

EVALUATION OF F.W. WHITCOMB/N. WALPOLE, N.H.
3/4" CRUSHED STONE FOR USE IN STRUCTURAL CONCRETE

REPORT 82-4
MARCH 1982

REPORTING ON WORK PLAN 82-C-3

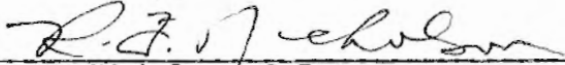
STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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Date: March 29, 1982

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ABSTRACT

As aggregate sources are developed, tests must be conducted to assure that the materials meet specifications and perform satisfactorily when used in concrete mixtures.

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" crushed stone produced by Frank W. Whitcomb Construction Corporation at their facilities in North Walpole, New Hampshire.

Results indicate that the material performs satisfactorily.

INTRODUCTION

As new aggregate sources are developed for use in structural concrete, they must be evaluated not only to determine their compliance with materials specifications but to examine their performance in concrete mixtures. A procedure has been developed whereby proposed new aggregate sources are evaluated by comparing results of tests performed on concrete using the new aggregate with results obtained from concrete containing a reference aggregate. See Appendix A for evaluation procedures.

A request was received from Frank W. Whitcomb Construction Corp. to evaluate crushed stone coarse aggregate, produced at their facilities in North Walpole, New Hampshire, for use in structural concrete. Samples of 3/4 inch crushed stone were obtained from the source at North Walpole, New Hampshire and evaluated for compliance with the requirements of Section 704.02 of the Standard Specifications. 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 704.02 TESTS

The 3/4 inch crushed stone was sampled from an existing stockpile at the Whitcomb, North Walpole, New Hampshire quarry on February 17, 1982 by representatives of the Materials and Research Division. The material was examined for gradation, wear, fractured faces, thin and elongated pieces, and soundness. It was found to comply with the Section 704.02 requirements. The reports on Laboratory Nos. G82 0004 and A82 0178 which document these tests are in Appendix B.

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., N. Walpole, N.H.

B. Reference Aggregate

3/4 inch crushed gravel
Frank W. Whitcomb Construction Corp., N. Walpole, N.H.

Fine Aggregate:

Frank W. Whitcomb Construction Corp., N. Walpole, N. H.

Cement:

Type II
Lehigh Portland Cement Co., Alsen, New York

Air Entraining Admixture:

Darex AEA
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 1 and Table 2.

TABLE 1
COARSE AGGREGATE PROPERTIES

	Bulk Specific Gravity	Absorption, Percent	Dry Rodded Unit Weight, lbs/ft ³
New Aggregate - Crushed Stone	2.85	0.9	105.08
Reference Aggregate - Crushed Gravel	2.67	1.0	101.51

TABLE 2
FINE AGGREGATE PROPERTIES

	Bulk Specific Gravity	Absorption, Percent	Fineness Modulus
Reference Aggregate	2.62	1.2	2.91

The concrete used in this evaluation was mixed in a Sears rotary drum mixer with batch size being 1.5 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 3/4 inch crushed stone (new aggregate) were prepared as well as two batches each of the Class A and Class B concrete containing the 3/4 inch crushed gravel (reference aggregate).

The mix proportions used are shown in Table 3 and Table 4.

TABLE 3

NEW AGGREGATE MIX DESIGN
BATCH QUANTITIES PER C.Y.

	Class A		Class B	
	Batch 1	Batch 2	Batch 3	Batch 4
*Crushed Stone Coarse Aggregate, lbs.	1747	1747	1747	1747
*Fine Aggregate, lbs.	1264	1264	1407	1407
Cement, lbs.	660	660	611	611
Air Entraining Admixture, oz.	3	3	3	1 1/2
Water Reducing Admixture, oz.	19.8	19.8	18.3	18.3
New Water, gal.	31.5	32.9	33.5	33.4

*Weights converted to saturated surface-dry condition.

TABLE 4

REFERENCE AGGREGATE MIX DESIGN
BATCH QUANTITIES PER C.Y.

	Class A		Class B	
	Batch 5	Batch 6	Batch 7	Batch 8
*Crushed Gravel Coarse Aggregate, lbs.	1689	1689	1689	1689
*Fine Aggregate, lbs.	1213	1213	1357	1357
Cement, lbs.	660	660	611	611
Air Entraining Admixture, oz.	3 1/2	4	3 1/2	3 1/2
Water Reducing Admixture, oz.	19.8	19.8	18.3	18.3
Net Water, gal.	32.5	30.2	31.2	32.0

*Weights converted to saturated surface-dry condition.

Tests were performed on the fresh concrete to determine Slump, Air Content, and Unit Weight. Six test cylinders (6" x 12") were fabricated from each batch. The cylinders were tested for compressive strength, two each, at ages 7, 14, and 28 days.

RESULTS

The results of tests on the fresh and hardened concrete are shown in Table 5 and Table 6.

TABLE 5

NEW AGGREGATE TEST RESULTS

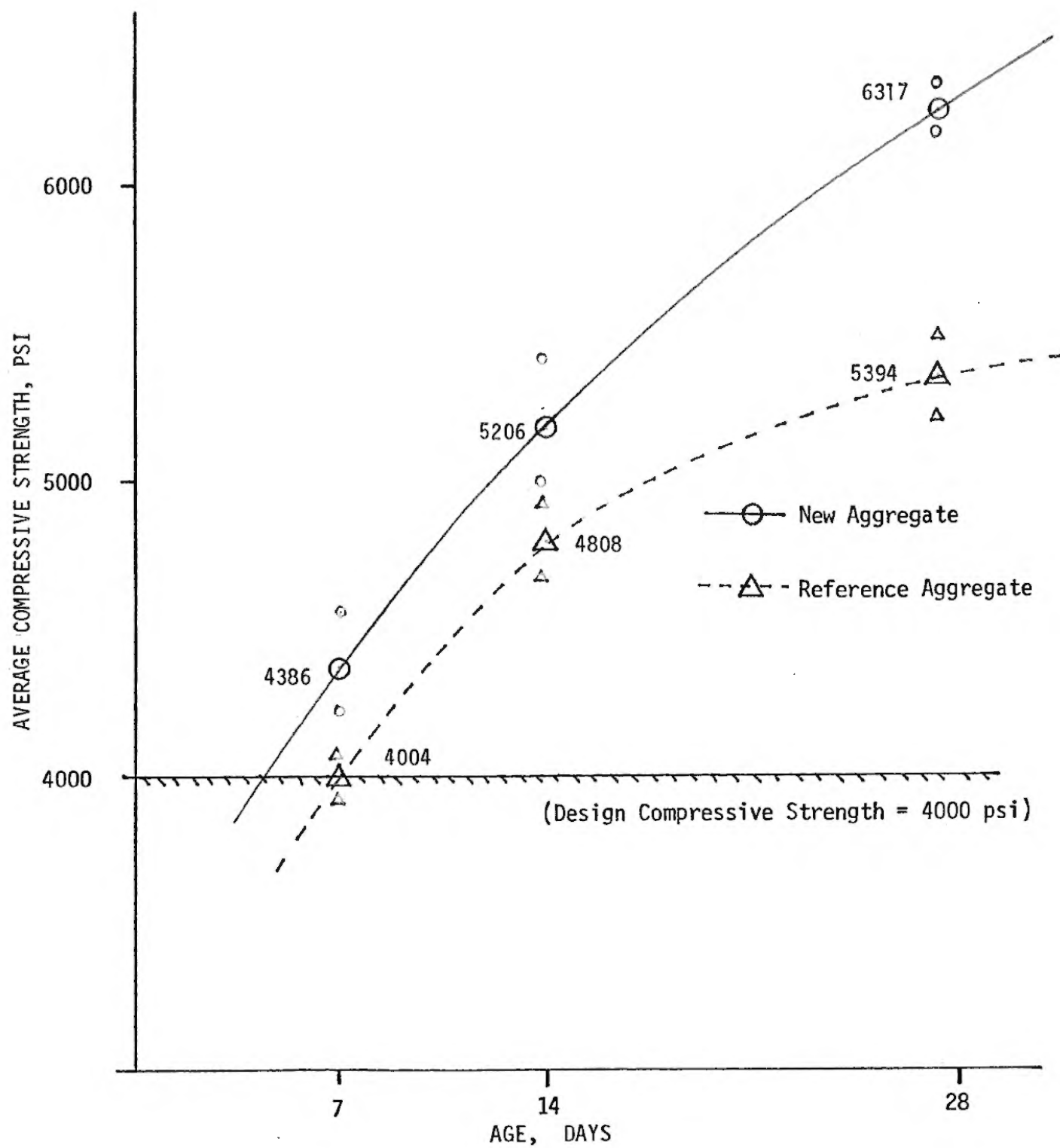
	Class A		Class B	
	Batch 1	Batch 2	Batch 3	Batch 4
Slump, inches	2	3	3	2 3/4
Air Content, percent	4.3	5.3	6.8	4.9
Unit Weight, lbs/ft ³	152.54	150.19	147.02	150.05
Compressive Strength, psi				
7 days	4554	4218	3550	3829
14 days	5412	5000	4381	4722
28 days	6403	6230	5382	5770
(Design compressive strength, psi)	(4000)		(3500)	

TABLE 6

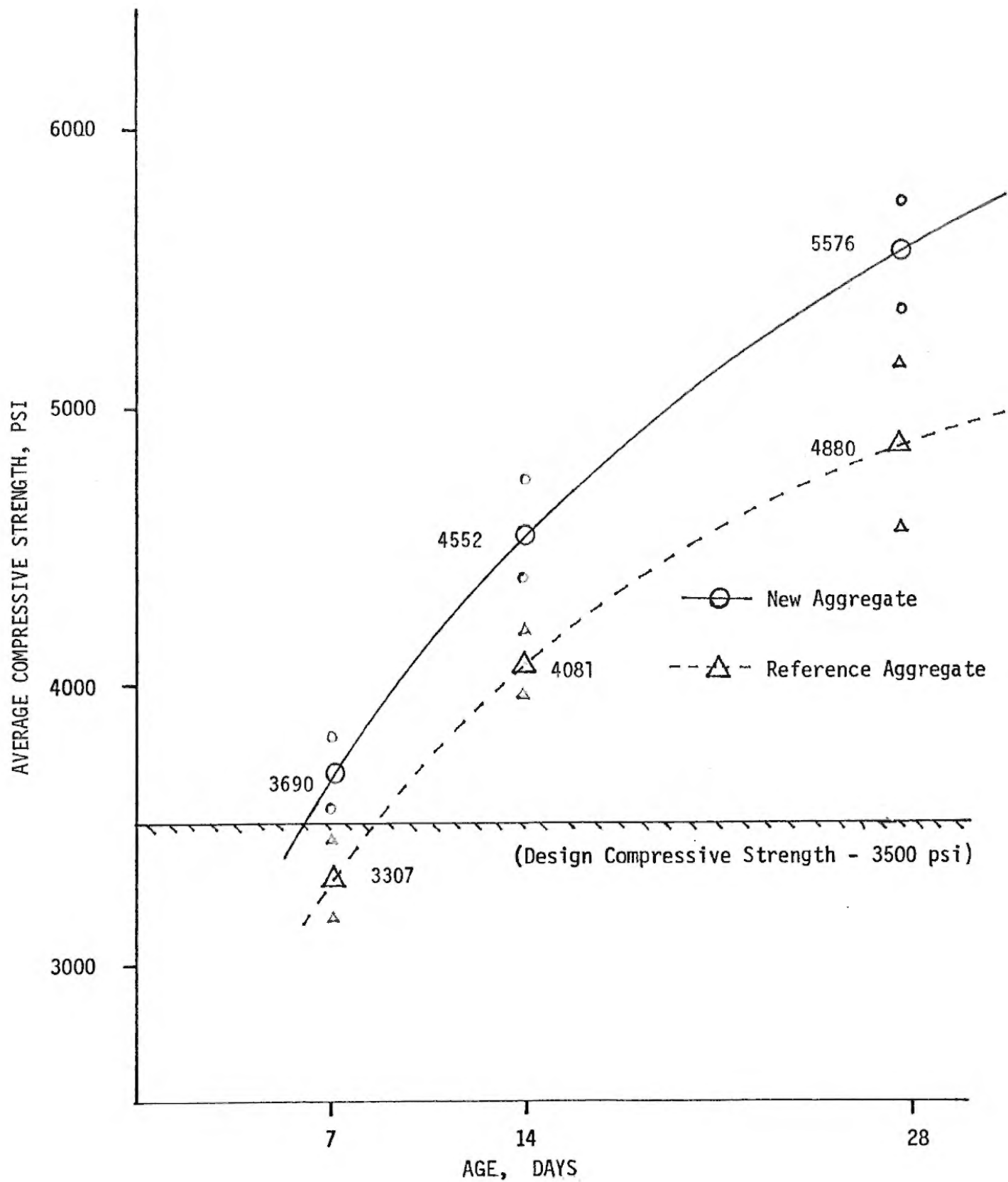
REFERENCE AGGREGATE TEST RESULTS

	Class A		Class B	
	Batch 5	Batch 6	Batch 7	Batch 8
Slump, inches	3 1/4	1 3/4	3	3 1/2
Air Content, percent	5.3	4.1	5.5	7.2
Unit Weight, lbs/ft ³	146.64	149.14	145.49	142.90
Compressive Strength, psi				
7 days	3930	4077	3462	3152
14 days	4700	4916	4196	3966
28 days	5531	5257	5187	4572
(Design compressive strength, psi)	(4000)		(3500)	

The results of compressive strength tests are also shown on Laboratory Reports Nos. C82 0008 through C82 0015 in Appendix C. Strength-age plots illustrating average compressive strengths are shown in Figure I and Figure II.



AVERAGE COMPRESSIVE STRENGTH VS AGE
CLASS A
Figure I



AVERAGE COMPRESSIVE STRENGTH VS AGE

CLASS B

Figure II

CONCLUSIONS AND RECOMMENDATIONS

- 1) The 3/4 inch crushed stone coarse aggregate from the Frank W. Whitcomb Construction Corp. quarry in North Walpole, New Hampshire, complied with all requirements of Section 704.02 when tested in conjunction with this evaluation.
- 2) The compressive strengths obtained from the Class A and Class B laboratory mixes using the 3/4 inch crushed stone coarse aggregate were appreciably higher than the compressive strengths of the reference mixes.
- 3) It is recommended that the present Frank W. Whitcomb Construction Corp. quarry in North Walpole, New Hampshire be approved as a source of crushed stone coarse aggregate for use in structural concrete.
- 4) 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.

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Appendix A

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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Montpelier, Vermont 05602Appendix B

REPORT ON SAMPLE OF AGGREGATE

Report Feb. 26, 19 82Laboratory No. G82 0004Tested By M. MorissetteName Coarse Aggregate for Concrete, Item 501Identification Marks Evaluation sample, 3/4" crushed stoneSubmitted by M. Morissette Title PFP Address _____Sampled 2-17, 19 82 Received 2-17, 19 82Sample from Stockpile @ F. W. Whitcomb Const. Corp., N. Walpole, N.H.

Quantity Represented _____

Source of Material F. W. Whitcomb Const. Corp., N. Walpole, N.H.Location used or to be used W.P. 82-C-3Examined for 704.02

TEST RESULTS

Total Sample		Fineness Modulus		Percent of Wear	
Sieve Size	% Passing	% Coarser Than			
4 1/2"	_____	No. 100	_____	AASHTO T3	_____
4"	_____	No. 50	_____	AASHTO T4	_____
3 1/2"	_____	No. 30	_____	AASHTO T96	<u>28.6</u>
3"	_____	No. 16	_____	"B" Grading	_____
2 1/2"	_____	No. 8	_____	Fractured Faces, %	<u>100</u>
2"	_____	No. 4	_____	Thin & Elongated	_____
1 3/4"	_____	Fineness Modulus = _____		Pieces, %	<u>1</u>
1 1/2"	_____	Comments:		Soundness, % Loss	
1"	<u>100</u>			_____	
3/4"	<u>99</u>			_____	
5/8"	_____			_____	
1/2"	_____	This material was examined for gradation, wear, fractured faces, and thin and elongated pieces. The results are as indicated.		_____	
3/8"	<u>36</u>			_____	
No. 4	<u>7</u>			_____	
No. 8	<u>2</u>			_____	
No. 10	_____			_____	
No. 16	_____			_____	
No. 30	_____	Sand Portion		_____	
No. 50	_____	_____		_____	
No. 100	_____	_____		_____	
No. 200	_____	_____		_____	

S. J. Gage, P.E., Chief Engineer

By: R. F. Gage /RAZ
R. F. Gage, P.E., Materials & Research Engineer

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Montpelier, Vermont 05602Appendix B

REPORT ON SAMPLE OF AGGREGATE

Report March 19, , 19 82Laboratory No. A82 0178Tested By M. LavinName Coarse Aggregate for Concrete, Item 501Identification Marks Evaluation Sample, 3/4" Crushed StoneSubmitted by M. Morissette Title PFP Address Sampled 2-17 , 19 82 Received 2-18 , 19 82Sample from Stockpile @ Frank W. Whitcomb Const. Corp., N. Walpole, N.H.Quantity Represented Source of Material Frank W. Whitcomb Const. Corp., N. Walpole, N.H.Location used or to be used W.P. 82-C-3Examined for 704.02

TEST RESULTS

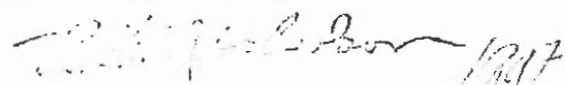
Total Sample		Fineness Modulus		Percent of Wear	
Sieve Size	% Passing	% Coarser Than			
4 1/2"	_____	No. 100	_____	AASHTO T3	_____
4"	_____	No. 50	_____	AASHTO T4	_____
3 1/2"	_____	No. 30	_____	AASHTO T96	_____
3"	_____	No. 16	_____	Fractured Faces, % _____	
2 1/2"	_____	No. 8	_____		
2"	_____	No. 4	_____	Thin & Elongated Pieces, % _____	
1 3/4"	_____	Fineness Modulus = _____			
1 1/2"	_____			Soundness, % Loss <u>0.9</u>	
1"	_____				
3/4"	_____				
5/8"	_____	Comments:			
1/2"	_____	This material was examined for soundness. The results are			
3/8"	_____	as indicated.			
No. 4	_____				
No. 8	_____				
No. 10	_____				
No. 16	_____	Sand			
No. 30	_____	Portion			
No. 50	_____				
No. 100	_____			S. J. Gage, P.E., Chief Engineer	
No. 200	_____				

Comments:

This material was examined for soundness. The results are as indicated.

Sand
Portion

S. J. Gage, P.E., Chief Engineer



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Appendix C

Report on Concrete Test Beam or Cylinders

Laboratory No. C82 0008 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address

Materials & Research Lab

Source of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.

F. W. Whitcomb Const. Corp.

F. W. Whitcomb Const. Corp.

Coarse Aggregate N. Walpole, N.H. Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 611Air Entraining Admixture Darex AEA Dosage 3 1/2 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 3013Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ lab Date Sampled: February 23, 1982Location Used or to be Used Reference Mix Batch No. 7Examined for Mod. of Rupture Compressive Strength

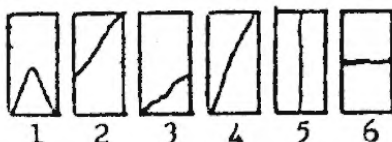
TEST RESULTS

Unit Weight Fresh Concrete 145.49 lbs/cf Air: Pressure 5.5% Chace Total Water, Gal/Cy Used 31.2 Slump 3" Temperature, Concrete 70°F Ambient 72°F

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	2
NWG 7B	1	146									
	2	148		3-2	7	S	3404	3519	3462		
	3	147									
	4	148		3-9	14	S	4165	4226	4196		
	5	148									
	6	147		3-23	28	S	5324	5050	5187		

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

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

Comments:
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Report on Concrete Test Beam or Cylinders

Laboratory No. C82 0009 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address Materials & Research LabSource of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.F. W. Whitcomb Const. Corp. F. W. Whitcomb Const. Corp.Coarse Aggregate N. Walpole, N.H. Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 611Air Entraining Admixture Darex AEA Dosage 3 1/2 oz/cy Admixture WRDA Hycol dosage 3 oz/cwtMaximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 3013Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ lab Date Sampled: February 23, 1982Location Used or to be Used Reference Mix Batch No. 8Examined for Mod. of Rupture Compressive Strength

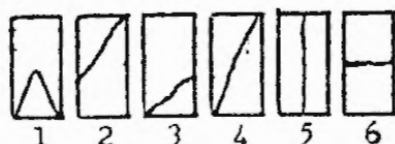
TEST RESULTS

Unit Weight Fresh Concrete 142.90 lbs/cf Air: Pressure 7.2% Chace Total Water, Gal/Cy Used 32 Slump 3 1/2" Temperature, Concrete 70°F Ambient 70°F

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	2
NWG 8B	1	144									
	2	144		3-2	7	S	3174	3130	3152		
	3	144									
	4	144		3-9	14	S	3997	3935	3966		
	5	144									
	6	144		3-23	28	S	4528	4616	4572		

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

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

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Report on Concrete Test Beam or Cylinders

Laboratory No. C82 0010 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address _____

Materials & Research Lab

Source of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.

F. W. Whitcomb Const. Corp.

F. W. Whitcomb Const. Corp.

Coarse Aggregate N. Walpole, N.H. Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 611Air Entraining Admixture Darex AEA Dosage 3 oz/cy Admixture WRDA Hycol dosage 3 oz/cwtMaximum allowable water content, Gal/Cy _____ Total Aggregate, Dry Wgt. 3121Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ lab Date Sampled: February 23, 1982Location Used or to be Used _____ Test Mix _____ Batch No. 3

Examined for Mod. of Rupture _____ Compressive Strength _____

TEST RESULTS

Unit Weight Fresh Concrete 147.02 lbs/cf Air: Pressure 6.8% Chace _____Total Water, Gal/Cy Used 33.5 Slump 3" Temperature, Concrete 70°F Ambient 70°F

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	2
NWL 3B	1	148									
	2	149		3-2	7	S	3599	3501	3550		
	3	147									
	4	150		3-9	14	S	4394	4368	4381		
	5	150									
	6	149		3-23	28	S	5430	5333	5382		

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

18A7

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Report on Concrete Test Beam or Cylinders

Laboratory No. C82 0011 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address _____

Materials & Research Lab

Source of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.

F. W. Whitcomb Const. Corp.

F. W. Whitcomb Const. Corp.

Coarse Aggregate N. Walpole, N.H.Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 611Air Entraining Admixture Darex AEA Dosage 1 1/2 oz/cy Admixture WRDA Hycol dosage 3 oz/cwtMaximum allowable water content, Gal/Cy _____ Total Aggregate, Dry Wgt. 3121Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ labDate Sampled: February 23, 1982Location Used or to be Used _____ Test Mix _____ Batch No. 4

Examined for Mod. of Rupture _____ Compressive Strength _____

TEST RESULTS

Unit Weight Fresh Concrete 150.05 lbs/cf Air: Pressure 4.9% Chace _____Total Water, Gal/Cy Used 33.4 Slump 2 3/4" Temperature, Concrete 70°F Ambient 70°F

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	2
NWL 4B	1	151									
	2	151		3-2	7	S	3820	3837	3829		
	3	151									
	4	150		3-9	14	S	4739	4704	4722		
	5	151									
	6	150		3-23	28	S	5730	5810	5770		

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

Comments:

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1-1-1

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Appendix C

Report on Concrete Test Beam or Cylinders

Laboratory No. C82 0012 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address Materials & Research LabSource of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.F. W. Whitcomb Const. Corp. F. W. Whitcomb Const. Corp.Coarse Aggregate N. Walpole, N.H. Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 660Air Entraining Admixture Darex AEA Dosage 3 1/2 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 2871Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ lab Date Sampled: February 23, 1982Location Used or to be Used Reference Mix Batch No. 5Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 146.64 lbs/cf Air: Pressure 5.3% Chace Total Water, Gal/Cy Used 32.5 Slump 3 1/4 Temperature, Concrete 66°F Ambient 70°F

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	2
NWG 5A	1	148									
	2	147		3-2	7	S	3952	3908	3930		
	3	148									
	4	148		3-9	14	S	4695	4704	4700		
	5	148									
	6	147		3-23	28	S	5447	5615	5531		

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

R. F. Nicholson RAZ

R. F. Nicholson, P.E., Chief Engineer

Comments:
TA 133H Rev.
10/1/81

Project Name

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WP 82-C-3

Project Number

MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Appendix C

Laboratory No. C82 0013 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address _____Source of Material Materials & Research Lab
Berlin, VermontQuantity Represented 1 1/2 C.F.Coarse Aggregate F. W. Whitcomb Const. Corp.

F. W. Whitcomb Const. Corp.

N. Walpole, N.H.

Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 660Air Entraining Admixture Darex AEA Dosage 4 oz/cy Admixture WRDA Hycol dosage 3 oz/cwtMaximum allowable water content, Gal/Cy _____ Total Aggregate, Dry Wgt. 2871Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ labDate Sampled: February 23, 1982Location Used or to be Used _____ Reference Mix Batch No. 6

Examined for Mod. of Rupture _____ Compressive Strength _____

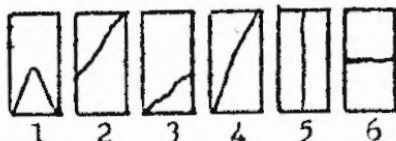
TEST RESULTS

Unit Weight Fresh Concrete 149.14 lbs/cf Air: Pressure 4.1% Chace _____Total Water, Gal/Cy Used 30.2 Slump 1 3/4 " Temperature, Concrete 68° 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	2
NWG 6A	1	149									
	2	150		3-2	7	S	3935	4218	4077		
	3	149									
	4	149		3-9	14	S	4925	4907	4916		
	5	149									
	6	149		3-23	28	S	5615	4899	5257		

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

By: _____

20 P. E. Gage, P.E., Chief Engineer

Comments:
TA 133H Rev.
11/1/81

Project Name

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Montpelier, Vermont 05602

Appendix C

Report on Concrete Test Beam or Cylinders

Laboratory No. C82 0014 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address Materials & Research LabSource of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.F. W. Whitcomb Const. Corp. F. W. Whitcomb Const. Corp.Coarse Aggregate N. Walpole, N.H. Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 660Air Entraining Admixture Darex AEA Dosage 3 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 2980Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ lab Date Sampled: February 23, 1982Location Used or to be Used Test Mix Batch No. 1Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 152.54 lbs/cf Air: Pressure 4.3% Chace Total Water, Gal/Cy Used 31.5 Slump 2" Temperature, Concrete 72°F Ambient 68°F

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	2	
NWL 1A	1	152		3-2	7	7	S	4483	4624	4554		
	2	153										
	3	153		3-9	14	14	S	5376	5447	5412		
	4	153										
	5	153		3-23	28	28	S	6411	6394	6403		
	6	152										

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

mjm

Comments:
TA 183H Rev.
1/81

Project Name

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Project Number

MATERIALS AND RESEARCH DIVISION
Montpelier, Vermont 05602

Report on Concrete Test Beam or Cylinders

Appendix C

Laboratory No. C82 0015 (28) Report of 7, 14, 28 Day Breaks Date typed 3-25-82Pay Item Performance in Concrete Type of Sample EvaluationSubmitted by W. Meyer Title CLP Address Materials & Research LabSource of Material Berlin, Vermont Quantity Represented 1 1/2 C.F.F. W. Whitcomb Const. Corp. F. W. Whitcomb Const. Corp.
Coarse Aggregate N. Walpole, N.H. Fine Aggregate N. Walpole, N.H.Cement Brand Lehigh Type II Lbs. 660Air Entraining Admixture Darex AEA Dosage 3 oz/cy Admixture WRDA Hycot Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 2980Field Tested by M. Morissette Lab. Tested by EatonSampled from Sears Mixer @ lab Date Sampled: February 23, 1982Location Used or to be Used Test Mix Batch No. 2Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 150.19 lbs/cf Air: Pressure 5.3% Chace Total Water, Gal/Cy Used 32.9 Slump 3" Temperature, Concrete 70°F Ambient 68°F

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	2	
NWL 2A	1	152		3-2	7	7	S	4226	4209	4218		
	2	151										
	3	151		3-9	14	14	S	5040	4960	5000		
	4	151										
	5	151		3-23	28	28	S	6270	6190	6230		
	6	151										

*S = Standard Cured; F = Field Cured

Types of Breaks:



S. J. Gage, P.E., Chief Engineer

By:

R. F. Gage, P.E.

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISIONAppendix DRESEARCH INVESTIGATIONWork Plan No. 82-C-3Subject Evaluation of Proposed Crushed Stone Coarse Aggregate, Frank W. Whitcomb
Construction Corp., N. Walpole, N.H.Investigation Requested By Frank W. Whitcomb Const. Corp. Date February 10, 1982Date Information Required March 29, 1982Purpose of Investigation To evaluate the proposed crushed stone coarse aggregate from
the Frank W. Whitcomb Construction Corporation, N. Walpole, N.H. quarry for use as
a structural concrete aggregate.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 and Class B concrete containing the proposed new aggregate and two batches
each of Class A and Class B concrete containing a reference aggregate.

Proposal Discussed With R. I. Frascoia Projected Manpower Requirements 15 mandaysInvestigation To Be Conducted By Structural Concrete SubdivisionProposed Starting Date Feb. 17, 1982 Estimated Completion Date March 29, 1982Approval Disapproval by Materials & Research Engineer R. F. Nicholson 3/29/82

Comments by Materials & Research Engineer _____

Materials & Research Division
Agency of Transportation
Date Typed: 3/26/82