60							
NO. 100							
NO. 200							
F.M.(%)							
BULK SP. GR., SAT. SURF. DRY (CRD-C 107, 108):				2.57 2.61			
ABSORPTION, PER CENT (CRD-C 107, 108):				1.3 0.6			
ORGANIC IMPURITIES, FIG. NO. (CRD-C 121):				0			
SOFT PARTICLES, PER CENT (CRD-C 130):				0.0			
PER CENT LIGHTER THAN SP. GR. 2.40 (CRD-C 122):				8.0			
PER CENT FLAT AND ELONGATED (CRD-C 119, 120):				3.0			
WEIGHTED AV. % LOSS, 5 CYC. M ₃ SL (CRD-C 115):				12.0 6.0			
ABRASION LOSS (L.A.), % (CRD-C 117):				30.0			
UNIT WT., LB./CU. FT. (CRD-C 106):				0.00.1			
CLAY LUMPS, % (CRD-C 118):				0.0			
PER CENT LIGHTER THAN SP. GR. 2.00 (CRD-C 123):				0.0			
SPECIFIC HEAT, BTU/LB./DEG. F. (CRD-C 124):							
REACTIVITY WITH NaOH (CRD-C 126):				Sc, mm/L: 127 44			
* R _c , mm/L:				71 35			
MORTAR-MAKING PROPERTIES (CRD-C 116)							
TYPE III CEMENT, RATIO 3 DAYS, 119 3, 7 DAYS, 109 3							
LINEAR THERMAL EXPANSION X10 ⁻⁶ DEG. F. (CRD-C 125, 126):							
ROCK TYPE				PARALLEL ACROSS ON AVERAGE			
MORTAR:							
MORTAR-EXPANSION AT 100°F, % (CRD-C 123):							
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:							
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:							
SOUNDNESS IN CONCRETE (CRD-C 40, 114):				F & T HW-CD HD-CW			
FINE AGG. COARSE AGG. DFE ₂₀₀							
FINE AGG. COARSE AGG. DFE ₃₀₀							
PETROGRAPHIC DATA (CRD-C 127) Percentage Composition							
Constituents		Gravel		Sand			
Chert		82		26			
Quartz		17		73			
Sandstone, quartzite, and assorted rock types		1		1			
REMARKS: * The gravel shows a possibility of deleterious reactivity if used with a high-alkali cement. Sulfate soundness loss high.							

WES FORM 726 JAN. 1951

PLATE 5

STATE: Ark.		INDEX NO.:		AGGREGATE DATA SHEET		TESTED BY: USAEWES	
LAT: 33		LONG: 92		DATE: Nov 1964			
LAB. SYMBOL NO.: VICKS-39 S-3, G-3				TYPE OF MATERIAL: Nat. sand and gravel			
LOCATION: Just north of Camden, Ark., north of Hwy 79 on Gravel Pit Road							
PRODUCER: Standard Gravel Co., Camden, Ark., Vicksburg District Source No. 13							
SAMPLED BY: USAEWES							
TESTED FOR: Felsenthal and Calion Locks and Dams							
PROCESSING BEFORE TESTING:							
GEOLOGICAL FORMATION AND AGE:							
GRADING (CRD-C 103) (CUM. % PASSING):				TEST RESULTS			
SIEVE	3-6"	1 1/2-3"	3/4-1 1/2"	3/8-1"	3-6"	1 1/2-3"	3/4-1 1/2"
6 IN.							
5 IN.							
4 IN.							
3 IN.							
2 1/2 IN.							
2 IN.							
1 1/2 IN.			100				
1 IN.			95				
3/4 IN.			81				
1/2 IN.			46				
3/8 IN.			16				
NO. 4			0	100			
NO. 8				88			
NO. 16				81			
NO. 30				75			
NO. 50				33			
NO. 100				3			
NO. 200				--			
- 200 ^(a)				0.3			
F.M. (b)				2.20			
(a) CRD-C 105 (b) CRD-C 104				MORTAR:			
MORTAR-PAK EXPANSION AT 100% (CRD-C 123):				FIN. AGGREGATE			
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:				3 MO. 6 MO. 9 MO. 12 MO.			
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:				3 MO. 6 MO. 9 MO. 12 MO.			
SOUNDNESS IN CONCRETE (CRD-C 40, 114):				F & T HW-CO HD-CW			
FINE AGG. COARSE AGG.				D.F.E. 200			
FINE AGG. COARSE AGG.				D.F.E. 200			
PETROGRAPHIC DATA (CRD-C 127): Percentage Composition (some chalcedonic chert in sand)							
Constituents		Gravel		Sand			
		3/4 - 1-1/2 in.	No. 4 - 3/4 in.				
Chert		92	90	27			
Quartz		7	8	69			
Sandstone, quartzite, and assorted rock types		1	2	4			
REMARKS: * The gravel shows a possibility of deleterious reactivity if used with a high-alkali cement.							

WES FORM 726 JAN. 1951

PLATE 6

STATE: Ark.		INDEX NO.:		AGGREGATE DATA SHEET		TESTED BY: USAEWES	
LAT.: 33		LONG.: 92				DATE: Nov. 1964	
LAB. SYMBOL NO.: LR-38 S1(2); VICKS-23 G-1(2), G1(3) TYPE OF MATERIAL: Nat. sand and gravel							
LOCATION: 1/4 to 1/2 mile south of Hwy 79 on gravel crossroad, approximately 2-1/2 miles west of Bearden, Ark.							
PRODUCER: Pine Bluff Sand and Gravel Co., Pine Bluff, Ark., Vicksburg							
District Source No. 11							
SAMPLED BY: USAEWES							
TESTED FOR: Felsenthal and Calion Locks and Dams							
PROCESSING BEFORE TESTING: None							
GEOLOGICAL FORMATION AND AGE:							
GRADING (CRD-C 103) (CLM. % PASSING):				TEST RESULTS			
SIEVE	3-6"	1 1/2-3"	3/4-1 1/2"	NO. 4-10"	FINE AGG.	3-6"	1 1/2-3"
8 IN.							
5 IN.							
4 IN.							
3 IN.							
2 1/2 IN.							
2 IN.							
1 1/2 IN.							
1 IN.							
3/4 IN.							
1/2 IN.							
3/8 IN.							
NO. 4							
NO. 8							
NO. 16							
NO. 30							
NO. 50							
NO. 100							
NO. 200							
- 200"							
F.M. (G)							
(a) CRD-C 105 (b) CRD-C 104				MORTAR:			
MORTAR-BAR EXPANSION AT 100F, % (CRD-C 123):				FINE AGGREGATE			
				COARSE AGGREGATE			
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:				3 MO. 6 MO. 9 MO. 12 MO. 3 MC. 6 MO. 9 MO. 12 MO.			
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:							
SOUNDNESS IN CONCRETE (CRD-C 40, 114):				F & T HW-CO HD-CW			
FINE AGG.				COARSE AGG.			
FINE AGG.				COARSE AGG.			
PETROGRAPHIC DATA (CRD-C 127): Percentage Composition							
Gravel							
Constituents							
3/4 - 1-1/2 in. No. 4 - 3/4 in. Sand							
Chert 89 86 34							
Quartz 11 13 63							
Sandstone, quartzite, and assorted rock types Trace 1 3							
REMARKS: The gravel shows a high magnesium sulfate loss and a possibility of deleterious reactivity if used with a high-alkali cement. The sand shows low strength in mortar as compared with mortar containing standard Ottawa sand. Soundness and mortar strength were satisfactory in washed samples.							

STATE: Ark.	INDEX NO.:	AGGREGATE DATA SHEET	TESTED BY: USAEWES
LAT: 33	LONG: 92	DATE: Nov. 1964	
LAB SYMBOL NO.: VICKS-26 S-1(2), G-1(4)		TYPE OF MATERIAL: Nat. sand and gravel	
LOCATION: Champaigne Creek Deposit, 4 miles west of Hwy 167, between Haryton and El Doredo, Ark.			
PRODUCER: Ouachita Aggregate Company (Formerly Nettles Pit), Hampton, Ark			
Vicksburg District Source No. 8			
SAMPLED BY: USAEWES			
TESTED FOR: Felseenthal and Calion Locks and Dams			
PROCESSING BEFORE TESTING: None			
GEOLOGICAL FORMATION AND AGE:			
GRADING (CRD-C 103) (CUM. % PASSING):		TEST RESULTS	
SIEVE	3-6" 1 1/2-3" 3/4-1 1/2" 3/8-1/2" FINE AGG.	3-6" 1 1/2-3" 3/4-1 1/2" 3/8-1/2" FINE AGG.	
8 IN.		BULK SP. GR., SAT SURF DRY (CRD-C 107, 108):	2.57 2.61
5 IN.		ABSORPTION, PER CENT (CRD-C 107, 108):	1.4 0.7
4 IN.		ORGANIC IMPURITIES, FIG. NO. (CRD-C 121):	---
3 IN.		SOFT PARTICLES, PER CENT (CRD-C 130):	0.0 ---
2 1/2 IN.		PER CENT LIGHTER THAN SP. GR. 2.40 (CRD-C 122):	2.5 ---
2 IN.		PER CENT FLAT AND ELONGATED (CRD-C 119, 120):	2.7 ---
1 1/2 IN.	100	WEIGHTED AV. % LOSS, 3 CYC. MgSO ₄ ((C) 1/2-1", (A) 1/2") (CRD-C 115)	8.7 5.6
1 IN.	90	ABRASION LOSS (L. A.), %, (CRD-C 117):	29.8 ---
3/4 IN.	72	UNIT WT., LB/CU FT. (CRD-C 106):	---
3/8 IN.	34	CLAY LUMPS, % (CRD-C 118):	0.1 0.1
NO. 4	9	PER CENT LIGHTER THAN SP. GR. 2.65 (CRD-C 123):	---
NO. 8	1	SPECIFIC HEAT, BTU/LB/DEG. F. (CRD-C 124):	---
NO. 16	64	REACTIVITY WITH NaOH (CRD-C 128): S _c , mm/L	110 46
NO. 30	55	R _c , mm/L	79 70
NO. 50	29	MORTAR-MAKING PROPERTIES (CRD-C 116)	
NO. 100	6	TYPE III CEMENT-RATIO 3 DAYS, 125 % 7 DAYS, 121 %	
NO. 200	---	LINEAR THERMAL EXPANSION X10 ⁶ DEG. F. (CRD-C 125, 126):	
-200 ^{mm}	1.3	ROCK TYPE	PARALLEL ACROSS ON AVERAGE
F.M. (C)	2.70		
(a) CRD-C 103 (b) CRD-C 104		MORTAR:	
MORTAR BAR EXPANSION AT 100F, % (CRD-C 123):		FINE AGGREGATE COARSE AGGREGATE	
LOW-ALK. CEMENT: % H ₂ O EQUIVALENT:		3 MO. 6 MO. 9 MO. 12 MO.	3 MO. 6 MO. 9 MO. 12 MO.
HIGH-ALK. CEMENT: % H ₂ O EQUIVALENT:			
SOUNDNESS IN CONCRETE (CRD-C 40, 114):		F & T HV-CU NO-CW	
FINE AGG.	COARSE AGG.	DFE ₅₀₀	
FINE AGG.	COARSE AGG.	DFE ₂₀₀	
PETROGRAPHIC DATA (CRD-C 127) Percentage Composition (Some chalcidonic chert in sand)			
Constituents	Gravel		
	3/4 - 1-1/2 in.	No. 4 - 3/4 in.	Sand
	82	80	27
	16	20	71
Sandstone, quartzite, and assorted rock types	2	Trace	2
REMARKS: * The gravel shows a possibility of deleterious reactivity if used with a high-alkali cement.			

WES FORM 726 JAN. 1951

PLATE 8

STATE: La.		INDEX NO.:		AGGREGATE DATA SHEET		TESTED BY: USAEWES	
LAT.: 32		LONG.: 92		DATE: Nov 1964			
LAB. SYMBOL NO.: VICKS-39 S-2, G-2				TYPE OF MATERIAL: Nat. sand and gravel			
LOCATION: 1/2 mile west of Sterlington, south on blacktop and gravel road							
PRODUCER: Monroe Sand and Gravel Co., Sterlington, La.							
SAMPLED BY: USAEWES							
TESTED FOR: Felsenthal and Calion Locks and Dams							
PROCESSING BEFORE TESTING: None							
GEOLOGICAL FORMATION AND AGE:							
GRADING (CRD-C 103) (CUM. % PASSING)				TEST RESULTS			
SIEVE	3-6"	1 1/2-3"	1/2-2"	#4-1 1/2"	FINE AGG.	3-6"	1 1/2-3"
8 IN.							
5 IN.							
4 IN.							
3 IN.							
2 1/2 IN.							
2 IN.			100	100			
1 1/2 IN.			81	96			
1 IN.			42	64			
3/4 IN.			20	38			
1/2 IN.			3	14			
3/8 IN.				6	100		
NO. 4				0	92		
NO. 8					81		
NO. 16					70		
NO. 30					47		
NO. 50					18		
NO. 100					5		
NO. 200					--		
- 200"					2.7		
F.M. (b)					2.88		
(a) CRD-C 105 (b) CRD-C 104				MORTAR:			
MORTAR-BAR EXPANSION AT 100F, % (CRD-C 123):				FINE AGGREGATE			
				COARSE AGGREGATE			
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:				3 MO. 6 MO. 9 MO. 12 MO. 3 MO. 6 MO. 9 MO. 12 MO.			
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:							
SOUNDNESS IN CONCRETE (CRD-C 40, 114):				F & T HW-CO HD-CW			
FINE AGG. COARSE AGG. DFE ₃₆₀							
FINE AGG. COARSE AGG. DFE ₃₆₀							
PETROGRAPHIC DATA (CRD-C 127): Percentage Composition (some chalcedonic chert in sand)							
Gravel							
Constituents	3/4 - 1-1/2 in.		No. 4 - 3/4 in.		Sand		
Chert	96		90		21		
Quartz	1		9		71		
Sandstone, quartzite, and assorted rock types	3		1		5		
Feldspar	--		--		3		
REMARKS: * The gravel shows a possibility of deleterious reactivity if used with a high-alkali cement. The percentage of clay lumps in the sand is high.							

WES FORM 726 JAN. 1951

PLATE 9

STATE: <u>Ark.</u>	INDEX NO: <u>2 (Rev #2)</u>	AGGREGATE	TESTED BY: <u>JISA EWES</u>																								
LAT: <u>33</u>	LONG: <u>92</u>	DATA SHEET	DATE: <u>28 March 1957, 29 Sept 1958</u>																								
LAB. SYMBOL NO: <u>VICKS-26 G-1(2), S-1 Job 6001/308</u> TYPE OF MATERIAL: <u>Natural gravel</u>																											
LOCATION: <u>Pit on Nettles property, 5 mi S of Hampton, Ark., 4 mi W of Hwy 167.</u>																											
PRODUCER: <u>Ouachita Gravel Company, Nettles Pit</u>																											
SAMPLED BY: <u>Vicksburg District</u>																											
TESTED FOR: <u>Calion Protection Works</u>																											
PROCESSING BEFORE TESTING: <u>None</u>																											
GEOLOGICAL FORMATION AND AGE: <u>Recent Alluvial</u>																											
USED IN: <u>Calion Pumping Station (1958)</u>																											
GRADING (CRD-C 103) (CUR. % PASSING)		TEST RESULTS																									
SIEVE	3-6" 1 1/2-3" 3/4-1 1/4" #4-2" FINE AGG.	3-6" 1 1/2-3" 3/4-1 1/4" #4-2" FINE AGG.																									
6 IN.		BULK SP. GR., SAT SURF DRY (CRD-C 107, 108):	2.58																								
5 IN.		ABSORPTION, PER CENT (CRD-C 107, 108):	1.3																								
4 IN.		ORGANIC IMPURITIES, FIG. NO (CRD-C 121):	2																								
3 IN.		SOFT PARTICLES, PER CENT (CRD-C 130):	0.2																								
2 1/2 IN.		PER CENT LIGHTER THAN SOLIDS (CRD-C 129):																									
2 IN.		PER CENT FLAT AND ELONGATED (CRD-C 119, 120):	2																								
1 1/2 IN.	100	WEIGHTED AV. % LOSS, 5 CYC. $MgSO_4$ (10) 1/2-1", #4-1/2" (CRD-C 115)	10.6																								
1 IN.	93	ABRASION LOSS (L.A.), %, (CRD-C 117):	27.4																								
3/4 IN.	72	UNIT WT., LB./CU FT (CRD-C 106):																									
1/2 IN.	35	CLAY LUMPS, % (CRD-C 118):																									
3/8 IN.	10	COAL AND LIGNITE, % (CRD-C 122):																									
NO. 4	9	SPECIFIC HEAT, BTU/LB./DEG. F. (CRD-C 124):																									
NO. 8	79	REACTIVITY WITH NaOH (CRD-C 128):	164																								
NO. 16	60		178																								
NO. 30	49	MORTAR-MAKING PROPERTIES (CRD-C 116)																									
NO. 50	21	TYPE <u>III</u> CEMENT, RATIO <u>3</u> DAYS, <u>130</u> 7 DAYS, <u>130</u>																									
NO. 100	2	LINEAR THERMAL EXPANSION X10 9/DEG. F. (CRD-C 125, 126):																									
NO. 200	*	<table border="1"> <tr> <th>ROCK TYPE</th> <th>PARALLEL</th> <th>ACROSS</th> <th>ON</th> <th>AVERAGE</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		ROCK TYPE	PARALLEL	ACROSS	ON	AVERAGE																			
ROCK TYPE	PARALLEL	ACROSS	ON	AVERAGE																							
- 200	0.8																										
F.M. (b)	E. 20																										
(a) CRD-C 105 (b) CRD-C 104		MORTAR:																									
MORTAR-BAR EXPANSION AT 100F, % (CRD-C 123):		<table border="1"> <tr> <th colspan="4">FINE AGGREGATE</th> <th colspan="4">COARSE AGGREGATE</th> </tr> <tr> <th>3 MO.</th> <th>6 MO.</th> <th>9 MO.</th> <th>12 MO.</th> <th>3 MO.</th> <th>6 MO.</th> <th>9 MO.</th> <th>12 MO.</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FINE AGGREGATE				COARSE AGGREGATE				3 MO.	6 MO.	9 MO.	12 MO.	3 MO.	6 MO.	9 MO.	12 MO.								
FINE AGGREGATE				COARSE AGGREGATE																							
3 MO.	6 MO.	9 MO.	12 MO.	3 MO.	6 MO.	9 MO.	12 MO.																				
LOW-ALK. CEMENT: % Na_2O EQUIVALENT:																											
HIGH-ALK. CEMENT: % Na_2O EQUIVALENT:																											
SOUNDNESS IN CONCRETE (CRD-C 40, 114):		F & T HW-CD HU-CV																									
FINE AGG.	COARSE AGG.	DEF 300																									
FINE AGG.	COARSE AGG.	DEF 300																									
PETROGRAPHIC DATA (CRD-C 127):																											
Note (Suggested by Vicksburg District): Watch this source for a coating on the gravel; it will affect the compressive strength of concrete. Corrective action--(1) selective digging in pit and (2) effective washing.																											
REMARKS: Sample of No. 4 - 3/4" gravel decanted over No. 200 sieve - loss 0.5%. This sample then allowed to stand in saturated solution of oxalic acid over weekend and again decanted over No. 200. The total % passing the No. 200 sieve was then 0.9.																											

WFO FORM 726 JAN. 1951

PL. 10

Issued Sept. 1958

STATE: Ark.		INDEX NO: 3		AGGREGATE DATA SHEET		TESTED BY: USAEWES	
LAT. 33		LONG. 92				DATE: 19 July 1957	
LAB. SYMBOL NO: VICKS-26 S-2, G-2 Job 6001/323 TYPE OF MATERIAL: Sand and gravel							
LOCATION: Harrells Pit, two miles north of Harrell, Arkansas							
PRODUCER: St. Francis Materials Company							
SAMPLED BY: Vicksburg District							
TESTED FOR: Calion Protection Works							
PROCESSING BEFORE TESTING: None							
GEOLOGICAL FORMATION AND AGE:							
USED IN: Calion Floodwall (1957)							
GRADING (CRD-C 103) (CUM. % PASSING):				TEST RESULTS			
3 IEVE	3-6"	1 1/2-3"	3/4-1 1/2"	1/4-3/4"	FINE AGG.	3-6"	1 1/2-3"
6 IN.							
5 IN.							
4 IN.							
3 IN.							
2 1/2 IN.							
2 IN.							
1 1/2 IN.							
1 IN.							
3/4 IN.							
3/8 IN.							
NO. 4							
NO. 8							
NO. 16							
NO. 30							
NO. 50							
NO. 100							
NO. 200							
-200 ^u							
F ₁₀₀ (b)							
(a) CRD-C 105 (b) CRD-C 104				MORTAR:			
MORTAR-BAR EXPANSION AT 100F, % (CRD-C 105)				FINE AGGREGATE			
				COARSE AGGREGATE			
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:				3 MO. 6 MO. 9 MO. 12 MO. 3 MO. 6 MO. 9 MO. 12 MO.			
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:							
SOUNDNESS IN CONCRETE (CRD-C 40, 114):				F & T . J - CD HS - CW			
FINE AGG. COARSE AGG.				D'E ₅₀₀			
FINE AGG. COARSE AGG.				D'E ₅₀₀			
PETROGRAPHIC DATA (CRD-C 127):							
REMARKS:							

WES FORM 726 JAN. 1951

PLATE II

Issued Sept 1963

STATE: Ark.		INDEX NO.: 1 (rev #2)		AGGREGATE DATA SHEET		TESTED BY: USAEWES	
LAT.: 33		LONG.: 92		DATE: 9 Feb 1956, 9 Apr 1963			
LAB. SYMBOL NO.: VICKS-23 G-1, Job 6001/247				TYPE OF MATERIAL: Ben gravel & nat. sand			
LOCATION: Bearden, Ark.				LR-18 S-1, Job 6444			
PRODUCER: Pine Bluff Sand and Gravel Co.							
SAMPLED BY: John Johnson, Vicksburg District							
TESTED FOR: Flat Bayou Drainage Structure							
PROCESSING BEFORE TESTING: None							
GEOLOGICAL FORMATION AND AGE:							
USED AT: Flat Bayou Drainage Structure (1956)							
GRADING (CRD-C 105) (CUM. % PASSING):				TEST RESULTS			
SIEVE	3-6"	1 1/2-3"	3/4-1 1/2"	NO. 4	NO. 10	NO. 20	FINE AGG.
8 IN.							BLK. SP. GR., SAT SURF DRY (CRD-C 107, 108):
5 IN.							Absorption, PER CENT (CRD-C 107, 108):
4 IN.							ORGANIC IMPURITIES, FIG. NO. (CRD-C 121):
3 IN.							SOFT PARTICLES, PER CENT (CRD-C 130):
2 1/2 IN.							PER CENT LIGHTER THAN SP. GR. 2.40 (CRD-C 122):
2 IN.							PLR. CENT. FLAT AND ELONGATED (CRD-C 119, 120):
1 1/2 IN.							WEIGHTED AV. % LOSS, 3 CYC. MgSO ₄ (C) 1/2-1", #4-1/2" (CRD-C 115):
1 IN.							ABRASION LOSS (L.A.), %, (CRD-C 117):
3/4 IN.							UNIT WT., LB/CU FT (CRD-C 106):
1/2 IN.							CLAY LUMPS, % (CRD-C 118):
3/8 IN.							COAL AND LIGNITE, % (CRD-C 122):
1/4 IN.							SPECIFIC HEAT, BTU/LB/DEG. F. (CRD-C 124):
NO. 4							REACTIVITY WITH NaOH (CRD-C 128):
NO. 8							Sc, mM/L
NO. 16							Rc, mM/L
NO. 30							MORTAR-MAKING PROPERTIES (CRD-C 116)
NO. 50							TYPE: CEMENT, RATIO: DAYS: %
NO. 100							LINEAR THERMAL EXPANSION X10 9 DEG. F. (CRD-C 125, 126)
NO. 200							
- 200"							
F.M. (b)							
(a) CRD-C 105 (b) CRD-C 104				MORTAR:			
MORTAR-BAR EXPANSION AT 100F, % (CRD-C 123):				FINE AGGREGATE			
				COARSE AGGREGATE			
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:				3 MO. 6 MO. 9 MO. 12 MO. 3 MO. 6 MO. 9 MO. 12 MO.			
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:							
SOUNDNESS IN CONCRETE (CRD-C 46, 114):				F & T HW-CO HD-CW			
FINE AGG. COARSE AGG. DFE ₃₀₀							
FINE AGG. COARSE AGG. DFE ₂₀₀							
PETROGRAPHIC DATA (CRD-C 127):							
REMARKS:							

WES FORM 726 JAN. 1951

PLATE 12

FROM: CORPS OF ENGINEERS U. S. ARMY Lower Miss. Valley Division		REPORT OF SOUNDNESS TEST (CRD-C 175)		ADDRESS: USAEMES, Concrete Division P. O. Drawer 2131 Jackson, Mississippi 39205											
SYMBOL VICKS-39 Job 6606		PROJECT Felsenthal and Calion Locks and Dams		MATERIAL Natural sand and gravel											
SERIAL NO. VICKS-26 S-1(2), G-1(4)		SOURCE Ouachita Aggregate Company, Hampton, Ark.													
COARSE AGGREGATE															
SIEVE SIZE	GRADING FOR CALCULATION (Per Cent)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		WEIGHT PASSING FINER SIEVE AFTER TEST ACTUAL LOSS (g)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVG CORRECTED PER CENT LOSS					
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2				
NO. 4 TO 1/2 IN.	50	750	750	684.4	664.3	62.5	85.7	8.3	11.4	4.15	5.73				
1/2 TO 1 IN.	50	1500	1500	1387.9	1385.2	112.5	114.8	7.5	7.7	3.75	3.85				
TOTALS		2250	2250	2075.0	2049.5	175.0	200.5	15.8	19.1	7.90	9.55				
										SUM WEIGHTED AVG RUNS 1 & 2		17.45			
										AVG TOTAL WEIGHTED AVG RUNS 1 & 2		8.7 PER CENT			
CONSTITUENT (Size 1/2 to 1 in.)		NO. OF PARTICLES BEFORE TEST		NO. PARTICLES AFTER TEST											
				SPLIT		CHIMBLED		CRACKED		FLAKED		SOUND		TOTAL	
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
Chert		38	42	2	5	2	0	0	1	2	2	32	34	36	42

FINE AGGREGATE										
SIEVE SIZE	GRADING FOR CALCULATION (Per Cent)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVERAGE CORRECTED % LOSS		
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	
3/8 IN. NO. 4	2	-	-	-	-	(16.2)	(18.8)	0.3	0.4	
NO. 4-8	13	100	100	83.8	81.2	16.2	18.8	2.1	2.4	
NO. 8-16	20	100	100	94.4	94.2	5.6	5.8	1.1	1.2	
NO. 16-30	20	100	100	97.0	94.5	3.0	5.5	0.6	1.1	
NO. 30-50	24	100	100	96.6	95.3	3.4	4.7	0.8	1.1	
NO. 50-100	14	-	-	-	-	0.0	0.0	0.0	0.0	
NO. 100-PAN	7	-	-	-	-	0.0	0.0	0.0	0.0	
TOTALS		100	400	400	371.8	365.2	28.2	34.8	4.9	6.2
									SUM WEIGHTED AVG RUNS 1 & 2	11.1
									AVG TOTAL WEIGHTED AVG RUNS 1 & 2	5.6 PER CENT

REMARKS		
COARSE BY JFJ	CHECKED RLC	
FINE BY JFJ	DATE OF REPORT	
COMPUTED JFJ	11-5-64	

DES FORM
REV. REC. 1955 477

PLATE 13

FROM: CORPS OF ENGINEERS U. S. ARMY Lower Miss. Valley Division		REPORT OF SOUNDNESS TEST (CRD.C 115)	ADDRESS: USAHEWS, Concrete Division P. O. Drawer 2131 Jackson, Mississippi 39205
SYMBOL VICKS-39 Job 6606		PROJECT Felsenthal and Calion Locks and Dams	MATERIAL Natural sand and gravel
SERIAL NO. VICKS-26 S-2(2), G-2(2)		SOURCE St. Francis Materials Company, Harrell, Ark.	

COARSE AGGREGATE											
SIEVE SIZE	GRADING FOR CALCULATION (Per Cent)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		WEIGHT PASSING FINER SIEVE AFTER TEST ACTUAL LOSS (g)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVG CORRECTED PER CENT LOSS	
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
NO. 4 TO 1 IN	50	750	750	650.8	662.4	99.4	87.6	13.3	11.7	6.65	5.85
1 TO 1 IN	50	1500	1500	1333.0	1324.8	167.0	175.2	11.1	11.7	5.55	5.85
TOTALS		2250	2250	1983.8	1987.2	266.4	262.8	24.4	23.4	12.20	11.70
SUM WEIGHTED AVG RUNS 1 & 2										23.95	
AVG TOTAL WEIGHTED AVG RUNS 1 & 2										12.0 PER CENT	

CONSTITUENT (Size 1/8 to 7 in.)	NO. OF PARTICLES BEFORE TEST		NO. PARTICLES AFTER TEST													
			SPLIT		CRUMBLD		CRACKED		FLAKED		FUND		TOTAL			
	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2		
Chert	44	42	2	2	4	4	0	0	6	4	32	32	44	42		

FINE AGGREGATE									
SIEVE SIZE	GRADING FOR CALCULATION (%)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVERAGE CORRECTED % LOSS	
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
3/8-in.-NO. 4	2					(20.7)	(16.8)	0.4	0.3
NO. 4-8	12	100	100	79.3	83.2	20.7	16.8	2.7	2.2
NO. 8-16	20	100	100	94.2	92.8	5.8	7.2	1.2	1.4
NO. 16-30	20	100	100	94.8	95.6	5.2	4.4	1.0	0.9
NO. 30-50	24	100	100	94.4	97.4	5.6	2.6	1.3	0.6
NO. 50-100	14	-	-	-	-	0.0	0.0	0.0	0.0
NO. 100-PAN	7	-	-	-	-	0.0	0.0	0.0	0.0
TOTALS	100	400	400	362.7	369.0	37.3	31.0	6.6	5.4
SUM WEIGHTED AVG RUNS 1 & 2								12.0	
AVG TOTAL WEIGHTED AVG RUNS 1 & 2								6.0 PER CENT	

REMARKS		
COARSE BY JEF	CHECKED RLC	
FINE BY JEF	DATE OF REPORT	
COMPUTED JEF	11-5-64	

U.S. FORM
REV. DEC. 1955 477

PLATE 14

FROM: CORPS OF ENGINEERS U. S. ARMY Lower Miss. Valley DIVISION		REPORT OF SOUNDNESS TEST (CRD-C 115)		ADDRESS: USAEWES, Concrete Division P. O. Drawer 2131 Jackson, Mississippi 39205											
SYMBOL VICKS-39 Job 6606		PROJECT Felsenthal and Calion Locks and Dams		MATERIAL Natural sand and gravel											
SERIAL NO. VICKS-23 G-1(3)		SOURCE Pine Bluff Sand and Gravel Company, Bearden, Ark.													
COARSE AGGREGATE															
SIEVE SIZE	GRADING FOR CALCULATION (Per Cent)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		WEIGHT PASSING FINER SIEVE AFTER TEST ACTUAL LOSS (g)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVG CORRECTED PER CENT LOSS					
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2				
NO. 4 TO 1/2 IN	50	750	750	650.2	679.8	99.8	70.2	13.3	9.4	6.65	4.70				
1/2 TO 1 IN	50	1500	1500	1353.4	1365.4	146.6	134.6	9.8	9.0	4.90	4.50				
TOTALS		2250	2250	2003.6	2045.2	246.4	204.8	23.1	18.4	11.55	9.20				
SUM WEIGHTED AVG RUNS 1 & 2										20.75					
AVG TOTAL WEIGHTED AVG RUNS 1 & 2										10.4 PER CENT					
CONSTITUENT (Size % to 7 in.)		NO. OF PARTICLES BEFORE TEST		NO. PARTICLES AFTER TEST											
		RUN 1	RUN 2	SPLIT		CRUMBLE		CRACKED		FLAKED		SOUND		TOTAL	
Chert		50	46	3	3	10	4	1	1	10	5	26	33	50	46

FINE AGGREGATE									
SIEVE SIZE	GRADING FOR CALCULATION (%)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVERAGE CORRECTED % LOSS	
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
3/8-IN.-NO. 4	2								
NO. 4-8	13								
NO. 8-16	20								
NO. 16-30	20								
NO. 30-50	24								
NO. 50-100	14					0.0	0.0	0.0	0.0
NO. 100-PAN	7					0.0	0.0	0.0	0.0
TOTALS		100							
SUM WEIGHTED AVG RUNS 1 & 2									
AVG TOTAL WEIGHTED AVG RUNS 1 & 2 PER CENT									

REMARKS		
COARSE BY JFJ	CHECKED RLC	
FINE BY JFJ	DATE OF REPORT	
COMPUTED JFJ	1-12-65	

FROM: CORPS OF ENGINEERS U. S. ARMY Lower Miss. Valley DIVISION		REPORT OF SOUNDNESS TEST (CRD-C 115)		ADDRESS: USAEWES, Concrete Division P. O. Drawer 2131 Jackson, Mississippi 39205											
SYMBOL VICKS-39 Job 6606		PROJECT Felsenthal and Calion Locks and Dams		MATERIAL Natural sand and gravel											
SERIAL NO. VICKS-39 S-3, G-3		SOURCE Standard Gravel Company, Camden, Ark.													
COARSE AGGREGATE															
SIEVE SIZE	GRADING FOR CALCULATION (Per Cent)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		WEIGHT PASSING FINER SIEVE AFTER TEST ACTUAL LOSS (g)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVG CORRECTED PER CENT LOSS					
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2				
NO. 4 TO 1/2 IN	50	750	750	702	742	48	8	6.4	1.1	3.20	0.55				
1/2 TO 1 IN	50	1500	1500	1446	1419	54	81	3.6	5.4	1.80	2.70				
TOTALS		2250	2250	2148	2161	102	89	10.0	6.5	5.00	3.25				
										SUM WEIGHTED AVG RUNS 1 & 2		8.25			
										AVG TOTAL WEIGHTED AVG RUNS 1 & 2		4.1 PER CENT			
CONSTITUENT (Size 1/2 to 1 in.)		NO. OF PARTICLES BEFORE TEST		NO. PARTICLES AFTER TEST											
				SPLIT		CRUMBLED		CRACKED		FLAKED		SOUND		TOTAL	
				RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
Chert		39 42		3	1	0	0	2	0	3	1	31	40	39	42

FINE AGGREGATE										
SIEVE SIZE	GRADING FOR CALCULATION (%)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVERAGE CORRECTED % LOSS		
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	
3/8-IN.-NO. 4	2					(9.2)	(6.6)	0.2	0.1	
NO. 4-8	13	100	100	90.8	93.4	9.2	6.6	1.2	0.9	
NO. 8-16	20	100	100	97.4	97.1	2.6	2.9	0.5	0.6	
NO. 16-30	20	100	100	95.5	95.3	3.5	3.7	0.7	0.7	
NO. 30-50	24	100	100	95.6	98.3	4.4	1.7	1.1	0.4	
NO. 50-100	14	-	-	-	-	0.0	0.0	0.0	0.0	
NO. 100-PAN	7	-	-	-	-	0.0	0.0	0.0	0.0	
TOTALS		400	400	380.3	385.1	19.7	14.9	3.7	2.7	
								SUM WEIGHTED AVG RUNS 1 & 2		6.4
								AVG TOTAL WEIGHTED AVG RUNS 1 & 2		3.2 PER CENT

REMARKS		
COARSE BY JFJ	CHECKED RLC	
FINE BY JFJ	DATE OF REPORT	
COMPUTED JFJ	11-5-64	

WES FORM
REV. DEC. 1955 477

PLATE 16

FROM: CORPS OF ENGINEERS U. S. ARMY Lower Miss. Valley Division		REPORT OF SOUNDNESS TEST (CRD-C 115)		ADDRESS: USAENES, Concrete Division P. O. Drawer 2131 Jackson, Mississippi 39205											
SYMBOL VICKS-39 Job 6606		PROJECT Felsenthal and Calion Locks and Dams		MATERIAL Natural sand and gravel											
SERIAL NO. VICKS-39 S-2, G-2		SOURCE Monroe Sand and Gravel Company, Sterlington, La.													
COARSE AGGREGATE															
SIEVE SIZE	GRADING FOR CALCULATION (Per Cent)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		WEIGHT PASSING FINER SIEVE AFTER TEST ACTUAL LOSS (g)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVG CORRECTED PER CENT LOSS					
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2				
NO. 4 TO 1/2 IN.	50	750	750	745	711	5	39	0.7	5.2	0.35	2.60				
1/2 TO 1 IN.	50	1500	1500	1470	1496	30	4	2.0	0.3	1.00	0.15				
TOTALS		2250	2250	2215	2207	35	43	2.7	5.5	1.35	2.75				
SUM WEIGHTED AVG RUNS 1 & 2										4.1					
AVG TOTAL WEIGHTED AVG RUNS 1 & 2										2.0 PER CENT					
CONSTITUENT (Size % to 1 in.)		NO. OF PARTICLES BEFORE TEST		NO. PARTICLES AFTER TEST											
		RUN 1	RUN 2	SPLIT		CRUMLED		CRACKED		FLAKED		SOUND		TOTAL	
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
Chert		42	43	1	0	0	0	0	0	1	2	10	11	42	43

FINE AGGREGATE									
SIEVE SIZE	GRADING FOR CALCULATION (%)	WEIGHT OF TEST FRACTIONS BEFORE TEST (Grams)		WEIGHT OF TEST FRACTIONS AFTER TEST (Grams)		% PASSING FINER SIEVE AFTER TEST ACTUAL % LOSS		WEIGHTED AVERAGE CORRECTED % LOSS	
		RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2	RUN 1	RUN 2
3/8-IN.-NO. 4	2					(9.8)	(5.4)	0.2	0.1
NO. 4-8	13	100	100	90.2	94.6	9.8	5.4	1.3	0.7
NO. 8-16	20	100	100	96.8	95.5	3.2	4.5	0.6	0.9
NO. 16-30	20	100	100	97.9	97.2	2.1	2.8	0.4	0.6
NO. 30-50	24	100	100	98.1	95.7	1.9	4.3	0.5	1.0
NO. 50-100	14	-	-	-	-	0.0	0.0	0.0	0.0
NO. 100-PAN	7	-	-	-	-	0.0	0.0	0.0	0.0
TOTALS		100	400	383.0	383.0	17.0	17.0	3.0	3.3
SUM WEIGHTED AVG RUNS 1 & 2								6.3	
AVG TOTAL WEIGHTED AVG RUNS 1 & 2								3.2 PER CENT	

REMARKS		
COARSE BY JFJ	CHECKED RLC	
FINE BY JFJ	DATE OF REPORT	
COMPUTED JFJ	11-5-64	

RES FORM
REV. DEC. 1955 477

PLATE 17

Appendix A

Petrographic Report

Samples

1. Five samples of gravel and five samples of natural sand were received for petrographic analysis on 21 August 1964. They represented four deposits of sand and gravel from the central part of southern Arkansas and one deposit of sand and gravel from an area in Louisiana just south of the others. All of the samples represented processed material taken from stockpiles. Only two of the sands were within the grading limits specified in Corps of Engineers Guide Specifications for Concrete. For the eight samples that were not within the limits, a grading conforming to the middle of that given in the Guide Specifications was assumed for use in calculating sample compositions (table. A1-A5). Sample identifications are given below.

Concrete Division Serial No.	Producer and Source
VICKS-26 G-1(4), S-1(2)	Quachita Aggregate Co., Inc., Hampton, Arkansas. Champagnolle Creek Deposit, 4 miles west of Highway 167 between Hampton and El Dorado, Arkansas.
VICKS-26 G-2(2), S-2(2)	St. Francis Materials Co., Harrell, Arkansas. Harrell's Pit, 3 miles north of Harrell, Arkansas.
VICKS-23 G-1(2); LR-18 S-1(2)	Pine Bluff Sand and Gravel Co., Pine Bluff, Arkansas. 1/4 mile south of Highway 79 on gravel crossroad, approximately 2-1/2 miles west of Bearden, Arkansas.
VICKS-39 G-3, S-3	Standard Gravel Co., Camden, Arkansas. Just north of Camden, Arkansas, north of Highway 79 on Gravel Pit Road.
VICKS-39 G-2, S-2	Monroe Sand and Gravel Co., Sterlington, Louisiana. 1/2 mile west of Sterlington, south on blacktop and gravel road.

Test procedure

2. A representative portion of each sieve fraction that amounted to five or more percent of a sample was examined. The particles were classified and counted. A stereoscopic microscope was used as needed for the examination of the gravels. Sand sizes larger than the No. 30 sieve were examined with a stereoscopic microscope. The sizes passing No. 30 sieve

were examined as grain immersion mounts with a polarizing microscope. The refractive index of the immersion liquid used was 1.544. A monochromatic sodium light source was used as needed with a microscope equipped with a Saylor double diaphragm in testing for the presence of chalcedonic chert. (Chert having an aggregate refractive index below 1.544 is regarded as chalcedonic chert.) Since each pair of sand and gravel samples came from a common source, the search for chalcedonic chert was restricted to the sand sizes. It was thus assumed that chalcedonic chert is either present or absent in both the sand and the gravel.

Results of examination

3. a. Gravels. All of the gravels are composed largely of blocky chert particles with minor amounts of quartz particles. Dense chert particles make up from 59 to 85 percent of the samples. Particles of vuggy, fractured, or porous chert are present in small to moderate amounts (tables A1-A5).
- b. Sands. The sands are also composed largely of chert and of quartz particles, but quartz is the dominant constituent, amounting to 63 to 73 percent of the total sample (tables A1-A5). Some chalcedonic chert was found in three of the sands. These were VICKS-26 S-1(2), VICKS-39 S-3, and VICKS-39 S-2 (tables A1, A4, and A5, respectively).

Description of constituents

4. a. Dense chert. The particles are blocky with rounded edges, dominantly brown, with many black and light-gray particles.
- b. Porous chert. The porous particles are typically white or tan, tabular in shape with rounded edges, and would be expected to make popouts in concrete surfaces. The particles with porous rims have dense cores and porous rims up to 1/8 in. thick. Dense particles with some porous surface were counted as chert with porous rims. It is not known whether particles with porous rims will form popouts in concrete surfaces. As particle size decreases, the porous particles cannot be separated into "rimmed" and "not rimmed."
- c. Vuggy chert. Particles with many reentrants on their surfaces are classed in this group. They are lost, by breaking into smaller pieces without reentrants, in sizes passing the 3/4-in. sieve. They amounted to from a trace to 8 percent in the samples examined (tables A1-A5).
- d. Fractured chert. The particles contain incipient fractures and are expected to break into smaller pieces in the mixer. They diminish in fractions passing the 3/4-in. sieve. Fractured chert amounted to from a trace to 11 percent in the samples examined (tables A1-A5).

e. Quartz.

- (1) Gravels. The particles are blocky with rounded edges and many surface reentrants. They are translucent white to tan with some orange shading. The quartz particles are composed of intergrown quartz crystals, and represent vein quartz surviving longer than the sandstone that originally contained them. A few sandstone fragments contained quartz veins crossing the bedding.
 - (2) Sands. The quartz particles in the sand are generally transparent single crystals of variable particle shapes and rounded edges.
- f. Miscellaneous. Sandstone or quartzite particles make up most of this category in the gravels. The tan sandstone and quartzite are silica-cemented. A few pieces of iron oxide conglomerate are present in the gravels. In the sands many miscellaneous particles are acid igneous rocks.
- g. Feldspar. A small amount of blocky pinkish orthoclase and microcline particles were found in VICKS-39 S-2, VICKS-39 S-3, and VICKS-26 S-1(2). No feldspar was found in the other two sands or in the gravels.

Summary

5. Samples from five deposits of sand and gravel have been examined. All represented commercially processed aggregate. Chert made up about 80 to 96 percent of each gravel (tables A1-A5). Most of the chert was dense. The rest of the gravels was largely vein quartz.

6. The sands contained 63 to 73 percent quartz with chert the second most abundant constituent (tables A1-A5). Some chalcedonic chert was found in the samples from the Monroe Sand and Gravel Co. (VICKS-39 S-2), the Standard Gravel Co. (VICKS-39 S-3), and the Ouachita Aggregate Co. (VICKS-26 S-1(2)). Chert in each of these aggregates amounted to more than 20 percent; under the requirements of EM 1110-2-2000 of 15 December 1963, low-alkali cement should be used if any of these aggregates are used.

7. The sand from the Monroe Sand and Gravel Co. was dirty; the larger grains were coated with smaller grains, and the smaller grains were partially coated with reddish clay.

8. Three of the sources, the Ouachita Aggregate Co., the St. Francis Materials Co., and the Pine Bluff Sand and Gravel Co., had been sampled previously, but previous samples were not examined petrographically.

Table A1

Composition of Gravel and Sand from the Ouachita Aggregate Company
near Hampton, Arkansas, VICKS-26 G-1(4), S-1(2)

Constituents	Composition of Fractions Retained on Sieves										Weighted Average	
	Shown Below, %*										Composition, %**	
	1- in.	3/4- in.	1/2- in.	3/8- in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	3/4- to 1-1/2-in.	No. 4 to 3/4-in. Sand
Chert						57	42	27	12	8		27 Trace
Chalcedonic												
Dense	68	67	73	68	69						68	71
Vuggy		1									Trace	1
Fractured	10	2	1								7	tr
Porous rim	2	9	5	{10	{11						{7	{8
Porous	2	3	3									
Quartz	16	17	17	21	20	38	56	71	87	91	16	20
Miscellaneous	2	1	1	1		5	2	2	tr	1	2	Trace
Total	100	100	100	100	100	100	100	100	100	100	100	100

* Based on examination of 300 or more particles in each size shown except the 1-in.; it consisted of 131 particles.

** Percentage calculated using the composition of sieve fractions shown above and a grading taken from the middle of that given in Guide Specifications for Concrete, CE 1401.01, Aug 1963.

+ Composed of sandstone, quartzite, and assorted rock fragments.

Table A2

Composition of Gravel and Sand from the St. Francis Materials Company
near Harrell, Arkansas, VICKS-26 G-2(2), S-2(2)

Constituents	Composition of Fractions Retained on Sieves										Weighted Average Composition, %**
	Shown Below, %										
	3/4- in.	1/2- in.	3/8- in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 4 to 3/4-in.	
Chart	70	71	67	74	52	45	24	9	8	71 Trace	26
Dense										Trace	
Vuggy	2	6	4	{ 11						{ 11	
Fractured	9	4	8								
Porous rim	3										
Porous											
Quartz	14	18	20	14	42	54	75	90	92	17	73
Miscellaneous	2	1	1	1	6	1	1	1	Trace	1	1
Total	100	100	100	100	100	100	100	100	100	100	100

* Based on the examination of 300 or more particles in each size shown above.

** Percentage calculated using the composition of sieve fractions shown above and a grading taken from the middle of that given in Guide Specifications for Concrete, CE 1401.01, Aug 1963.

† Composed of sandstone, quartzite, and assorted rock particles.

Composition of Gravel and Sand from the Pine Bluff Sand and Gravel Company
Pine Bluff, Arkansas, VICKS-23 G-1(2); LR-18 S-1(2)

Constituents	Composition of Fractions Retained on Sieves						Weighted Average Composition, %		
	Shown Below, %*						3/4- to 1-1/2-in.**	No. 4 to 3/4-in.**	Sand
	1-in.	3/4-in.	1/2-in.	3/8-in.	No. 4	No. 10			
Chert	57	64	73	66	74	13	59	70	34
Donse		1	1				Trace		
Vuggy	7	5	tr				7		
Fractured	17	12	8	{19	{12		{23	{16	
Porous rim	9	5	9						
Percus									
Quartz	10	12	9	14	14	85	11	13	63
Miscellaneous††	100	100	100	100	100	100	tr	1	3
							100	100	100

Based on examination of 300 or more particles in each fraction shown except the 1-in.; it consisted of 108 particles.

108 particles.

Percentage calculated using the composition of sieve fractions shown above and a grading taken from the middle of that given in Guide Specifications for Concrete, CE 1401.01, Aug 1963.

+ Percentage based on the composition by sieve fractions and on the grading of the sample. For this calculation of that given in Guide Specifications for Concrete, CE 1401.01, Aug 1965.

†† Composed of sandstone, quartzite, and assorted rock particles.

Table A4

Composition of Gravel and Sand from the Standard Gravel Company
Camden, Arkansas, VICKS-39 G-3, S-3

Constituents	Composition of Fractions Retained on Sieved Shown Below, %*							Weighted Average Composition, %**		
	No.							No.		
	3/4- in.	1/2- in.	3/8- in.	No. 4	No. 10	No. 20	No. 40	3/4- to 1-1/2-in.	No. 4 to 3/4-in.	Sand
Chart				73	45	20	8	7		27
Thalassidomide								Trace		Trace
Dense	72	82	69	81				74	85	
Vuggy	1	Trace	Trace					1		
Fractured	13	7	5	5				11	5	
Forcus	6	4						6		
Quartz	7	6	6	13	23	49	77	7	8	69
Miscellaneous	1	1	1	1	4	6	3	1	2	4
Total	100	100	100	100	100	100	100	100	100	100

* Based on examination of 300 or more particles in each size shown except the 1-in.; it consisted of 94 particles.

** Percentage calculated using the composition of sieve fractions shown above and a grading taken from the middle of that given in Guide Specifications for Concrete, CE 1401.01, Aug 1963.

* Composed of sandstone, quartzite, and assorted rock fragments.

Table A5

Composition of Gravel and Sand from the Monroe Sand and Gravel Company
Sterlington, Louisiana, VICKS-39 G-2, S-2

Constituents	Composition of Fractions Retained on Sieves Shown Below, %*										Weighted Average				
											Composition, %				
	1-1/2- in.	1- in.	3/4- in.	1/2- in.	3/8- in.	No. 4 Gravel	Sand	No. 8	No. 16	No. 30	No. 50	No. 100	3/4- 1-1/2- in.**	3/4- in.**	Sand†
Chert						79	52	33	5	6	{8				{21
Chalcedonic															
Dense	58	79	89	79	75	76							82	76	
Vuggy	24	10	3	3									8	1	
Fractured	8	4	1	10	10								3	Trace	
Porous rim		{3	{4	4	4	{11							{3	{13	
Porous															
Quartz		1		3	10	12	19	41	60	93	83	70	1	9	71
Miscellaneous††	10	3	3	1	1	1	3	6	4	1	6	10	3	1	5
Feldspar								1	3	1	3	10			3
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

* Based on examination of 300 or more particles in each sieve fraction shown except the 1-1/2-in. and the No. 4 of the sand; the 1-1/2-in. size consisted of 50 particles, and the No. 4 size of the sand contained 88 particles.

** Percentage calculated using the composition of sieve fractions shown above and a grading taken from the middle of that given in Guide Specifications for Concrete, CE 1401.01, Aug 1963.

† Percentage based on the composition by sieve fractions and on the grading of the sample. The material passing No. 100 sieve was assumed to have a composition like the No. 100 sieve size material for this calculation.

†† Composed of sandstone, quartzite, and assorted rock particles.