EVALUATION OF 3/4 INCH CRUSHED STONE FROM F. W. WHITCOMB, WALLINGFORD, VERMONT FOR USE IN STRUCTURAL CONCRETE

REPORT 89-2
OCTOBER 1989

REPORTING ON WORK PLAN 89-C-8

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

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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 coarse aggregate for structural concrete. The material tested was a 3/4 inch crushed stone produced at the F. W. Whitcomb Construction Corp. facilities in Wallingford, Vermont.

Test results and evaluation confirm this material meets the required specifications as a coarse 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 Warner N. Hodgdon, Quality Control Manager of Frank W. Whitcomb Construction Corp. to evaluate 3/4 inch crushed stone, being produced at his company's facility in Wallingford, Vermont, for use in structural concrete.

Samples of the 3/4 inch crushed stone were obtained by Materials and Research Division representatives and evaluated for compliance with the requirements of Section 704.02 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 coarse aggregate was sampled, by representatives of the Materials and Research Division, from a stockpile at the Frank W. Whitcomb Construction Corp. facility in Wallingford, Vermont. The material was examined for Gradation (AASHTO T 27-84), Percent of Wear (AASHTO T 96-83), Thin and Elongated Pieces (VT AOT-MD 22), Fractured Faces (VT AOT-MD 23) and Sodium Sulfate Soundness (AASHTO T 104-86).

Two initial samples, obtained on July 12, 1989, failed to comply with grading and fractured face requirements. A follow up sample, obtained on July 25, 1989, was found to be in compliance with requirements.

The reference coarse aggregate and the fine aggregate were also sampled from stockpiles at the Frank W. Whitcomb Construction Corp. facility in Wallingford, Vermont. The fine aggregate was examined for Gradation (AASHTO T 27-84) and Organic Impurities (AASHTO T 21-81). The reference 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 fine aggregate and reference 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 and Table 3. Aggregate test results are also shown on Laboratory Report Nos. G89 0482, G89 0483, G89 0656, G89 0657, G89 0658, and A89 0276 in Appendix B.

The Vermont Agency of Transportation, Chief Geologist traveled to the facility in Wallingford, Vermont to make an on-site investigation of the raw material quarry 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

	F. W. Whitcomb Wallingford, VT Dates Sampled 7-27-89	V.A.O.T. Specification Requirements
Sieve Size	%Passing	%Passing
3/8"	100	100
#4	99	95-100
#8	86	-
#16	68	50-80
#30	47	25-60
#50	21	10-30
#100	8	2-10
Fineness Modulus	2.71	2.60-3.10
Organic Impurities, color	<1	2 maximum

TABLE 2

COARSE AGGREGATE TEST DATA

	3/4" Crushed Stone F. W. Whitcomb, Wallingford, VT Dates Sampled				V.A.O.T. Specification Requirements
	7/12/89	7/12/89	7/12/89	7/25/89	
Sieve Size	%Passing	%Passing	%Passing	%Passing	%Passing
1"	100	100	-	100	100
3/4"	98	97	-	99	90-100
3/8"	46	41	-	36	20-55
#4	12	13	-	3	0-10
#8	3	2	-	2	0-5
L. A. Abrasion, % loss	29.6	24.4	-	29.5	35 maximum
Thin and Elongated Pieces, %	3.5	3.8	-	4.0	10 maximum
Fractured Faces, %	90.3	98.8	-	100	100 minimum
Soundness, % loss	-	-	0.38	-	8 maximum

TABLE 3

COARSE AGGREGATE TEST DATA

	3/4" Crushed Gravel F. W. Whitcomb Wallingford, VT Date Sampled 8/1/89	V.A.O.T. Specification Requirements
Sieve Size	%Passing	%Passing
1"	100	100
3/4"	96	90-100
3/8"	37	20-55
#4	10	0-10
#8	3	0-5
L. A. Abrasion, % loss	29.6	35 maximum
Thin and Elongated Pieces, %	3.5	10 maximum
Fractured Faces, %	67.5	50 minimum

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

A. Proposed New Aggregate
   3/4 inch Crushed Stone
   Frank W. Whitcomb Construction Corp., Wallingford, Vermont

B. Reference Aggregate
   3/4 inch Crushed Gravel
   Frank W. Whitcomb Construction Corp., Wallingford, Vermont

Fine Aggregate

Frank W. Whitcomb Construction Corp., Wallingford, Vermont

Cement

Type II
Blue Circle Atlantic, Inc., Ravena, New York

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 4 and Table 5.

TABLE 4

COARSE AGGREGATE PROPERTIES

	Bulk Specific Gravity	Absorp., percent	Dry Rodded Unit Weight, lbs/cu. ft.
New Aggregate Whitcomb, Wallingford, Vermont 3/4" Crushed Stone	2.76	0.6	102.64
Reference Aggregate Whitcomb, Wallingford, Vermont 3/4" Crushed Gravel	2.66	0.7	102.99

TABLE 5

FINE AGGREGATE PROPERTIES

	Bulk Specific Gravity	Absorp., Percent	Fineness Modulus
Reference Aggregate Whitcomb, Wallingford, Vermont	2.65	0.7	2.75

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

The mix proportions used are shown in Table 6 and Table 7.

TABLE 6

NEW AGGREGATE MIX DESIGN
BATCH QUANTITIES PER C.Y.

	Class A		Class B	
	Batch 1	Batch 2	Batch 5	Batch 6
*Coarse Aggregate, lbs.	1718	1718	1718	1718
*Fine Aggregate, lbs.	1245	1245	1366	1366
Cement, lbs.	660	660	611	611
Air Entraining Admixture, oz.	5.5	6.0	4.0	3.5
Water Reducing Admixture, oz.	19.8	19.8	18.3	18.3
Net Water, gal.	32.1	32.2	32.3	29.7

*Weights converted to saturated surface-dry condition

TABLE 7

REFERENCE AGGREGATE MIX DESIGN
BATCH QUANTITIES PER C.Y.

	Class A		Class B	
	Batch 3	Batch 4	Batch 7	Batch 8
*Coarse Aggregate, lbs.	1724	1724	1724	1724
*Fine Aggregate, lbs.	1177	1177	1298	1298
Cement, lbs.	660	660	611	611
Air Entraining Admixture, oz.	5.0	6.0	4.5	4.0
Water Reducing Admixture, oz.	19.8	19.8	18.3	18.3
Net Water, gal.	30.3	32.5	32.7	32.2

*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 29 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 8 and Table 9.

TABLE 8

PERFORMANCE TEST RESULTS
NEW AGGREGATE

	Class A		Class B	
	Batch 1	Batch 2	Batch 5	Batch 6
Slump, inches	3	3	3	2 1/2
Air Content, percent	5.4	6.0	6.0	5.4
Unit Weight, lbs/cu. ft.	149.14	148.54	147.25	148.66
Compressive Strength, psi				
7 days	4335	4020	3815	4030
14 days	4790	4905	4000	4885
29 days	5490	5575	4955	5445

(Design Compressive Strength, psi) (4000) (3500)

TABLE 9

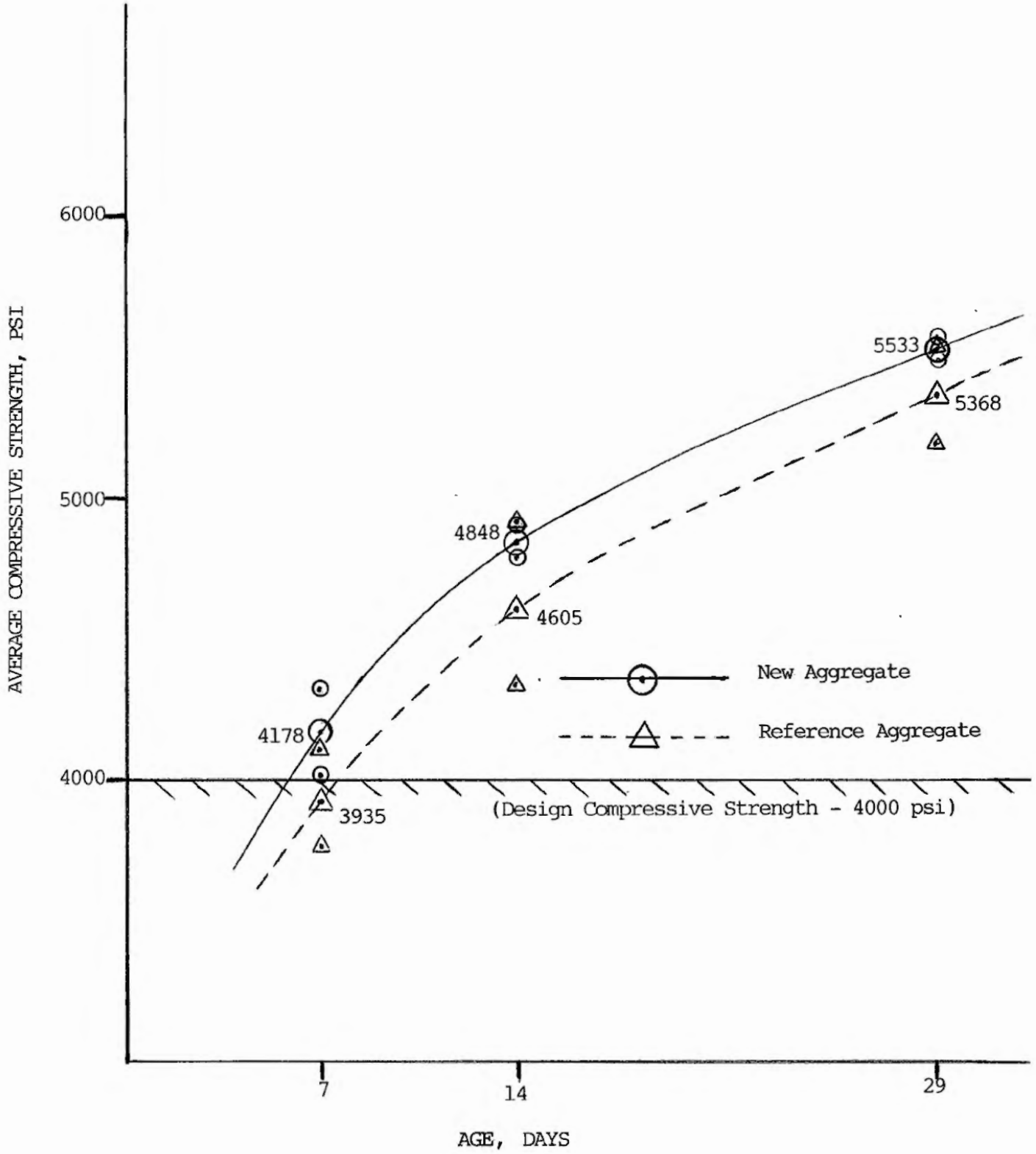
PERFORMANCE TEST RESULTS
REFERENCE CONCRETE

	Class A		Class B	
	Batch 3	Batch 4	Batch 7	Batch 8
Slump, inches	2 3/4	3	3 1/4	3
Air Content, percent	5.4	6.2	6.4	5.6
Unit Weight, lbs/cu. ft.	145.84	144.84	144.35	145.88
Compressive Strength, psi				
7 days	4110	3760	3580	3965
14 days	4865	4345	4355	4600
29 days	5535	5200	4780	5035

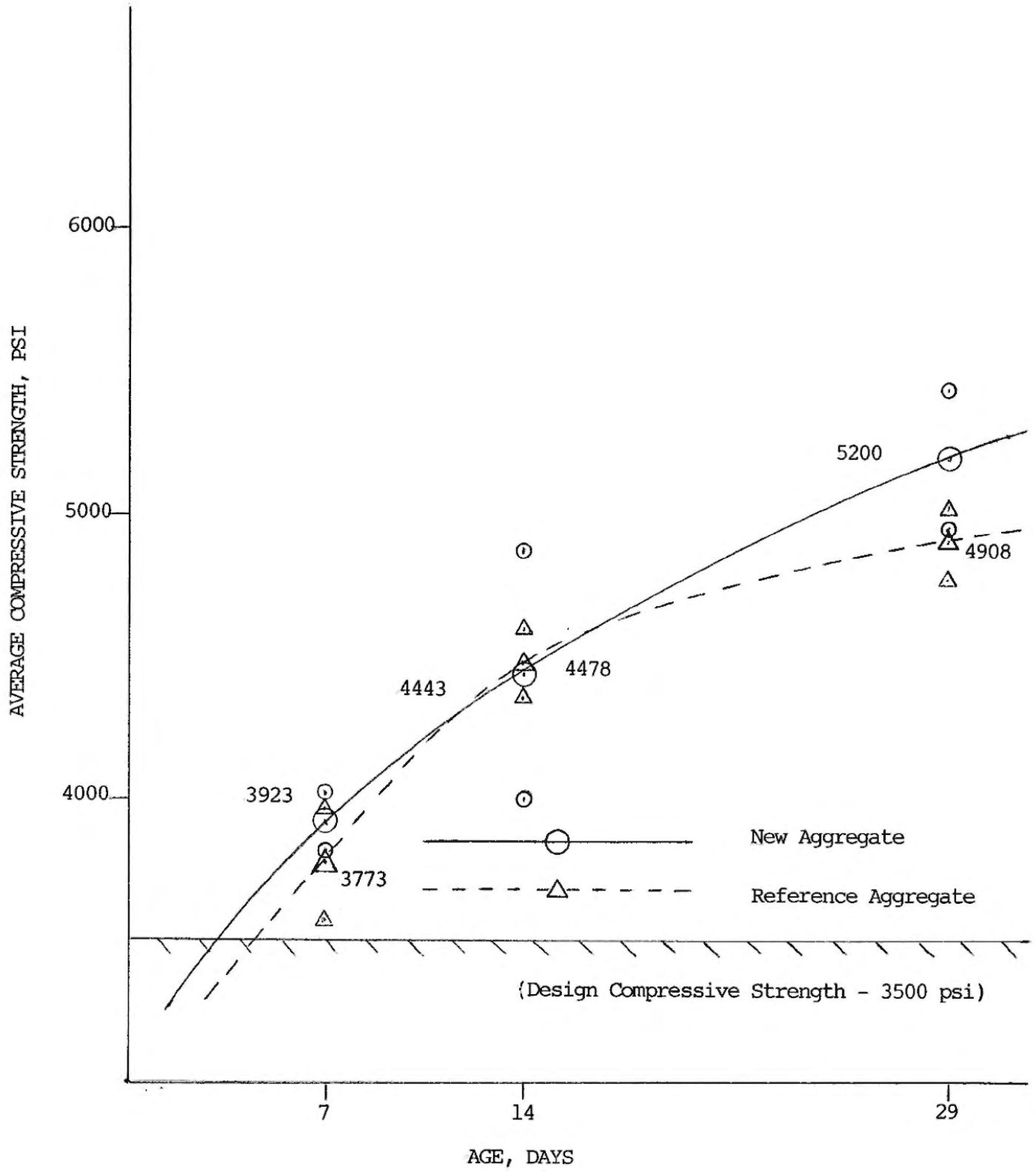
(Design Compressive Strength, psi) (4000) (3500)

The results of compressive strength tests are also shown on Laboratory Report Nos. C89 0615 through C89 0622 in Appendix D. Strength vs. age plots illustrating average compressive strengths in psi over time in days are shown in Figure I and Figure II.

The results of dynamic testing of freeze-thaw specimens are shown in Table 10. The percent weight change resulting from freezing and thawing of specimens is shown in Table 11. 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.



AVERAGE COMPRESSIVE STRENGTH VS AGE
CLASS A
FIGURE I



AVERAGE COMPRESSIVE STRENGTH VS AGE
CLASS B
FIGURE II

TABLE 10

FREEZE-THAW TEST RESULTS - DURABILITY FACTOR

	New Aggregate				Reference Aggregate			
	Class A		Class B		Class A		Class B	
No. of Cycles	Batch 1	Batch 2	Batch 5	Batch 6	Batch 3	Batch 4	Batch 7	Batch 8
	Durability Factor							
50	100.0	100.0	98.8	99.3	102.0	101.2	100.7	101.2
100	103.1	100.6	99.9	99.2	101.2	101.9	102.0	102.2
150	103.3	100.1	98.7	99.2	101.7	98.8	104.0	103.5
200	103.2	100.7	98.1	98.7	101.6	101.6	103.8	104.6
250	102.2	100.5	98.1	97.7	100.4	100.9	105.4	105.7
300	100.9	100.7	98.4	94.7	100.6	99.9	103.8	105.5

TABLE 11

FREEZE-THAW TEST RESULTS - PERCENT WEIGHT CHANGE

	New Aggregate				Reference Aggregate			
	Class A		Class B		Class A		Class B	
No. of Cycles	Batch 1	Batch 2	Batch 5	Batch 6	Batch 3	Batch 4	Batch 7	Batch 8
	Percent Weight Change							
50	-0.9	-0.6	-0.5	-0.6	-0.2	-0.2	+0.1	-0.1
100	-1.3	-1.3	-1.3	-1.6	-0.7	-0.6	0.0	-0.3
150	-1.9	-1.9	-2.1	-2.8	-1.4	-1.0	-0.1	-0.6
200	-2.8	-2.5	-3.0	-3.9	-1.9	-1.0	-0.3	-1.0
250	-3.4	-3.1	-3.9	-5.0	-3.1	-2.6	-0.6	-1.4
300	-4.4	-3.9	-4.9	-6.2	-4.4	-3.5	-1.0	-2.0

Batch Number	No. Cycles	Weight Lbs.	Percent Weight Loss	Fundamental Transverse Frequency "N"	"N"	Individual Durability Factor DF	Average DF	Relative Durability Factor RDF
Reference Aggregate								
3	0	12.51		1637	2679769			
			4.4			100.6		
3	300	11.96		1642	2696164			
							100.3	
4	0	12.43		1626	2643876			
			3.5			99.9		
4	300	12.00		1625	2640625			
								100.5
New Aggregate								
1	0	12.85		1626	2643876			
			4.4			100.9		
1	300	12.29		1633	2666689			
							100.8	
2	0	12.77		1646	2709316			
			3.9			100.7		
2	300	12.27		1652	2729104			

SUMMARY OF FREEZE-THAW TEST RESULTS

CLASS A

FIGURE III

Batch Number	No. Cycles	Weight Lbs.	Percent Weight Loss	Fundamental Transverse Frequency "N"	"N"	Individual Durability Factor DF	Average DF	Relative Durability Factor RDF
Reference Aggregate								
7	0	12.33		1613	2601769			
			1.0			103.8		
7	300	12.21		1643	2699449			
							104.7	
8	0	12.46		1636	2676496			
			2.0			105.5		
8	300	12.21		1680	2822400			
								92.3
New Aggregate								
5	0	12.66		1648	2715904			
			4.9			98.4		
5	300	12.04		1635	2673225			
							96.6	
6	0	12.81		1649	2719201			
			6.2			94.7		
6	300	12.01		1605	2576025			

SUMMARY OF FREEZE-THAW TEST RESULTS

CLASS B

FIGURE IV

SUMMARY AND CONCLUSIONS

1. The initial sample of 3/4" crushed stone from the F. W. Whitcomb Construction Corp. facility in Wallingford, Vermont failed to comply with requirements for grading and fractured faces. A subsequent sample obtained from the same facility was found to be in compliance with these requirements. The 3/4" crushed stone complied with all remaining requirements of Section 704.02 when tested in conjunction with this evaluation.

2. The compressive strengths of concrete containing the Wallingford 3/4" crushed stone were approximately five percent greater than the strengths of concrete containing the reference aggregate. The Class A concrete containing the 3/4" crushed stone had an average compressive strength at 29 days which was 255 psi higher than the Class A concrete containing the reference aggregate. The Class B concrete containing the 3/4" crushed stone had an average compressive strength at 29 days which was 292 psi higher than the Class B concrete containing the reference aggregate.

3. Results of freezing and thawing tests showed the performance of Class A concrete containing the new aggregate and Class A concrete containing the reference aggregate to be approximately equal. However, the Class B concrete containing the new aggregate 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 104.7 for the Class B concrete with the

reference aggregate and 96.6 for the Class B concrete with the new aggregate. The percent weight loss averaged 1.5% for the Class B concrete with the reference aggregate and 5.6% for the Class B concrete containing the new aggregate. The freeze-thaw test results indicate satisfactory performance of the new aggregate.

4. Mix design Tables, shown on page 9, indicate there was no appreciable difference in the quantity of water required in the concrete, based on the type of aggregate used. Class A concrete containing the new aggregate used slightly more water than Class A concrete with the reference aggregate. However, less water was used in the Class B conrete with the new aggregate.

RECOMMENDATIONS

1. It is recommended that the present F. W. Whitcomb Construction Corp. facility in Wallingford, Vermont be approved as a source of crushed stone coarse 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.

Prepared By: W. Meyer WFM
Date: March 26, 1982
Page: 1 of 2

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.

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

C. Benda
C.F.

REPORT ON SAMPLE OF STRUCTURAL CONCRETE AGGREGATE

Laboratory Number GE900482 Pay Item 501
Project Name Possible Future Use Project Number W.P. BA-C-B
Sampled By C. Benda Date Sampled 7/12/89 Examined For 704.02
Sampled From Stack pile Plant Whitcomb; Wallingford, Vt.
Source of Material Whitcomb; Wallingford, Vt.
Quantity Represented — Sample Type Evaluation Sample
Sample Comparison NO Cross Reference Number

MATERIAL TESTED 3/4" Crushed Stone for Concrete

SIEVE SIZE	WEIGHT INDIV.	% RETAINED INDIV.	% RETAINED CUMUL.	% PASSING CUMUL.
RET —				
RET —				
RET 1"	—			100
RET 3/4	565	2.0		98
RET 1/2	6915	24.0		74
RET 3/8	8030	27.9		46
RET 4	9750	33.9		12
RET 8	2580	9.0		3
PAN	940	3.3		
TOTAL	28780			

Fineness Modulus
Cumul. Total Retained/100 _____

Organic Impurities: Color _____

T&E / Total Weight = 39 / 1130 = 3.5 % Thin & Elongated Pieces

Fractures / Total Weight = 1020 / 1130 = 90.3 % Fractured Faces

Original Weight 5000 Grading D
Final Weight 3520.3 Percent Wear 29.6 AASHTO T96

( ) Test results are in compliance with specifications.

(✓) Test results are outside specifications.

Comments: Material tests 2% high passing No. 4 Sieve
SAMPLE CONTAMINATED WITH SOME GRAVEL.

Tested By J. A. / Peter O. Collins Reviewed By C. C. Benda, P.E. CCB Initials
Date Completed 7/14/89 Date 7-14-89

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

C. Benda
C.F.

REPORT ON SAMPLE OF STRUCTURAL CONCRETE AGGREGATE

Laboratory Number CC900483 Pay Item 501
Project Name Possible Future Use Project Number W.P. 89-C-B
Sampled By C. Benda Date Sampled 7/12/89 Examined For 704.02
Sampled From Stockpile Plant Whitcomb; Wallingford, Vt.
Source of Material Whitcomb; Wallingford, Vt.
Quantity Represented — Sample Type Evaluation Sample
Sample Comparison NO Cross Reference Number

MATERIAL TESTED 3/4" Crushed Stone for Concrete

SIEVE SIZE	WEIGHT INDIV.	% RETAINED INDIV.	% RETAINED CUMUL.	% PASSING CUMUL.
RET				
RET				
RET 1"	—			100
RET 3/4	675	2.8		97
RET 1/2	7030	29.5		68
RET 3/8	6390	26.8		41
RET 4	6700	28.1		13
RET 8	2475	10.4		2
PAN	590	2.5		
TOTAL	23,860			

Fineness Modulus
Cumul. Total Retained/100 _____

Organic Impurities: Color _____

$\frac{\text{T\&E}}{\text{Total Weight}} = \frac{35}{923} = 3.8$ % Thin & Elongated Pieces

$\frac{\text{Fractures}}{\text{Total Weight}} = \frac{923}{934} = 98.8$ % Fractured Faces

Original Weight 5000 Grading B
Final Weight 3777 Percent Wear 24.4 AASHTO T96

( ) Test results are in compliance with specifications.

(✓) Test results are outside specifications.

Comments: Material tests 3% high passing No. 4 sieve. Sample contaminated with some gravel

Tested By S.A. / Peter D. Collins Reviewed By C. C. Benda, P.E. CCB Initials
Date Completed 7/13/89 Date 7-14-89

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

CF Benda P.E.

REPORT ON SAMPLE OF STRUCTURAL CONCRETE AGGREGATE

Laboratory Number C8900656 Pay Item 501.
Project Name Work Plan Project Number 89-C-8
Sampled By W. Meyer Date Sampled 7/25/89 Examined For 704.02
Sampled From Stockpile Plant Whitcomb Wallingford Vt.
Source of Material Whitcomb, Wallingford
Quantity Represented — Sample Type Evaluation
Sample Comparison No Cross Reference Number

MATERIAL TESTED 3/4" Crushed Stone for Concrete

SIEVE SIZE	WEIGHT INDIV.	% RETAINED INDIV.	% RETAINED CUMUL.	% PASSING CUMUL.
RET				
RET				
RET 1	—			100
RET 3/4	.43	1		99
RET 1/2	11.22	31		68
RET 3/8	11.86	32		36
RET 4	12.22	33		3
RET 8	.36	1		2
PAN	.57	2		
TOTAL	36.66			

Fineness Modulus
Cumul. Total Retained/100 _____

Organic Impurities: Color _____

T&E / Total Weight = 44 / 1119 = 4 % Thin & Elongated Pieces

Fractures / Total Weight = 1119 / 1119 = 100 % Fractured Faces

Original Weight 5000 Grading "B"
Final Weight 3526 Percent Wear 29.5 AASHTO T96

(✓) Test results are in compliance with specifications.

( ) Test results are outside specifications.

Comments: _____

Tested By R. Hood Reviewed By C. C. Benda, P.E. CCB Initials
Date Completed 7/26/89 Date 7-27-89

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REPORT ON SAMPLE OF STRUCTURAL CONCRETE AGGREGATE

Laboratory Number C8900657 Pay Item 501
Project Name Work Plan Project Number 89-C-8
Sampled By Meyer Date Sampled 7/27/89 Examined For 704.01
Sampled From Stockpile Plant Whitcomb, Wallingford VT.
Source of Material Whitcomb, Wallingford
Quantity Represented — Sample Type Evaluation
Sample Comparison No Cross Reference Number

MATERIAL TESTED Fine Aggregate for Concrete

SIEVE SIZE	WEIGHT INDIV.	% RETAINED INDIV.	% RETAINED CUMUL.	% PASSING CUMUL.
RET				
RET 3/8	—			100
RET 4	5	1	1	99
RET 8	98	13	14	86
RET 16	131	18	32	68
RET 30	155	21	53	47
RET 50	189	26	79	21
RET 100	92	13	92	8
PAN	57	8		
TOTAL	727	100		

Fineness Modulus
Cumul. Total Retained/100 2.71

Organic Impurities: Color <1

T&E / Total Weight = ____ = ____ % Thin & Elongated Pieces

Fractures / Total Weight = ____ = ____ % Fractured Faces

Original Weight ____ Grading ____
Final Weight ____ Percent Wear ____ AASHTO T96

(✓) Test results are in compliance with specifications.

( ) Test results are outside specifications.

Comments:

Tested By R. Hoyt Reviewed By C. C. Benda, P.E. WB Initials
Date Completed 8/21/89 Date 8-24-89

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REPORT ON SAMPLE OF STRUCTURAL CONCRETE AGGREGATE

Laboratory Number G8900658 Pay Item 501
Project Name Work Plan Project Number 89-C-8
Sampled By Armstrong Date Sampled 8/1/89 Examined For 704.02
Sampled From Stockpile Plant Whitcomb, Wallingford, Vt.
Source of Material Whitcomb, Wallingford, Vt.
Quantity Represented — Sample Type Evaluation
Sample Comparison No Cross Reference Number

MATERIAL TESTED 3/4" Crushed Gravel for Concrete

	SIEVE SIZE	WEIGHT INDIV.	% RETAINED INDIV.	% RETAINED CUMUL.	% PASSING CUMUL.
RET					
RET					
RET	1	—			100
RET	3/4	1.05	4		96
RET	1/2	8.71	31		65
RET	3/8	7.86	28		37
RET	4	7.64	27		10
RET	8	1.79	7		3
PAN		.80	3		
TOTAL		27.93	100		

Fineness Modulus
Cumul. Total Retained/100 _____

Organic Impurities: Color _____

$\frac{\text{T\&E}}{\text{Total Weight}} = \frac{19}{548} = 3.5$ % Thin & Elongated Pieces

$\frac{\text{Fractures}}{\text{Total Weight}} = \frac{370}{548} = 67.5$ % Fractured Faces

Original Weight 5000 Grading B
Final Weight 3522 Percent Wear 29.6 AASHTO T96
1478

(✓) Test results are in compliance with specifications.

( ) Test results are outside specifications.

Comments: _____

Tested By R. Hoeft Reviewed By C. C. Benda, P.E. CCB Initials
Date Completed 8/21/89 Date 8-24-89

Vermont Agency of Transportation
Materials and Research Division
Montpelier, Vermont 05602

Distribution:
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REPORT ON SAMPLE OF AGGREGATE

LAB NO.: A890276

Report Date: 08/03/89

Project:

Sampled By: Benda

Pay Item: Coarse Aggregate for Concrete 501.25

Date Sampled: 07/12/89

Material Name/Type: Coarse Aggregate Concrete

Sampled From: Stockpile

Material Spec No.: 704.02B

Date Received: 07/13/89

Quantity Represented:

Tested By: M Lavin

Sample Source: Whitcomb Wallingford

Test Date: 08/02/89

Material Source: Whitcomb Wallingford

Sample Type: Preliminary

Comparison Sample?:
X-Ref.No.:

Comments: 3/4 inch Cr St

TEST RESULTS

TOTAL SAMPLE SIEVE SIZE	% PASSING	FINENESS MODULUS % COARSER THAN	
4-1/2"		NO. 4	PERCENT OF WEAR AASHTO T96 GRADING
4"		NO. 8	
3-1/2"		NO. 16	
3"		NO. 30	
2-1/2"		NO. 50	FRACTURED FACES, %
2"		NO. 100	
1-3/4"			THIN & ELONGATED PIECES, %
1-1/2"		FINENESS MODULUS =	
1"			
3/4"		COLOR =	SOUNDNESS, % LOSS 0.38
1/2"			
3/8"		COMMENTS: Test Results are in compliance with specifications.	
NO. 4			
NO. 8			
NO. 16			
NO. 30			
NO. 50			
NO. 100			
NO. 200			

REVIEWED BY: R. J. O'BRIEN, RJO
CHEMIST, TESTING LAB SUPERVISOR

FOR: M. W. Lawson, MATERIALS & RESEARCH ENGINEER

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

TO: Chris Benda, P.E., Structural Concrete Engineer

FROM: Alan J. McBean, Chief Geologist via Milan W. Lawson, P.E., Materials & Research Engineer

DATE: August 7, 1989

SUBJECT: F.W. Whitcomb Quarry, Wallingford Vt.

At the request of the Structural Concrete Engineer, a petrographic field examination of the F.W. Whitcomb Quarry in Wallingford was conducted on July 12, 1989 as a supplement to the evaluation of a new aggregate source for use in structural concrete.

The rock exposed in the Quarry consists of prodominantly dolomite and dolomitic limestone with minor layers of micaceous, dolomitic quartzite. The dolomite and dolomitic limestone layers are buff or light gray in color, while the quartzite layers are dark gray. All rock types belong to the Winooski formation of Cambrian age.

Structurally, the layers are tightly folded and slightly overturned as they dip steeply to the east and are overlain by the older Monkton Quartzite. Outcrops of the Winooski are limited to a width of approximately 600 feet. The rock is only slightly weathered at the upper surface of the quarry.

Overall this rock appears to meet requirements for composition, texture and particle shape. No deleterious particles were noted and the extent of weathering seen does not significantly alter the integrity of the stone.

MWL:AJM:cc

cc: MWL/Testing File
AJM File

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MATERIALS AND RESEARCH DIVISION
MONTPELIER, VERMONT 05602

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C8906:5 PAY. ITEM 501.25 Concrete, Class B

PROJ. NAME Work Plan PROJ. NO. 89-C-6 REPORTED 09/05/89

EXAM. FOR 501 C. B Compressive Strength SAMPLE TYPE B SAMPLED 08/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT. REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 3021

CEMENT BRAND Atlantic TYPE 2 LBS. 611 AIR ENT. ADMIX. Daravair DOSAGE 4 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Ref Mix Batch No8

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT. FRESH CONC., LBS/CF	145.88	N.A.	N.A.
AIR CONTENT, %	5.60	4.00	6.00
SLUMP, INCHES	3.00	2.00	4.00
TOTAL WATER, GAL/CY	32.16	N.A.	35.8
W/C RATIO	0.439	N.A.	0.45
CONCRETE TEMP., DEGREES F	76	50	80
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL. UNIT. WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG. BRK P.S.I.	BREAK TYPE*
R-8-B 1	150.00	08/08	08/14	7	7	S	3930	N.A.	N.D.
R-8-B 2	150.00	08/08	08/14	7	7	S	4000	3965	N.D.
R-8-B 3	150.00	08/08	08/21	14	14	S	4560	N.A.	N.D.
R-8-B 4	150.00	08/08	08/21	14	14	S	4640	4600	N.D.
R-8-B 5	150.00	08/08	09/05	28	29	S	5080	N.A.	N.D.
R-8-B 6	150.00	08/08	09/05	28	29	S	4990	5035	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

DIRECTOR, DEPT. OF
PLANNING & PRECONSTRUCTION
Milan W. Lawson
MATERIALS & RESEARCH ENGINEER
BY:

pla

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C690616 PAY.ITEM 501.25 Concrete, Class B

PROJ.NAME Work Plan PROJ.NO. 89-C-8 REPORTED 09/05/89

EXAM.FOR 28 C. B Compressive Strength SAMPLE TYPE R SAMPLED 08/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT.REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL Y & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 3021

CEMENT BRAND Atlantic TYPE 2 LBS. 611 AIR ENT.ADMIX. Daravair DOSAGE 4.5 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Ref Mix Batch No7

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT.FRESH CONC., LBS/CF	144.35	N.A.	N.A.
AIR CONTENT, %	6.40	4.00	6.00
SLUMP, INCHES	3.25	2.00	4.00
TOTAL WATER, GAL/CY	32.74	N.A.	35.8
W/C RATIO	0.447	N.A.	0.45
CONCRETE TEMP., DEGREES F	76	50	80
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL.UNIT.WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG.BRK P.S.I.	BREAK TYPE*
R-7-B 1	149.00	08/08	08/14	7	7	S	3640	N.A.	N.D.
R-7-B 2	149.00	08/08	08/14	7	7	S	3520	3580	N.D.
R-7-B 3	148.00	08/08	08/21	14	14	S	4340	N.A.	N.D.
R-7-B 4	149.00	08/08	08/21	14	14	S	4370	4355	N.D.
R-7-B 5	149.00	08/08	09/05	28	29	S	4810	N.A.	N.D.
R-7-B 6	149.00	08/08	09/05	28	29	S	4750	4780	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: Test(s) outside specifications:
Air Content

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB.NO. C890617 PAY.ITEM 501.25 Concrete, Class B

PROJ.NAME Work Plan PROJ.NO. 89-C-8 REPORTED 09/05/89

EXAM.FOR 501 C. B Compressive Strength SAMPLE TYPE P SAMPLED 08/08/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT.REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 3084

CEMENT BRAND Atlantic TYPE 2 LBS. 611 AIR ENT.ADMIX. Daravair DOSAGE 4 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Test Mix Batch No5

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT.FRESH CONC., LBS/CF	147.25	N.A.	N.A.
AIR CONTENT, %	6.00	4.00	6.00
SLUMP, INCHES	3.00	2.00	4.00
TOTAL WATER, GAL/CY	32.25	N.A.	35.0
W/C RATIO	0.440	N.A.	0.45
CONCRETE TEMP., DEGREES F	74	50	90
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL.UNIT.WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG.BRK P.S.I.	BREAK TYPE*
W-5-B 1	152.00	08/08	08/14	7	7	S	3800	N.A.	N.D.
W-5-B 2	152.00	08/08	08/14	7	7	S	3830	3815	N.D.
W-5-B 3	152.00	08/08	08/21	14	14	S	3570	N.A.	N.D.
W-5-B 4	153.00	08/08	08/21	14	14	S	4430	4000	N.D.
W-5-B 5	153.08	08/08	09/05	28	29	S	4900	N.A.	N.D.
W-5-B 6	152.00	08/08	09/05	28	29	S	5010	4955	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C890618 PAY. ITEM 501.25 Concrete, Class B

PROJ. NAME Work Plan PROJ. NO. 89-C-8 REPORTED 09/05/89

EXAM. FOR 501 C. A Compressive Strength SAMPLE TYPE P SAMPLED 06/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT. REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 2963

CEMENT BRAND Atlantic TYPE 2 LBS. 660 AIR ENT. ADMIX. Daravair DOSAGE 6 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Test Mix Batch No2

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT. FRESH CONC., LBS/CF	148.54	N.A.	N.A.
AIR CONTENT, %	6.00	5.00	7.00
SLUMP, INCHES	3.00	2.00	4.00
TOTAL WATER, GAL/CY	32.22	N.A.	35.1
W/C RATIO	0.407	N.A.	0.44
CONCRETE TEMP., DEGREES F	75	50	80
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL. UNIT. WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG. BRK P.S.I.	BREAK TYPE*
W-2-A 1	153.00	08/08	08/14	7	7	S	3910	N.A.	N.D.
W-2-A 2	153.00	08/08	08/14	7	7	S	4130	4020	N.D.
W-2-A 3	153.00	08/08	08/21	14	14	S	4960	N.A.	N.D.
W-2-A 4	153.00	08/08	08/21	14	14	S	4850	4905	N.D.
W-2-A 5	153.00	08/08	09/05	28	29	S	5510	N.A.	N.D.
W-2-A 6	153.00	08/08	09/05	28	29	S	5640	5575	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C890619 PAY. ITEM 501.22 Concrete, Class A

PROJ. NAME Work Plan PROJ. NO. 89-C-8 REPORTED 09/05/89

EXAM. FOR 501 C., A Compressive Strength SAMPLE TYPE P SAMPLED 08/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT. REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 2900

CEMENT BRAND Atlantic TYPE 2 LBS. 660 AIR ENT. ADMIX. Daravair DOSAGE 5 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Ref Mix Batch No3

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT. FRESH CONC., LBS/CF	145.84	N.A.	N.A.
AIR CONTENT, %	5.40	5.00	7.00
SLUMP, INCHES	2.75	2.00	4.00
TOTAL WATER, GAL/CY	30.32	N.A.	35.1
W/C RATIO	0.383	N.A.	0.44
CONCRETE TEMP., DEGREES F	76	50	60
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL. UNIT. WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG. BRK P.S.I.	BREAK TYPE*
R-3-A 1	151.00	08/08	08/14	7	7	S	4140	N.A.	N.D.
R-3-A 2	151.00	08/08	08/14	7	7	S	4080	4110	N.D.
R-3-A 3	151.00	08/08	08/21	14	14	S	4930	N.A.	N.D.
R-3-A 4	152.00	08/08	08/21	14	14	S	4800	4865	N.D.
R-3-A 5	152.00	08/08	09/05	28	29	S	5590	N.A.	N.D.
R-3-A 6	152.00	08/08	09/05	28	29	S	5480	5535	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C890620 PAY. ITEM 501.22 Concrete, Class A

PROJ. NAME Work Plan PROJ. NO. 89-C-8 REPORTED 09/05/89

EXAM. FOR 501 C., A Compressive Strength SAMPLE TYPE P SAMPLED 08/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT. REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 2963

CEMENT BRAND Atlantic TYPE 2 LBS. 660 AIR ENT. ADMIX. Daravair DOSAGE 5.5 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Test Mix Batch No1

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT. FRESH CONC., LBS/CF	149.14	N.A.	N.A.
AIR CONTENT, %	5.40	5.00	7.00
SLUMP, INCHES	3.00	2.00	4.00
TOTAL WATER, GAL/CY	32.13	N.A.	35.[illegible]
W/C RATIO	0.406	N.A.	0.44
CONCRETE TEMP., DEGREES F	73	50	60
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL. UNIT. WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG. BRK P.S.I.	BREAK TYPE*
W-1-A 1	153.00	08/08	08/14	7	7	S	4460	N.A.	N.D.
W-1-A 2	153.08	08/08	08/14	7	7	S	4210	4335	N.D.
W-1-A 3	153.00	08/08	08/21	14	14	S	4790	N.A.	N.D.
W-1-A 4	153.00	08/08	08/21	14	14	S	4790	4790	N.D.
W-1-A 5	153.00	08/08	09/05	28	29	S	5470	N.A.	N.D.
W-1-A 6	153.00	08/08	09/05	28	29	S	5510	5490	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

DIRECTOR, DEPT. OF
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Milan W. Lawson
MATERIALS & RESEARCH ENGINEER
BY:

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C690621 PAY. ITEM 501.25 Concrete, Class B

PROJ. NAME Work Plan PROJ. NO. 89-C-8 REPORTED 09/05/89

EXAM. FOR 501 C., B Compressive Strength SAMPLE TYPE B SAMPLED 08/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT. REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 3084

CEMENT BRAND Atlantic TYPE 2 LBS. 611 AIR ENT. ADMIX. Daravair DOSAGE 3.5 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Test Mix Batch No6

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT. FRESH CONC., LBS/CF	148.66	N.A.	N.A.
AIR CONTENT, %	5.40	4.00	6.00
SLUMP, INCHES	2.50	2.00	4.00
TOTAL WATER, GAL/CY	29.68	N.A.	35.8
W/C RATIO	0.405	N.A.	0.49
CONCRETE TEMP., DEGREES F	74	50	60
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL. UNIT. WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG. BRK P.S.I.	BREAK TYPE*
W-6-B 1	153.00	08/08	08/14	7	7	S	4200	N.A.	N.D.
W-6-B 2	153.00	08/08	08/14	7	7	S	3860	4030	N.D.
W-6-B 3	153.00	08/08	08/21	14	14	S	4820	N.A.	N.D.
W-6-B 4	153.00	08/08	08/21	14	14	S	4950	4885	N.D.
W-6-B 5	153.00	08/08	09/05	28	29	S	5550	N.A.	N.D.
W-6-B 6	153.00	08/08	09/05	28	29	S	5340	5445	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

DIRECTOR, DEPT. OF
PLANNING & PRECONSTRUCTION
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MATERIALS & RESEARCH ENGINEER
BY:

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION
MONTPELIER, VERMONT 05602

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REPORT ON CONCRETE TEST BEAM OR CYLINDER

LAB. NO. C890622 PAY. ITEM 501.22 Concrete, Class A

PROJ. NAME Work Plan PROJ. NO. 89-C-8 REPORTED 09/05/89

EXAM. FOR 501 Cl. A Compressive Strength SAMPLE TYPE B SAMPLED 08/07/89

RESIDENT ADDRESS

SAMPLED/SUBMITTED BY Meyer TITLE FIELD TEST BY SCS

SAMPLE FROM Laboratory Mixer QUANT. REPRESENTED 1.8 cf LAB TEST BY Chesaux

SOURCE OF MATERIAL M & R Lab COARSE AGGREGATE Whitcomb Wallingford

FINE AGGREGATE Whitcomb Wallingford TOTAL AGGREGATE DRY WGT., LBS/CY 2900

CEMENT BRAND Atlantic TYPE 2 LBS. 660 AIR ENT. ADMIX. Daravair DOSAGE 6 oz/cy

ADMIXTURE WRDA/Hycol DOSAGE 3 oz/cwt ADMIXTURE DOSAGE

LOCATION USED Ref Mix Batch No4

	TEST RESULTS	SPECIFICATIONS MIN.	SPECIFICATIONS MAX.
UNIT WGT. FRESH CONC., LBS/CF	144.84	N.A.	N.A.
AIR CONTENT, %	6.20	5.00	7.00
SLUMP, INCHES	3.00	2.00	4.00
TOTAL WATER, GAL/CY	32.46	N.A.	35.1
W/C RATIO	0.410	N.A.	0.44
CONCRETE TEMP., DEGREES F	75	50	80
AMBIENT TEMP., DEGREES F	77	10	85

SPECIMEN NO.	CYL. UNIT. WGT. LBS/CF	DATE REC'D	DATE BROKEN	DESIRED AGE AT BREAK	AGE AT BREAK	CURE S-F*	BREAK P.S.I.	AVG. BRK P.S.I.	BREAK TYPE*
R-4-A 1	149.00	08/08	08/14	7	7	S	3690	N.A.	N.D.
R-4-A 2	149.00	08/08	08/14	7	7	S	3830	3760	N.D.
R-4-A 3	150.00	08/08	08/21	14	14	S	4330	N.A.	N.D.
R-4-A 4	150.00	08/08	08/21	14	14	S	4360	4345	N.D.
R-4-A 5	150.00	08/08	09/05	28	29	S	5200	N.A.	N.D.
R-4-A 6	150.00	08/08	09/05	28	29	S	5200	5200	N.D.

*See MATERIALS SAMPLING MANUAL for explanation.

COMMENTS: This material meets the requirements for the tests indicated for Item 501

DIRECTOR, DEPT. OF
PLANNING & PRECONSTRUCTION
Milan W. Lawson
MATERIALS & RESEARCH ENGINEER
BY:

pla

TA 565 Rev. 4/79

Prepared By: C. C. Benda
Date: 07-18-89
Sheet 1 of 1

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

RESEARCH INVESTIGATION

Work Plan No. 89-C-8

Subject Evaluation of Crushed Stone Coarse Aggregate, F. W. Whitcomb Constr. Corp., Wallingford, Vermont

Investigation Requested By Warner N. Hodgdon Date Received: 07-10-89

Date Information Required As Soon As Possible

Purpose of Investigation To evaluate a crushed stone coarse aggregate from the F. W. Whitcomb Construction Corporation Quarry in Wallingford, Vermont, proposed for use as a structural concrete aggregate. The rock is a dolomite exposed in the Whitcomb Gravel Pit.

Proposed Tests or Evaluation Procedure See Vermont Procedure for Evaluating a New Source of Structural Concrete Aggregate, VT-AOT-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 referenced aggregate.

2. Prepare specimens from each batch of concrete to determine resistance to freezing and thawing.

Proposal Discussed With D. Brown Projected Manpower Requirements 25 man days

Investigation To Be Conducted By Structural Concrete Subdivision

Proposed Starting Date July 24, 1989 Estimated Completion Date September 1, 1989

Approval/Disapproval by Materials & Research Engineer

Comments by Materials & Research Engineer

Materials & Research Division
Agency of Transportation
Date Typed: