EVALUATION OF FINE AGGREGATE FROM MCBRO, INC., CALAIS, VERMONT FOR USE IN STRUCTURAL CONCRETE

REPORT 87-4
JANUARY 1987

REPORTING ON WORK PLAN 86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

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Date: Jan. 26, 1987

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ABSTRACT

To produce the optimum structural concrete, aggregates must be tested and evaluated to assure conformance to required specifications.

This report documents results of tests performed on a proposed new source of fine aggregate for structural concrete. The material tested was a fine aggregate produced at the McBro, Inc. facilities in Calais, Vermont.

Test results and evaluation confirm this material meets the required specifications as a fine aggregate source for structural concrete.

INTRODUCTION

To provide an accurate evaluation of an aggregate for use in structural concrete, not only should tests be initiated to assure compliance with required specifications, but a collation of the new aggregate with a previously evaluated reference aggregate should be performed. This procedure compares both aggregates by preparing and testing concrete mixtures under the same conditions.

A request was received from Dwight McCullough, Secretary-Treasurer of McBro, Incorporated to evauate fine aggregate, being produced at his company's facility in Calais, Vermont, for use in structural concrete.

Samples of the fine aggregate were obtained by Materials and Research Division representatives and evaluated for compliance with the requirements of Section 704.01 of the Standard Specifications for Construction. Materials were obtained and the performance-in-concrete phase of the evaluation was conducted in the Central Laboratory of the Materials and Research Division.

PROCEDURES

PHASE I - SECTION 704.01 AND SECTION 704.02 TESTS

The proposed new fine aggregate was sampled, by representatives of the Materials and Research Division, from a stockpile at the McBro, Incorporated facility in Calais, Vermont. The material was examined for Gradation (AASHTO T 27-84), Organic Impurities (AASHTO T 21-81), Sodium Sulfate Soundness (AASHTO T 104-86) and Compressive Strength of Mortar (Section 704.01, (c) of the Standard Specifications for Construction).

An initial sample, obtained on June 20, 1986, failed to comply with soundness requirements. A second sample, also obtained on June 20, 1986, was then submitted for testing and was found to be in compliance with requirements. A follow up sample taken on August 5, 1986 also complied with the soundness requirements.

The reference fine aggregate and the coarse aggregate were sampled from stockpiles at the A. G. Anderson Ready Mixed Concrete Plant in Berlin, Vermont. The reference fine aggregate was examined for gradation and organic impurities. The coarse aggregate was examined for Gradation (AASHTO T 27-84), Percent of Wear (AASHTO T 96-83), Thin and Elongated Pieces (VT AOT-MD 22) and Fractured Faces (VT AOT-MD 23). The reference fine aggregate and coarse aggregate were found to comply respectively with Section 704.01 and Section 704.02 requirements.

Fine aggregate test results are shown in Table 1. Coarse aggregate

test results are shown in Table 2. Aggregate test results are also shown on Laboratory Report Nos. G86 0463, G86 0464, A86 0956, A86 1041 A86 1146, G86 1051, G86 1052 and G86 1187 in Appendix B.

The Vermont Agency of Transportation, Chief Geologist traveled to the facility in Calais, Vermont to make an on-site investigation of the raw material pit and to obtain samples for analysis. A copy of the Chief Geologist's petrographic analysis is shown in Appendix C.

TABLE 1
FINE AGGREGATE TEST DATA

	Proposed New Aggregate McBro, Inc. Calais, VT				Reference Aggregate Anderson Highgate, VT	
	Dates Sampled				Date Sampled	V.A.O.T. Specification
	6-20-86	6-20-86	8-5-86	9-16-86	9-12-86	Requirements
Sieve Size	%Passing	%Passing	%Passing	%Passing	%Passing	%Passing
3/8"	100	100	-	100	100	100
#4	95	96	-	96	99	95-100
#8	81	84	-	86	82	-
#16	64	69	-	72	62	50-80
#30	39	43	-	45	41	25-60
#50	17	18	-	20	23	10-30
#100	6	6	-	8	8	2-10
#200	-	-	-	2.8	-	-
Fineness Modulus	2.98	2.84	-	2.73	2.85	2.60-3.10
Organic Impurities, color	<1	<1	-	<1	1	2 maximum
Soundness, percent loss	10.89	6.63	6.35	-	-	8 maximum
Compressive Strength of Mortar, percent of Ottawa Sand						
3 days	138	-	-	-	-	100 minimum
7 days	149	-	-	-	-	100 minimum

TABLE 2

COARSE AGGREGATE TEST DATA

	3/4" Crushed Igneous Stone Cooley, Websterville, VT Date Sampled 9/12/86	V.A.O.T. Specification Requirements
Sieve Size	%Passing	%Passing
1"	100	100
3/4"	98	90-100
3/8"	20	20- 55
#4	3	0- 10
#8	2	0- 5
L. A. Abrasion, %loss	32.2	50 maximum
Thin and Elongated Pieces, %	1.6	10 maximum
Fractured Faces, %	100	-

PHASE II - PERFORMANCE-IN-CONCRETE TESTS

The performance-in-concrete tests were conducted on concrete prepared in the Central Laboratory. Mixtures were designed by Structural Concrete Subdivision personnel for Class A and Class B concrete, using the following materials:

Coarse Aggregate

3/4 inch Crushed Igneous Stone
Cooley, Websterville, Vermont

Fine Aggregate

A. Proposed New Aggregate
McBro, Inc., Calais, Vermont

B. Reference Aggregate
A. G. Anderson, Highgate, Vermont

Cement

Type II
Northeast Cement Co., St. Constant, Quebec

Air Entraining Admixture

Daravair
W. R. Grace & Co., Cambridge, Massachusetts

Water Reducing Admixture

WRDA with Hycol
W. R. Grace & Co., Cambridge, Massachusetts

Aggregate properties used for preparing mix designs are shown in Table 3 and Table 4.

TABLE 3

COARSE AGGREGATE PROPERTIES

	Bulk Specific Gravity	Absorp., percent	Dry Rodded Unit Weight, lbs/cu. ft.
Reference Aggregate Cooley, Websterville, Vermont	2.62	0.6	95.71

TABLE 4

FINE AGGREGATE PROPERTIES

	Bulk Specific Gravity	Absorp., Percent	Fineness Modulus
New Aggregate McBro Inc., Calais, Vermont	2.66	0.6	2.90
Reference Aggregate A. G. Anderson, Highgate, Vermont	2.60	1.1	2.80

The concrete used in this evaluation was mixed in a Sears rotary drum mixer with batch size being 1.8 cubic feet. Aggregates were dried prior to the start of mixing operations.

Two batches each of the Class A and Class B concrete containing the new fine aggregate were prepared as well as two batches each of the Class A and Class B concrete containing the reference fine aggregate.

The mix proportions used are shown in Table 5 and Table 6.

TABLE 5

NEW AGGREGATE MIX DESIGN
BATCH QUANTITIES PER C.Y.

	Class A		Class B	
	Batch 1	Batch 2	Batch 3	Batch 4
*Coarse Aggregate, lbs.	1597	1597	1597	1597
*McBro, Fine Aggregate, lbs.	1262	1262	1406	1406
Cement, lbs.	660	660	611	611
Air Entraining Admixture, oz.	5	5	4	4
Water Reducing Admixture, oz.	19.8	19.8	18.3	18.3
Net Water, gal.	35.0	34.6	35.2	35.2

*Weights converted to saturated surface-dry condition

TABLE 6

REFERENCE AGGREGATE MIX DESIGN
BATCH QUANTITIES PER C.Y.

	Class A		Class B	
	Batch 5	Batch 6	Batch 7	Batch 8
*Coarse Aggregate, lbs.	1623	1623	1623	1623
*Anderson, Fine Aggregate, lbs.	1207	1207	1348	1348
Cement, lbs.	660	660	611	611
Air Entraining Admixture, oz.	5	5	4	4
Water Reducing Admixture, oz.	19.8	19.8	18.3	18.3
Net Water, gal.	31.5	31.9	31.5	31.5

*Weights converted to saturated surface-dry condition

Tests were performed on the fresh concrete to determine Slump (AASHTO T 119-86), Air Content (AASHTO T 152-86) and Unit Weight (AASHTO T 121-86). Six test cylinders (6" x 12") and one 3" w x 3" d x 16" l freeze-thaw specimen were cast from each batch. The cylinders were tested for compressive strength (AASHTO T 22-86), two each at ages 7, 14 and 27 days. The freeze-thaw specimens were moist cured for 14 days, after which they were subjected to freezing and thawing (AASHTO T 161-86) in a 3% NaCl solution.

RESULTS

Results of tests on the fresh concrete and compressive strength test results are shown in Table 7 and Table 8.

TABLE 7

PERFORMANCE TEST RESULTS
NEW AGGREGATE

	Class A		Class B	
	Batch 1	Batch 2	Batch 3	Batch 4
Slump, inches	2 1/2	2 3/4	2 3/4	2 3/4
Air Content, percent	6.1	6.6	5.5	5.8
Unit Weight, lbs/cu.ft.	142.01	141.41	143.26	142.41
Compressive Strength, psi				
7 days	4076	4050	3886	3815
14 days	4594	4492	4377	4253
27 days	4881	4899	4607	4571
(Design Compressive Strength, psi)	(4000)		(3500)	

TABLE 8

PERFORMANCE TEST RESULTS
REFERENCE CONCRETE

	Class A		Class B	
	Batch 5	Batch 6	Batch 7	Batch 8
Slump, inches	2 1/4	2 3/4	2 1/2	2 1/2
Air Content, percent	5.7	5.9	5.3	5.9
Unit Weight, lbs/cu.ft.	143.62	143.22	143.66	143.01
Compressive Strength, psi				
7 days	4315	4448	4474	4302
14 days	4797	4987	4877	4722
27 days	5279	5473	5067	4978
(Design Compressive Strength, psi)	(4000)		(3500)	

The results of compressive strength tests are also shown of Laboratory Report Nos. C86 1486 through C86 1493 in Appendix D. Strength age plots illustrating average compressive strengths are shown in Figure I and Figure II.

The results of dynamic testing of freeze-thaw specimens are shown in Table 9. The percent weight loss resulting from freezing and thawing of specimens is shown in Table 10. Freeze-thaw test results are also summarized in Figure III and Figure IV. These figures show a comparison of results obtained with the reference aggregate and the new aggregate after 300 cycles of freezing and thawing.

TABLE 9

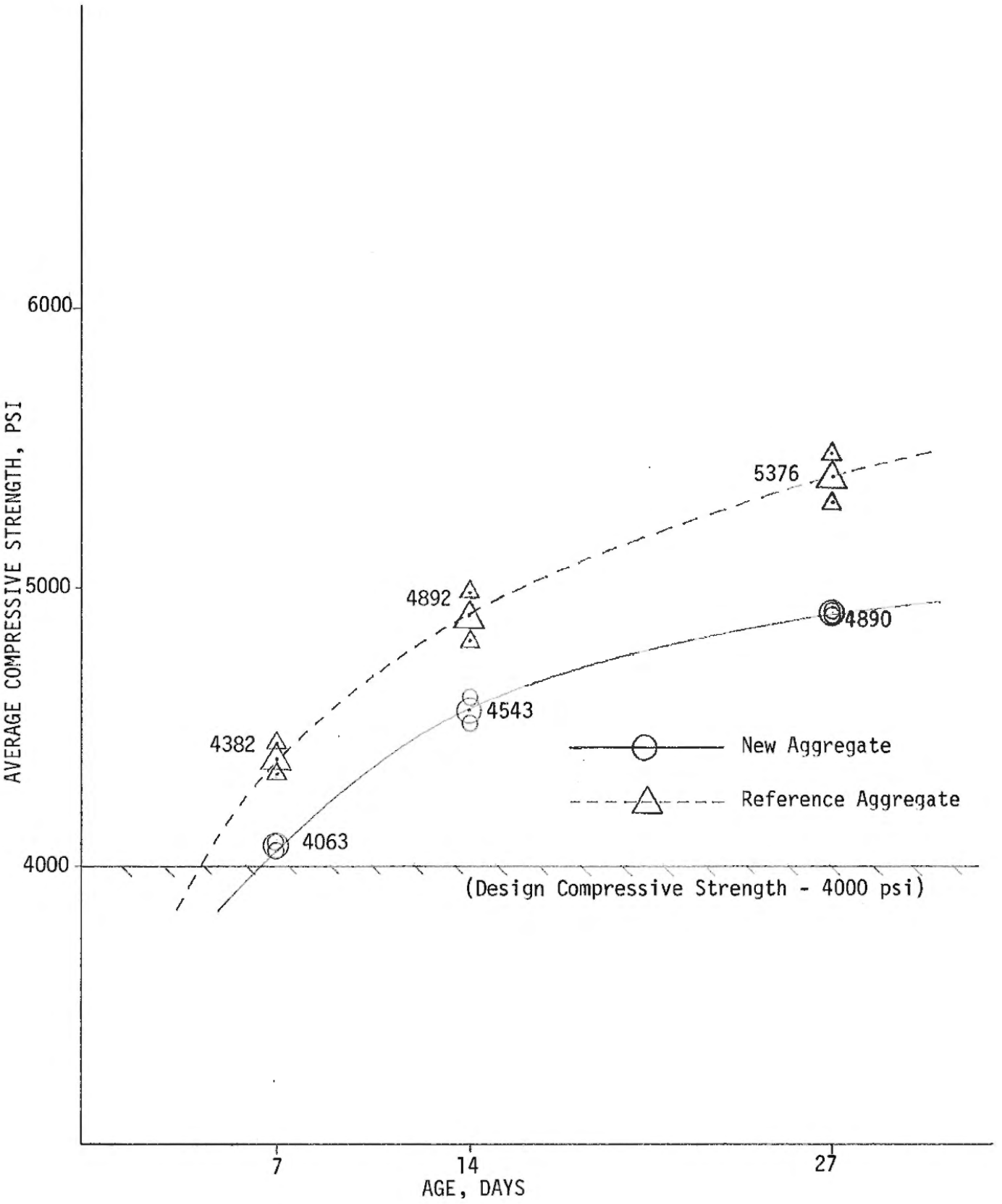
FREEZE-THAW TEST RESULTS - DURABILITY FACTOR

No. of Cycles	New Aggregate				Reference Aggregate			
	Class A		Class B		Class A		Class B	
	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Batch 6	Batch 7	Batch 8
	Durability Factor							
50	100.0	93.6	92.3	91.4	92.3	92.0	89.2	91.5
100	102.9	94.9	89.5	90.5	92.2	92.6	86.8	91.2
150	101.3	92.3	88.0	88.8	91.0	91.0	85.3	89.3
200	103.1	92.3	85.0	87.1	90.2	90.2	84.2	88.7
250	103.5	92.9	83.0	85.4	90.0	89.0	81.9	87.8
300	103.4	90.7	79.7	83.7	87.8	87.5	79.5	85.0

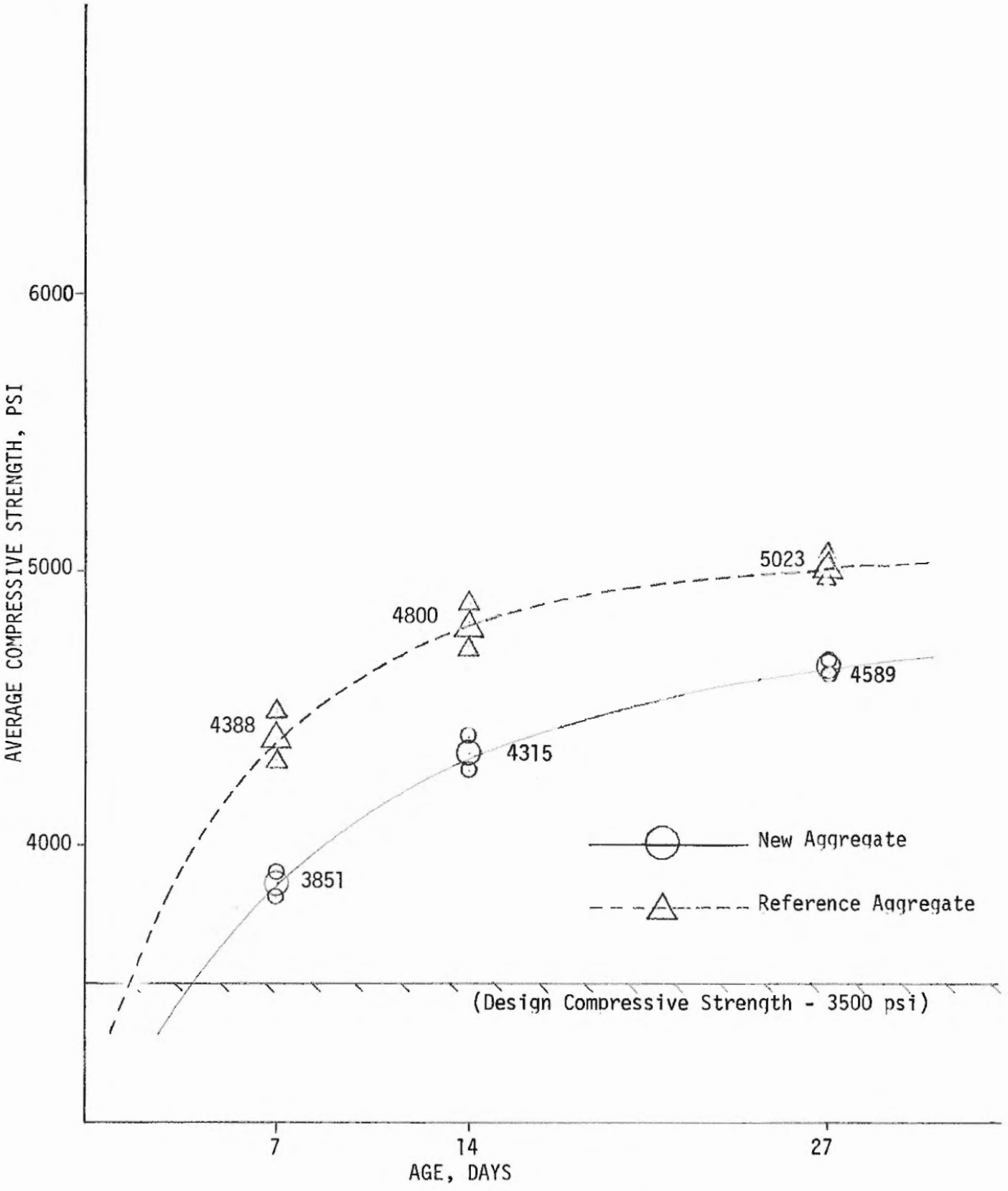
TABLE 10

FREEZE-THAW TEST RESULTS - PERCENT WEIGHT LOSS

No. of Cycles	New Aggregate				Reference Aggregate			
	Class A		Class B		Class A		Class B	
	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Batch 6	Batch 7	Batch 8
	Percent Weight Loss							
50	0.8	1.0	2.9	2.4	1.3	1.2	3.0	1.8
100	1.2	1.6	4.8	4.0	1.3	1.8	4.8	3.0
150	1.9	2.2	6.6	5.0	2.4	2.2	6.1	3.1
200	1.4	3.0	7.3	5.7	2.9	2.9	7.4	4.3
250	2.2	3.9	8.9	7.3	3.6	3.8	9.2	5.7
300	3.2	4.0	10.3	8.3	4.9	4.7	10.8	7.0



AVERAGE COMPRESSIVE STRENGTH VS AGE
CLASS A
FIGURE I



AVERAGE COMPRESSIVE STRENGTH VS AGE
CLASS B
FIGURE II

Batch Number	No. Cycles	Weight Lbs.	Percent Weight Loss	Fundamental Transverse Frequency "N"	"N"^{2}	Individual Durability Factor DF	Average DF	Relative Durability Factor RDF
Reference Aggregate								
5	0	12.27		1604	2572816			
			4.9			87.8		
5	300	11.67		1503	2259009			
							87.7	
6	0	12.22		1591	2531281			
			4.7			87.5		
6	300	11.65		1488	2214144			
								110.7
New Aggregate								
1	0	12.05		1504	2371600			
			3.2			103.4		
1	300	11.67		1566	2452356			
							97.1	
2	0	12.14		1573	2474329			
			4.0			90.7		
2	300	11.65		1498	2244004			

SUMMARY OF FREEZE-THAW TEST RESULTS

CLASS A

FIGURE III

Batch Number	No. Cycles	Weight Lbs.	Percent Weight Loss	Fundamental Transverse Frequency "N"	"N"^{2}	Individual Durability Factor DF	Average DF	Relative Durability Factor RDF
Reference Aggregate								
7	0	12.19		1599	2556801			
			10.8			79.5		
7	300	10.87		1426	2033476			
							82.3	
8	0	12.08		1584	2509056			
			7.0			85.0		
8	300	11.24		1460	2121600			
								99.3
New Aggregate								
3	0	12.26		1554	2414916			
			10.3			79.7		
3	300	11.00		1387	1923769			
							81.7	
4	0	12.13		1583	2505889			
			8.3			83.7		
4	300	11.12		1448	2096704			

SUMMARY OF FREEZE-THAW TEST RESULTS

CLASS B

FIGURE IV

SUMMARY AND CONCLUSIONS

1. The initial sample of fine aggregate from the McBro, Incorporated facility in Calais, Vermont failed to comply with soundness requirements. Two subsequent samples obtained from the same facility were found to be in compliance with soundness requirements. The fine aggregate complied with all remaining requirements of Section 704.01 when tested in conjunction with this evaluation.
2. The compressive strengths of concrete containing the Calais fine aggregate were approximately nine percent lower than the strengths of concrete containing the reference aggregate. The Class A concrete containing the reference aggregate had an average compressive strength at 27 days which was 486 psi higher than the Class A concrete containing the Calais aggregate. The Class B concrete containing the reference aggregate had an average compressive strength at 27 days which was 434 psi higher than the Class B concrete containing the Calais aggregate. Although the concrete containing the new aggregate did not yield compressive strengths equal to the strengths of the concrete containing the reference aggregate, the strengths obtained are considered acceptable.
3. Results of freezing and thawing tests showed the Class A concrete containing the new aggregate performed better in sonic testing than the Class A concrete containing the reference aggregate. The average durability factor for the Class A concrete with the new aggregate was 97.1 while the Class A concrete with the reference aggregate had an average durability factor of 87.7.

The Class A concrete containing the new aggregate also showed less weight loss (3.6%) than the Class A concrete containing the reference aggregate(4.8%). However, the Class B concrete showed slightly reduced performance for both sonic testing and percent of weight loss when compared to the Class B concrete containing the reference aggregate. The average durability factor was 82.7 for the Class B concrete with the reference aggregate and 81.7 for the Class B concrete with the new aggregate. The percent weight loss averaged 8.9% for the Class B concrete with the reference aggregate and 9.3% for the Class B concrete containing the new aggregate.

RECOMMENDATIONS

1. It is recommended that the present McBro, Incorporated facility in Calais, Vermont, be approved as a source of fine aggregate for use in structural concrete.
2. During the initial uses of concrete containing this aggregate on Agency projects, Materials and Research Division representatives shall conduct tests necessary to determine the performance of this aggregate in concrete under field conditions.
3. Also during the initial uses of concrete containing this aggregate on Agency projects, the Structural Concrete Engineer shall establish a schedule for performing soundness testing of the aggregate to insure continued compliance of the material with applicable specification requirements.

Prepared By: W. Meyer WJM
Date: March 26, 1982
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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

VERMONT PROCEDURE FOR EVALUATING A NEW SOURCE OF STRUCTURAL CONCRETE AGGREGATE

VT-AOT-MRD 9-82

1. SCOPE

A procedure for evaluating new structural concrete aggregate sources by testing proposed new aggregates for compliance with Section 700 requirements and by comparing results of tests performed on concrete using the new aggregate with results obtained from concrete containing a reference aggregate.

2. PROCEDURE

General

The evaluation of a new structural concrete aggregate source (i.e., one on which the Materials and Research Division has no service-in-concrete data) shall be divided into two sections called:

Phase I Section 700 and related tests, and Phase II Performance-in-Concrete tests.

All requests for evaluation of new structural concrete aggregate sources shall be made, in writing, to the Materials and Research Engineer. Requests shall describe the type of material proposed for use as well as the location and quantity of available stockpiles.

Materials and Research Division personnel shall perform all work necessary for both the Phase I and Phase II sections of this evaluation process. The work will be performed in an expeditious manner consistent with availability of manpower. Evaluations may require 60 calendar days or more from the date the aggregate is available for testing (controlled by the availability of personnel to perform testing). Delays beyond the control of the Materials and Research Division shall be documented and notification given of the consequent extension of time required to complete the evaluation.

Test results shall be the basis for determining acceptance, further testing, or rejection of the proposed new material. Failure of the material to comply with all applicable requirements, during any phase of testing, may necessitate rescheduling or termination of the evaluation.

The cost of materials necessary to complete the evaluation will be borne by the requesting party.

A report shall be prepared documenting the Materials and Research Division's involvement in the evaluation. A copy of the report shall be forwarded with a cover letter, informing the requesting party of the acceptability or nonacceptability of the aggregate.

Phase I

1. Following receipt of the written request, the Structural Concrete Engineer will schedule a field petrographic examination of the proposed new aggregate source by the Vermont A.O.T. Chief Geologist.

2. The Structural Concrete Engineer or his representative will visit the site and determine:

   (a) Does a stockpile of at least 50 cubic yards of processed material exist?

   (b) Can samples be obtained in the standard manner from the stockpiles?

3. If 2(a) and 2(b) are yes, the Structural Concrete Engineer shall make necessary arrangements for obtaining samples from the designated stockpile.

4. The material shall be tested at the Central Laboratory using the Structural Concrete Subdivision Annual Aggregate Testing Program procedure.

5. Report the results (as an Evaluation Sample) on the Standard Materials and Research Division forms.

Phase II

1. The performance-in-concrete tests shall be performed on concrete prepared at the Central Laboratory. The proposed new aggregate will be evaluated by comparing results of tests performed on concrete using the new aggregate with results obtained from concrete containing a reference aggregate. Cement, admixtures, and aggregates, other than the proposed new aggregate, will be selected by the Structural Concrete Engineer. Normally, these materials will be the same as the materials currently in use at the Ready-mix plant where the proposed new aggregate will be used.

2. Mix proportions for each class of concrete required shall be designed or approved by the Materials and Research Division and shall conform to Table 501.03A of the Vermont Standard Specifications for Highway and Bridge Construction, current edition.

3. Test cylinders shall be fabricated and cured in accordance with AASHTO T23. They shall be tested for compressive strength at ages 7, 14, and 28 days in accordance with AASHTO T22.

4. Tests of Slump, Air Content, and Unit Weight shall be in accordance with AASHTO T119, AASHTO T152, and AASHTO T121, respectively.

CF
BENDA
MCBEAN

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
2M 6/84
2M 6/85
2M 2/86

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report JUNE 27, 19 86

Laboratory No. G8600463 Tested By HOLT

Name FINE AGGREGATE FOR CONCRETE ITEM 501

Identification Marks EVALUATION SAMPLE

Submitted by BENDA Title SCE Address

Sampled 6/20 19 86 Received , 19 Testing Completed , 19

Sample from STOCKPILE AT MCBRO INC., EAST CALAIS

Quantity Represented 50 CY

Source of Material MCBRO INC., EAST CALAIS

Project Name & Number POSSIBLE FUTURE USE

Examined for 704.01

TEST RESULTS

Total Sample

Sieve Size	% Passing
6"	
5 1/2"	
5"	
4 1/2"	
4"	
3 3/4"	
3 1/2"	
3"	
2 1/2"	
2"	
1 3/4"	
1 1/2"	
1 1/4"	
1"	
7/8"	
3/4"	
5/8"	
1/2"	
3/8"	100
No. 4	96
No. 8	84
No. 10	
No. 16	69
No. 30	43
No. 50	18
No. 100	6
No. 200	

Sand Portion

Fineness Modulus
% Coarser Than

No. 100	94
No. 50	82
No. 30	57
No. 16	31
No. 8	16
No. 4	4

Fineness Modulus = 2.84

Color = < 1

Comments:

TEST #2: THIS MATERIAL WAS EXAMINED FOR COLOR AND GRADATION. THE RESULTS ARE AS INDICATED

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96
Grading
Fractured Faces, %

Thin & Elongated Pieces, %

Soundness, % Loss

Frank E. [illegible], P.E., Chief Engineer

By:
R. F. Nicholson, P.E., Materials & Research Engineer

cm

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
2M 6/84
2M 6/85
2M 2/86

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STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report JUNE 27, 19 86

Laboratory No. G8600464 Tested By HOLT

Name FINE AGGREGATE FOR CONCRETE ITEM 501

Identification Marks EVALUATION SAMPLE

Submitted by BENDA Title SCE Address

Sampled 6/20, 19 86 Received 6/20, 19 86 Testing Completed 6/23, 19 86

Sample from STOCKPILE AT MCBRO INC., EAST CALAIS

Quantity Represented 50 CY

Source of Material MCBRO INC., EAST CALAIS

Project Name & Number POSSIBLE FUTURE USE

Examined for 704.01

TEST RESULTS

Total Sample Sieve Size	% Passing	Sand Portion
6 1/2"		
6"		
5 1/2"		
5"		
4 1/2"		
4"		
3 1/2"		
3"		
2 1/2"		
2"		
1 3/4"		
1 1/2"		
1"		
7/8"		
5/8"		
1/2"		
3/8"	100	
No. 4	95	
No. 8	81	
No. 10		
No. 16	64	
No. 30	39	
No. 50	17	
No. 100	6	
No. 200		

Fineness Modulus
% Coarser Than

No. 100	94
No. 50	83
No. 30	61
No. 16	36
No. 8	19
No. 4	5

Fineness Modulus = 2.98

Color = 21

Comments:

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96
Grading
Fractured Faces, %
Thin & Elongated Pieces, %
Soundness, % Loss

TEST #1: THIS MATERIAL WAS EXAMINED FOR COLOR AND GRADATION. THE RESULTS ARE AS INDICATED

Frank E. Aldrich, P.E., Chief Engineer

By: R.F. Nicholson 1847

R. F. Nicholson, P.E., Materials & Research Engineer

cm

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
2M 6/84
2M 6/85
2M 2/86

CF
BENDA

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report JULY 23, 1986

Laboratory No. A86 0956 Tested By LAVIN

Name FINE AGGREGATE FOR CONCRETE 501.

Identification Marks EVALUATION SAMPLE

Submitted by BENDA Title ST. ENG. Address

Sampled 6/20 1986 Received 6/20, 1986 Testing Completed 7/16, 1986

Sample from STOCKPILE

Quantity Represented

Source of Material MCBRO PIT E CALAIS

Project Name & Number POSSIBLE FUTURE USE

Examined for 704.01

TEST RESULTS

Total Sample Sieve Size	% Passing	Sand Portion
6 1/2"		
6"		
5 1/2"		
5"		
4 1/2"		
4"		
3 3/4"		
3 1/2"		
3"		
2 5/8"		
2 1/2"		
2"		
1 5/8"		
1 1/2"		
1"		
7/8"		
5/8"		
1/2"		
3/8"		
No. 4		
No. 8		
No. 10		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

Fineness Modulus
% Coarser Than

No. 100	
No. 50	
No. 30	
No. 16	
No. 8	
No. 4	

Fineness Modulus =

Color =

Comments:

COMPRESSIVE STRENGTH: 138% OF REFERENCE IN 3 DAYS
149% OF REFERENCE IN 7 DAYS
THIS MATERIAL TESTS 2.89% HIGH ON SOUNDNESS FOR 704.01

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96
Grading
Fractured Faces, %

Thin & Elongated Pieces, %

Soundness, % Loss 10.89

Frank E. Aldrich, P.E., Chief Engineer

By: R. F. Nicholson 8/27

R. F. Nicholson, P.E., Materials & Research Engineer

cm

CF
BENDA

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
2M 6/84
2M 6/85
2M 2/86

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report AUGUST 4, 1986

Laboratory No. A86-1041 Tested By LAVIN

Name FINE AGGREGATE FOR CONCRETE 501

Identification Marks EVALUATION SAMPLE

Submitted by BENDA Title _____ Address _____

Sampled 6/20, 1986 Received 6/21, 1986 Testing Completed 7/30, 1986

Sample from STOCKPILE

Quantity Represented 50 CYS

Source of Material MCBRO PIT E CALAIS

Project Name & Number POSSIBLE FUTURE USE

Examined for 704.01

TEST RESULTS

Total Sample Sieve Size	% Passing
6 1/2"	
6"	
5 1/2"	
5"	
4 1/2"	
4"	
3 3/4"	
3 1/2"	
3"	
2 1/2"	
2"	
1 3/4"	
1 1/2"	
1"	
7/8"	
5/8"	
1/2"	
3/8"	
No. 4	
No. 8	
No. 10	
No. 16	
No. 30	
No. 50	
No. 100	
No. 200	

Fineness Modulus % Coarser Than	
No. 100	
No. 50	
No. 30	
No. 16	
No. 8	
No. 4	

Fineness Modulus = _____

Color = _____

Comments:

Sand Portion _____ _____

Percent of Wear

AASHTO T3 _____
AASHTO T4 _____
AASHTO T96 _____
Grading
Fractured Faces, % _____

Thin & Elongated Pieces, % _____

Soundness, % Loss 6.63

THIS MATERIAL WAS EXAMINED FOR SOUNDNESS. THE RESULTS ARE AS INDICATED

Frank E. Aldrich, P.E., Chief Engineer

By: R. F. Nicholson 8/27

R. F. Nicholson, P.E., Materials & Research Engineer

STJ

CF
BENDA

TA 182F Rev. 2M 3/82
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2M 6/84
2M 6/85
2M 2/86

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report SEPTEMBER 3, 1986

Laboratory No. A86 1146 Tested By LAVIN

Name FINE AGGREGATE FOR CONCRETE 501.

Identification Marks EVALUATION SAMPLE

Submitted by HOLT Title PFP Address _____

Sampled 8/5, 1986 Received 8/7, 1986 Testing Completed 8/21, 1986

Sample from STOCKPILE AT MCBRO INC. E CALAIS

Quantity Represented _____

Source of Material MCBRO INC., E CALAIS

Project Name & Number POSSIBLE FUTURE USE

Examined for 704.01 SOUNDNESS

TEST RESULTS

Total Sample

Sieve Size	% Passing
6 1/2"	
6"	
3 1/2"	
3"	
2 1/2"	
2"	
1 5/8"	
1 1/2"	
1"	
7/8"	
5/8"	
1/2"	
3/8"	
No. 4	
No. 8	
No. 10	
No. 16	
No. 30	
No. 50	
No. 100	
No. 200	

Fineness Modulus
% Coarser Than

No. 100	
No. 50	
No. 30	
No. 16	
No. 8	
No. 4	

Fineness Modulus = _____

Color = _____

Comments:

THIS MATERIAL WAS TESTED FOR SOUNDNESS, THE RESULTS ARE AS INDICATED.

Sand Portion _____ _____

Percent of Wear

AASHTO T3 _____
AASHTO T4 _____
AASHTO T96 _____
___ Grading
Fractured Faces, % _____

Thin & Elongated Pieces, % _____

Soundness, % Loss 6.35

Frank E. Aldrich, P.E., Chief Engineer

By: R. F. Nicholson /RAT
R. F. Nicholson, P.E., Materials & Research Engineer

CIN

C Benda
CF

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
2M 6/84
2M 6/85
2M 2/86
2M 9/86

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report 09/29, 1986

Laboratory No. G8601051 Tested By R Holt

Name Fine Aggregate for Concrete Item 501.

Identification Marks Evaluation sample

Submitted by M Rogers Title LFP Address

Sampled 09/12, 1986 Received , 19 Testing Completed 09/16, 1986

Sample from Stockpile @ Anderson Berlin VT

Quantity Represented

Source of Material Anderson Highgate VT

Project Name & Number Work Plan 86-C-11

Examined for 704.01

TEST RESULTS

Total Sample Sieve Size	% Passing	Fineness Modulus % Coarser Than		Percent of Wear
4 1/2"		No. 100	92	AASHTO T3
4"		No. 50	77	AASHTO T4
3 1/2"		No. 30	59	AASHTO T96
3"		No. 16	38	Grading
2 1/2"		No. 8	18	Fractured Faces, %
2"		No. 4	1	
1 3/4"				Thin & Elongated Pieces, %
1 1/2"		Fineness Modulus =	2.85	
1"		Color =	1	
3/4"				Soundness, % Loss
5/8"		Comments:		
1/2"				
3/8"	100	This material meets the requirements for the tests indicated for Item 704.01		
No. 4	99			
No. 8	82			
No. 10	-			
No. 16	62	Sand Portion		
No. 30	41			
No. 50	23			
No. 100	8			
No. 200				

ACCEPTED
Frank E. Aldrich, P.E., Chief Engineer

By: Robt. Nicholson /GAT
R. F. Nicholson, P.E., Materials & Research Engineer

C Benda
CF

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
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2M 6/85
2M 2/86
2M 9/86

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report 9/29, 1986

Laboratory No. G8601052 Tested By S Armstrong

Name Coarse Aggregate for Concrete Item 501.

Identification Marks Evaluation Sample 3/4" Crushed Igneous Stone

Submitted by M Rogers Title LFP Address ,

Sampled 9/12, 1986 Received , 19 Testing Completed 9/16, 1986

Sample from Stockpile @ Anderson Berlin VT

Quantity Represented

Source of Material Cooley Websterville VT

Project Name & Number Work Plan 86-C-11

Examined for 704.02

TEST RESULTS

Total Sample Sieve Size	% Passing	Sand Portion
4 1/2"		
4"		
3 1/2"		
3"		
2 1/2"		
2"		
1 3/4"		
1 1/2"		
1"	100	
3/4"	98	
5/8"		
1/2"		
3/8"	20	
No. 4	3	
No. 8	2	
No. 10		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

Fineness Modulus
% Coarser Than

No. 100		
No. 50		
No. 30		
No. 16		
No. 8		
No. 4		

Fineness Modulus =

Color =

Comments:

This material meets the requirements for the tests indicated for Item 704.02

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96 32.2
B Grading
Fractured Faces, % 100.0

Thin & Elongated Pieces, % 1.6

Soundness, % Loss

ACCEPTED

Frank E. Aldrich, P.E., Chief Engineer

e.

By: R. F. Nicholson 10/7

R. F. Nicholson, P.E., Materials & Research Engineer

CF
BENDA

TA 182F Rev. 2M 3/82
Rev. 2M 4/83
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2M 6/85
2M 2/86
2M 9/86

STATE OF VERMONT
AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

REPORT ON SAMPLE OF AGGREGATE

Report 10/18, 1986

Laboratory No. G86 1187 Tested By ARMSTRONG

Name FINE AGGREGATE FOR CONCRETE ITEM 501.

Identification Marks EVALUATION SAMPLE

Submitted by MEYER Title LFP Address

Sampled 9/16, 1986 Received , 19 Testing Completed 9/16, 1986

Sample from STOCKPILE @ McBRO INC E CALAIS VT

Quantity Represented

Source of Material McBRO INC E CALAIS VT

Project Name & Number POSSIBLE FUTURE USE

Examined for 704.01

TEST RESULTS

Total Sample Sieve Size	% Passing	Sand Portion
4 1/2"		
4"		
3 1/2"		
3"		
2 1/2"		
2"		
1 3/4"		
1 1/2"		
1"		
3/4"		
5/8"		
1/2"		
3/8"	100	
No. 4	96	
No. 8	86	
No. 10		
No. 16	72	
No. 30	45	
No. 50	20	
No. 100	8	
No. 200	2.8 dry	

Fineness Modulus
% Coarser Than

No. 100	92
No. 50	80
No. 30	55
No. 16	28
No. 8	14
No. 4	4

Fineness Modulus = 2.73

Color = <1

Comments:

THIS MATERIAL WAS EXAMINED FOR GRADATION AND COLOR.
THE RESULTS ARE AS INDICATED.

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96
Grading
Fractured Faces, %

Thin & Elongated Pieces, %

Soundness, % Loss

Frank E. Aldrich, P.E., Chief Engineer

By: R. F. Nicholson 10/17

R. F. Nicholson, P.E., Materials & Research Engineer

e

AGENCY OF TRANSPORTATION OFFICE MEMORANDUM

TO: Chris C. Benda, Structural Concrete Engineer

FROM: Alan J. McBean, Chief Geologist

DATE: June 27, 1986

SUBJECT: Petrographic Analysis Of Washed Sand From The McBro, Pit In Calais, Vermont For Possible Use In Structural Concrete

The following petrographic summary of washed sand from the McBro, Inc. pit in Calais, Vermont is based on a field inspection of the deposit on June 20, 1986 and a laboratory analysis on June 24, 1986 of the sieve fractions used for Fine Aggregate for Concrete (1986 Standard Specifications, Table 704.01A).

Three samples taken for laboratory analysis were obtained from a 200 to 300 cubic yard stockpile at three separate locations around its perimeter. At each location, material from several points of the pile were combined to assure a random and representative mixture of aggregate in each sample. The petrographic examination of each sieve fraction was done with the aid of a hand lens, hydrochloric acid and a magnet. The physical and chemical condition, lithologic variation and coatings of the aggregate were noted.

The McBro, Inc. sand and gravel deposit in Calais was mapped in 1962 by Paul McClintock as an ice contact deposit referred to as a Kame. The deposit consists of well graded layers of sandy gravel alternating with layers dominated by sand-sized material. Clay plugs are occasionally seen in the pit but are not laterally extensive. The gravel layers form lenses which pinch and swell grading laterally into sandier material. The dominant stone size of the gravel is 3 to 4 inches in diameter with an occasional stone as large as 10 or 12 inches.

The finer, sand-sized material which is being washed for Fine Aggregate consists of a variety of minerals and rock types. Included are the minerals quartz, magnetite, feldspar and mica as well as fragments of granite, quartzite, slate, phyllite, micaceous limestone and quartz-muscovite schist. The distribution of these materials varies somewhat between the various sieve fractions. In general, the amount of quartz and individual grains of mica, feldspar and magnetite increase in the finer fractions while rock fragments decrease in number as the material becomes finer. The shape of the aggregate particles ranges from equidimensional to thin and elongate. The phyllitic fragments exhibit a thin and elongate character while the quartz and other rock fragments tend to be more "blocky" in shape. The coarsest material is generally well rounded while the finer fractions are a mixture of angular and subrounded particles. The surfaces of phyllite and slate fragments are smooth while the surfaces of the other rock types are usually more porous and irregular.

The physical condition of the aggregate as a whole is satisfactory. Fragments of a soft, friable micaceous phyllite are the only poor quality aggregate but represent only a small portion of any one sample.

The chemical stability of the aggregate appears good. The micaceous phyllite is the only rock type which shows signs of significant weathering. This is partially caused by the oxidation of pyrite grains in the rock. The rock types present are not alkali reactive and, therefore, this aggregate can be classified as chemically innocuous. Clay and organic matter were not found in the sample.

Several coatings noted are of minor importance. A small portion of the quartz grains have limonite (iron oxide) staining on their outer surface and an occasional cluster of sand grains is cemented together by a coating of calcium carbonate.

AJM:srq

cc: RFN/Lab File
R. A. Fraser
AJM File

Project Name
Work Plan
Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Benda
CF

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1486 (27) Report of 7,14,28 Day Breaks Date typed 12-24-86

Pay Item Performance in Concrete Type of Sample Evaluation

Submitted by Meyer Title LFP Address

Source of Material M & R Lab Quantity Represented 1.8 cf

Coarse Aggregate Cooley - Websterville Fine Aggregate McBro E. Calais

Cement Brand Northeast Type II Lbs. 660

Air Intraining Admixture Daravair Dosage 5 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwt

Total Aggregate Dry Wgt.: Admixture Dosage

Field Tested by Structural Concrete Subdivision Lab. Tested by Cray

Sampled from Lab Mixer Date Sampled: 10-30-86

Location Used or to be Used Test mix Batch No. 1

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

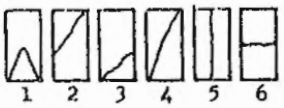
Unit Weight Fresh Concrete 142.01 Air: Pressure 6.1 Chace Slump 2½

Total Water, Gal/Cy Used 35.0 w/c Ratio .442 Temperature, Concrete 71 Ambient

Specimen No.		Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
M-1-A	1	144	10-31		7		S	4067	4085	4076		
	2	144										
	3	144	10-31		14		S	4598	4589	4594		
	4	144										
	5	144	10-31	11-26	28	27	S	4845	4916	4881		
	6	144										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

Susan C. Crampton, Secretary of Transportation

By: R. F. Nicholson

R. F. Nicholson, P.E., Materials & Research Engineer

mlm
TA 1838 Rev.
2M 4/81
2M 8/83
1M 11/84

Project Name
Work Plan
Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Benda
CF

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1487 (27) Report of 7,14,28 Day Breaks Date typed 12-24-86

Pay Item Performance in Concrete Type of Sample Evaluation

Submitted by Meyer Title LFP Address

Source of Material M & R Lab Quantity Represented 1.8 cf

Coarse Aggregate Cooley - Websterville Fine Aggregate McBro - E. Calais

Cement Brand Northeast Type II Lbs. 660

Air Intraining Admixture Daravair Dosage 5 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwt

Total Aggregate Dry Wgt.: Admixture Dosage

Field Tested by Structural Concrete Subdivision Lab. Tested by Cray

Sampled from Lab Mixer Date Sampled: 10-30-86

Location Used or to be Used Test Mix - Batch No. 2

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

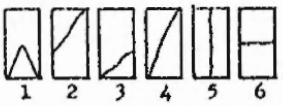
Unit Weight Fresh Concrete 141.41 Air: Pressure 6.6 Chace Slump 2 3/4

Total Water, Gal/Cy Used 34.6 w/c Ratio .438 Temperature, Concrete 70 Ambient

Specimen No.		Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
M-2-A	1	143	10-31		7		S	3961	4138	4050	4	2
	2	143										
	3	143	10-31	11-13	14	14	S	4386	4598	4492		
	4	143										
	5	143	10-31	11-26	28	27	S	4863	4934	4899		
	6	143										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

mlm

Susan C. Crampton, Secretary of Transportation

By: R. F. Nicholson 12/87

R. F. Nicholson, P.E., Materials & Research Engineer

TA 1938 Rev.
2M 4/81
2M 8/83
1M 11/84

CF
BENDA

Project Name
WORK PLAN

Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1488 Report of 7, 14, 28 Day Breaks Date typed 12/31/86

Pay Item PERFORMANCE IN CONCRETE Type of Sample EVALUATION

Submitted by MEYER Title LFP Address

Source of Material MATERIALS & RESEARCH LAB Quantity Represented 1.8 cf

Coarse Aggregate COOLEY WEBSTERVILLE Fine Aggregate McBRO E CALAIS

Cement Brand NORTHEAST Type II WRDA Lbs. 611

Air Entraining Admixture DARAVAIR Dosage 4 oz/cy Admixture HYCOL Dosage 3 oz/cwt

Total Aggregate Dry Wgt. 3003 Admixture Dosage

Field Tested by STRUCTURAL CONCRETE SUBDIV Lab. Tested by

Sampled from LABORATORY MIXER Date Sampled: 10/30/86

Location Used or to be Used TEST MIX BATCH #3

Examined for Mod. of Rupture Compressive Strength X

TEST RESULTS

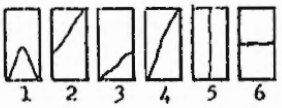
Unit Weight Fresh Concrete 143.26 Air: Pressure 5.5 Chace Slump 2 3/4

Total Water, Gal/Cy Used 35.2 w/c Ratio .481 Temperature, Concrete 73 Ambient

Specimen No.	Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
M-3-B 1	144	10/31		7		S	4014	3758	3886	2	4
2	144										
3	144	10/31	11/13	14	14	S	4403	4350	4377		
4	144										
5	144	10/31	11/26	28	27	S	4598	4615	4607		
6	144										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:
Director, Dept. of Planning and Preconstruction

By: R. F. Nicholson 1/8/87
R. F. Nicholson, P.E., Materials & Research Engineer

TA 193H Rev.
2H 4/81
2H 8/83
1M 11/84

e

Project Name
Work Plan
Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Benda
Central Files

Report on Concrete Test Beam or Cylinders

Laboratory No. C861489 Report of 7,14,28 Day Breaks Date typed 1/2/87

Pay Item Performance In Conc Type of Sample Evaluation

Submitted by Meyer Title LFP Address

Source of Material Mat. & Res. Lab Quantity Represented 1.8 cf

Coarse Aggregate Cooley, Websterville Fine Aggregate McBro, East Calais

Cement Brand Northeast Type II Lbs. 611

Air Entraining Admixture Daravair Dosage 4 oz/cy Admixture WRDA/Hycol Dosage 3 oz/cwt

Total Aggregate Dry Wgt. 3003 Admixture Dosage

Field Tested by Structural Concrete SubDiv Lab. Tested by

Sampled from Laboratory Mixer Date Sampled: 10/30/86

Location Used or to be Used Test Mix, Batch No. 4

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

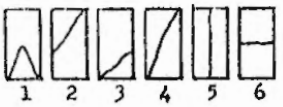
Unit Weight Fresh Concrete 142.41 Air: Pressure 5.8 Chace Slump 2 3/4

Total Water, Gal/Cy Used 35.2 w/c Ratio .481 Temperature, Concrete 74 Ambient

Specimen No.	Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
M-4-B 1	144										
2	144	10/31		7		S	3820	3810	3815	3	4
3	144										
4	144	10/31	11/13	14	14	S	4297	4209	4253		
5	144										
6	144	10/31	11/26	28	27	S	4562	4580	4571		

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

Director, Dept. of Planning and Preconstruction

srq

By: R. F. Nicholson 1/87

R. F. Nicholson, P.E., Materials & Research Engineer

TA 1931 Rev.
2M 4/81
2M 8/83
1M 11/84

CF
BENDA

Project Name
WORK PLAN
Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1490 Report of 7, 14, 28 Day Breaks Date typed 12/24/86

Pay Item PERFORMANCE IN CONCRETE Type of Sample EVALUATION

Submitted by MEYER Title LFP Address

Source of Material MATERIALS & RESEARCH LAB Quantity Represented 1.8 cf

Coarse Aggregate COOLEY WEBSTERVILLE Fine Aggregate ANDERSON HIGHGATE

Cement Brand NORTHEAST Type II Lbs. 660

Air Intraining Admixture DARAVAIR Dosage 5 oz/cy Admixture WRDA/HYCOL Dosage 3 oz/cwt

Total Aggregate Dry Wgt. 2830 Admixture Dosage

Field Tested by STRUCTURAL CONCRETE SUBDIV Lab. Tested by

Sampled from LABORATORY MIXER Date Sampled: 10/30/86

Location Used or to be Used REFERENCE MIX - BATCH NO. 5

Examined for Mod. of Rupture Compressive Strength X

TEST RESULTS

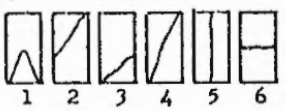
Unit Weight Fresh Concrete 143.62 Air: Pressure 5.7 Chace Slump 2¼

Total Water, Gal/Cy Used 31.5 w/c Ratio .398 Temperature, Concrete 72 Ambient

Specimen No.	Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
R-5-A 1	144	10/31		7		S	4333	4297	4315		6
2	144										
3	144	10/31	11/13	14	14	S	4792	4801	4797		
4	144										
5	144	10/31	11/26	28	27	S	5252	5305	5279		
6	144										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

Susan C. Crampton, Secretary of Transportation

By: R. F. Nicholson 12/27

R. F. Nicholson, P.E., Materials & Research Engineer

TA 183H Rev.
2M 4/81
2M 9/83
1M 11/84

e

CF
BENDA

Project Name
WORK PLAN
Project Number
88-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1491 Report of 7, 14, 28 Day Breaks Date typed 12/24/86

Pay Item PERFORMANCE IN CONCRETE Type of Sample EVALUATION

Submitted by MEYER Title LFP Address

Source of Material MATERIALS & RESEARCH LAB Quantity Represented 1.8 cf

Coarse Aggregate COOLEY WEBSTERVILLE Fine Aggregate ANDERSON HIGHGATE

Cement Brand NORTHEAST Type II Lbs. 660

Air Entraining Admixture DARAVAIR Dosage 5 oz/cy Admixture WRDA HYCOL Dosage 3 oz/cwt

Total Aggregate Dry Wgt. 2830 Admixture Dosage

Field Tested by STRUCTURAL CONCRETE SUBDIV Lab. Tested by

Sampled from LABORATORY MIXER Date Sampled: 10/30/86

Location Used or to be Used REFERENCE MIX BATCH NO. 6

Examined for Mod. of Rupture Compressive Strength X

TEST RESULTS

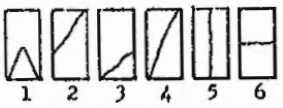
Unit Weight Fresh Concrete 143.22 Air: Pressure 5.9 Chace Slump 2 3/4

Total Water, Gal/Cy Used 31.9 w/c Ratio .403 Temperature, Concrete 72 Ambient

Specimen No.		Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
R-6-A	1	144	10/31		7		S	4262	4633	4448	4	4
	2	144										
	3	144	10/31	11/13	14	14	S	4934	5040	4987		
	4	144										
	5	144	10/31	11/26	28	27	S	5464	5482	5473		
	6	144										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

Susan C. Crampton, Secretary of Transportation

R. F. Nicholson, P.E., Materials & Research Engineer

TA 183H Rev.
2M 4/81
2M 9/83
1M 11/84

e

CF
BENDA

Project Name
WORK PLAN
Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1492 Report of 7, 14, 28 Day Breaks Date typed 12/24/86

Pay Item PERFORMANCE IN CONCRETE Type of Sample EVALUATION

Submitted by MEYER Title LFP Address

Source of Material MATERIALS & RESEARCH LAB Quantity Represented 1.8 cf

Coarse Aggregate COOLEY WEBSTERVILLE Fine Aggregate ANDERSON HIGHGATE

Cement Brand NORTHEAST Type II Lbs. 611

Air Entraining Admixture DARAVAIR Dosage 4 oz/cy Admixture WRDA/HYCOL Dosage 3 oz/cwt

Total Aggregate Dry Wgt. 2971 Admixture Dosage

Field Tested by STRUCTURAL CONCRETE SUBDIV Lab. Tested by

Sampled from LABORATORY MIXER Date Sampled: 10/30/86

Location Used or to be Used REFERENCE MIX BATCH #7

Examined for Mod. of Rupture Compressive Strength X

TEST RESULTS

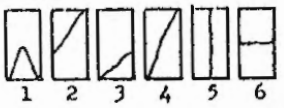
Unit Weight Fresh Concrete 143.66 Air: Pressure 5.3 Chace Slump 2½

Total Water, Gal/Cy Used 31.5 w/c Ratio .430 Temperature, Concrete 74 Ambient

Specimen No.	Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
R-7-B 1	144	10/31		7		S	4439	4509	4474	2	-
2	144										
3	145	10/31	11/13	14	14	S	4810	4943	4877		
4	145										
5	145	10/31	11/26	28	27	S	5040	5093	5067		
6	145										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

Susan C. Crampton, Secretary of Transportation

By: R. F. Nicholson 1/8/87

R. F. Nicholson, P.E., Materials & Research Engineer

TA 1838 Rev.
JH 4/81
JH 8/83
1M 11/84

e

CF
BENDA

Project Name
WORK PLAN

Project Number
86-C-11

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Laboratory No. C86 1493 Report of 7, 14, 28 Day Breaks Date typed 12/31/86

Pay Item PERFORMANCE IN CONCRETE Type of Sample EVALUATION

Submitted by MEYER Title LFP Address

Source of Material MAT & RESEARCH LAB Quantity Represented 1.8 cf

Coarse Aggregate COOLEY WEBSTERVILLE Fine Aggregate ANDERSON HIGHGATE

Cement Brand NORTHEAST Type II Lbs. 611

Air Entraining Admixture DARAVAIR Dosage 4 oz/cy Admixture WRDA HYCOL Dosage 3 oz/cwt

Total Aggregate Dry Wgt. 2971 Admixture Dosage

Field Tested by STRUCTURAL CONCRETE SUBDIV Lab. Tested by

Sampled from LABORATORY MIXER Date Sampled: 10/30/86

Location Used or to be Used REFERENCE MIX - BATCH #8

Examined for Mod. of Rupture Compressive Strength X

TEST RESULTS

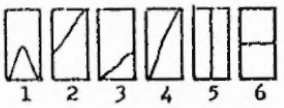
Unit Weight Fresh Concrete 143.01 Air: Pressure 5.9 Chace Slump 2½

Total Water, Gal/Cy Used 31.5 w/c Ratio .430 Temperature, Concrete 72 Ambient

Specimen No.	Cyl. Unit Wgt. P.C.F.	Date Rec'd	Date Broken	Desired age at break	Age at Break	Type* S - F	Break 1 P.S.I.	Break 2 P.S.I.	Ave. P.S.I.	Break Type 1	Break Type 2
R-8-B 1	145	10/31		7		S	4298	4306	4302		
2	145										
3	145	10/31	11/13	14	14	S	4757	4686	4722		
4	145										
5	145	10/31	11/26	28	27	S	4969	4987	4978		
6	145										

*S = Standard Cured; F = Field Cured

Types of Breaks:



Comments:

Director, Dept. of Planning and Preconstruction

By: R. F. Nicholson 12/87
R. F. Nicholson, P.E., Materials & Research Engineer

TA 183H Rev.
2M 4/81
2M 8/83
1M 11/84
e

TA 565 Rev. 4/79

Prepared By: C. C. Benda CCB
Date: 9/12/86
Sheet 1 of 1

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

RESEARCH INVESTIGATION

Work Plan No. 86-C-11

Subject Evaluation Of Fine Aggregate, McBro, Inc., Montpelier, Vermont

Investigation Requested By Dwight McCullough Date June 9, 1986

Date Information Required As soon as possible

Purpose of Investigation To evaluate a fine aggregate proposed for use as a structural concrete aggregate from the McBro Pit in Calais, Vermont.

Proposed Tests or Evaluation Procedure See Vermont procedure for evaluating a new source of structural concrete aggregate, Vermont A.O.T. - MRD 9-82.

1. Performance in concrete tests will be performed using two batches each of Class A & Class B concrete containing the proposed new aggregate and two batches each of Class A & Class B concrete containing a reference aggregate.
2. Prepare specimens from each batch of concrete to determine resistance to freezing and thawing.

Proposal Discussed With R. Feascoia Projected Manpower Requirements 25 man-days

Investigation To Be Conducted By Structural Concrete Subdivision

Proposed Starting Date October 1, 1986 Estimated Completion Date January 2, 1987

Approval/Disapproval by Materials & Research Engineer R J Nicholson 09-12-86

Comments by Materials & Research Engineer

Materials & Research Division
Agency of Transportation
Date Typed: 9/12/86