

Evaluation Of Hinesburg  
3/4" Crushed Gravel For  
Use In Structural Concrete

Final Report 81-6  
January 1983

(Originally Reported As Initial Report 81-6)  
December 1981

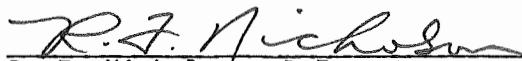
Reporting On Work Plan No. 81-C-19

State of Vermont  
Agency of Transportation  
Materials & Research Division

P. J. Garahan, P.E., Secretary of Transportation  
S. J. Gage, P.E., Director of Engineering and Construction  
R. F. Nicholson, P.E., Materials & Research Engineer

Prepared By:  
W. L. Meyer, Technician C

Reviewed By:



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

Date: 2-3-83

"The information contained in this report was compiled for the use of the Vermont Agency of Transportation. Conclusions and recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Agency policy. This report does not constitute a standard, specification, or regulation. The Vermont Agency of Transportation assumes no liability for its contents or the use thereof."

## TABLE OF CONTENTS

	<u>Page</u>
Abstract . . . . .	1
Introduction . . . . .	2
Procedures . . . . .	3
Phase I, Section 704.02 Tests	
Phase II, Performance-In-Concrete Tests	
Results . . . . .	6
Freeze-Thaw Test Results . . . . .	6A
Figure I . . . . .	7
Figure II . . . . .	8
Figure III . . . . .	9
Conclusions and Recommendations. . . . .	10
Appendix A : . . . . .	11-13
Procedure For Evaluation of New Structural Concrete Aggregate Sources To Determine Compliance With AOT Specifications	
Appendix B (Two Reports) . . . . .	14-15
Section 704.02 Test Results, Laboratory Report Nos. A81-0913 and G81-0701	
Appendix C (Six Reports) . . . . .	16-21
Compressive Strength Test Results, Laboratory Report Nos. C81-1229 thru C81-1234	
Appendix D . . . . .	22-23
Work Plan No. 81-C-19	

## ABSTRACT

Initial Report 81-6, December, 1981

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 initial report documents results of tests performed on a proposed new source of coarse aggregate for structural concrete. The new material is a 3/4" crushed gravel produced by Hinesburg Sand and Gravel Co., Inc. at their facilities in Hinesburg, Vermont

Initial results, to date, indicate that the material performs satisfactorily.

Final Report 81-6, January, 1983

The concrete containing crushed gravel coarse aggregate from Hinesburg Sand and Gravel Co., Inc. produced acceptable results in freeze-thaw testing and continued approval of the material is recommended.

## INTRODUCTION

As new aggregate sources are developed for use in structural concrete, they must be investigated 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. Since the concrete is produced at a ready-mix plant, the reference aggregate is the aggregate currently in use at the plant.

A request was received from Hinesburg Sand & Gravel Co., Inc. to evaluate a 3/4" crushed gravel coarse aggregate being produced at their facilities in Hinesburg, Vermont. They stated that they are currently interested in supplying the aggregate to A. G. Anderson, Co., in Berlin, Vermont for use on a highway project in that area. Their future goal, however, is to supply several ready-mix companies.

Samples of the 3/4" crushed gravel were obtained from the source at Hinesburg and evaluated in the Laboratory for compliance with requirements of Section 704.02 of the Standard Specifications. The performance-in-concrete tests were conducted at the A. G. Anderson, Co. ready-mix plant in Berlin.

## PROCEDURES

### PHASE I, SECTION 704.02 TESTS

The 3/4" crushed gravel was sampled from an existing stockpile at Hinesburg on July 29, 1981. The material was examined for gradation, wear, fractured faces, thin and elongated pieces, and soundness and was found to conform with Section 704.02 requirements.

The material was also sampled on October 3, 1981 from a stockpile prepared at the A. G. Anderson, Co. ready-mix plant in Berlin. The material was examined for gradation and complied with that requirement. See Appendix B for results of Section 704.02 tests.

### PHASE II, PERFORMANCE-IN-CONCRETE TESTS

After it was determined that the proposed aggregate complied with the requirements of Section 704.02, Hinesburg Sand & Gravel Co., Inc. and A. G. Anderson established a schedule for conducting the performance-in-concrete tests at the ready-mix plant in Berlin. Mix designs were prepared by Structural Concrete Subdivision personnel for Class A, Class B, and Class C concrete and mixing and testing of the concrete was carried out on October 5, 1981.

Moisture content of the aggregates was determined prior to the start of mixing and aggregate weights were adjusted accordingly. Concrete was mixed in a standard truck mixer with batch size being one cubic yard. Batches were prepared for Class A, Class B, and Class C concrete containing the Hinesburg 3/4" crushed gravel and the reference aggregate.

The materials used in this evaluation are as follows:

Coarse Aggregates:

- A. Proposed New Aggregate  
3/4" Crushed Gravel  
Hinesburg Sand & Gravel, Hinesburg, Vt.
- B. Reference Aggregate  
3/4" Crushed Igneous Stone  
Cooley, Websterville, Vt.

Fine Aggregate:

- A. G. Anderson, Highgate, Vt.

Cement:

Type II

Northeast Cement Co., Inc., St. Constant, Que.

Air Entraining Admixture:

Darex AEA  
W. R. Grace & Co., Cambridge, MA.

Water Reducing Admixture:

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

Aggregate properties used for preparing mix designs are as follows:

Hinesburg Coarse Aggregate:

Bulk Specific Gravity	2.66
Absorption, percent	0.8
Dry Rodded Unit Weight, lbs/ft <sup>3</sup>	- 103.27

Reference Coarse Aggregate:

Bulk Specific Gravity	- 2.59
Absorption, percent	- 1.1
Dry Rodded Unit Weight, lbs/ft <sup>3</sup>	- 94.50

Fine Aggregate:

Bulk Specific Gravity	- 2.60
Absorption, percent	- 1.5
Fineness Modulus	- 2.90

The mix designs used in this evaluation are as follows:

NEW AGGREGATE MIX DESIGN

	Batch Quantities Per Cubic Yard		
	Class A	Class B	Class C
Hinesburg Coarse Aggregate, lbs.	1715*	1715*	1715*
Fine Aggregate, lbs.	1172*	1315*	1425*
Cement, lbs.	660	611	565
Air Entraining Admixture, oz.	5	4	5
Water Reducing Admixture, oz.	19.8	18.3	17.0
Net Water, gal.	26.9	27.8	27.8

\*Weights shown are for aggregates in the saturated surface dry condition.

REFERENCE AGGREGATE MIX DESIGN

	Batch Quantities Per Cubic Yard		
	Class A	Class B	Class C
Reference Coarse Aggregate, lbs.	1573*	1573*	1573*
Fine Aggregate, lbs.	1275*	1418*	1527*
Cement, lbs.	660	611	565
Air Entraining Admixture, oz.	5	4	5
Water Reducing Admixture, oz.	19.8	18.3	17.0
Net Water, gal.	28.5	26.4	27.1

\*Weights shown are for aggregates in the saturated surface dry condition.

Immediately following batching and mixing operations, each batch of concrete was tested to determine Air Content, Unit Weight and Yield, and Slump. Seven test cylinders (6"x12") were fabricated from each batch. Six of the cylinders were tested for compressive strength, two each at ages of 7, 14, and 28 days. The remaining cylinder from each batch was moist cured for 28 days. At age 28 days, three 2 inch cubes were cut from the center section of these cylinders and the cubes subjected to freeze-thaw testing in accordance with "Method of Test For Freeze-Thaw Durability of Structural Concrete Mixes" VT AOT No. 25.



## RESULTS

Initial Report 81-6, December, 1981

The results of tests performed are as follows:

Hinesburg Coarse Aggregate	Class A	Class B	Class C
Slump, inches	2 1/2	3 1/2	3 1/2
Air Content, percent	4.4	5.4	7.5
Unit Weight, lbs/ft <sup>3</sup>	145.92	143.13	139.62
Relative Yield, percent	95.8	100.2	104.5
Compressive Strength, psi			
7 days	4682	3909	3026
14 days	5323	4257	3541
28 days	5717	4784	3942
(Design Compressive Strength, psi)	(4000)	(3500)	(3000)
Reference Coarse Aggregate	Class A	Class B	Class C
Slump, inches	1 1/2	3	4
Air Content, percent	4.6	5.8	6.4
Unit Weight, lbs/ft <sup>3</sup>	143.41	140.53	144.13
Relative Yield, percent	96.8	100.8	100.0
Compressive Strength, psi			
7 days	4514	3916	3577
14 days	5266	4810	4289
28 days	6123	5230	4956
(Design Compressive Strength, psi)	(4000)	(3500)	(3000)

The results of compressive strength tests are also shown on Laboratory reports Nos. C8101229 to C8101234 in Appendix C. Strength-age plots are shown in Figures I, II, and III.

Freeze-thaw test results will be available following the completion of testing.

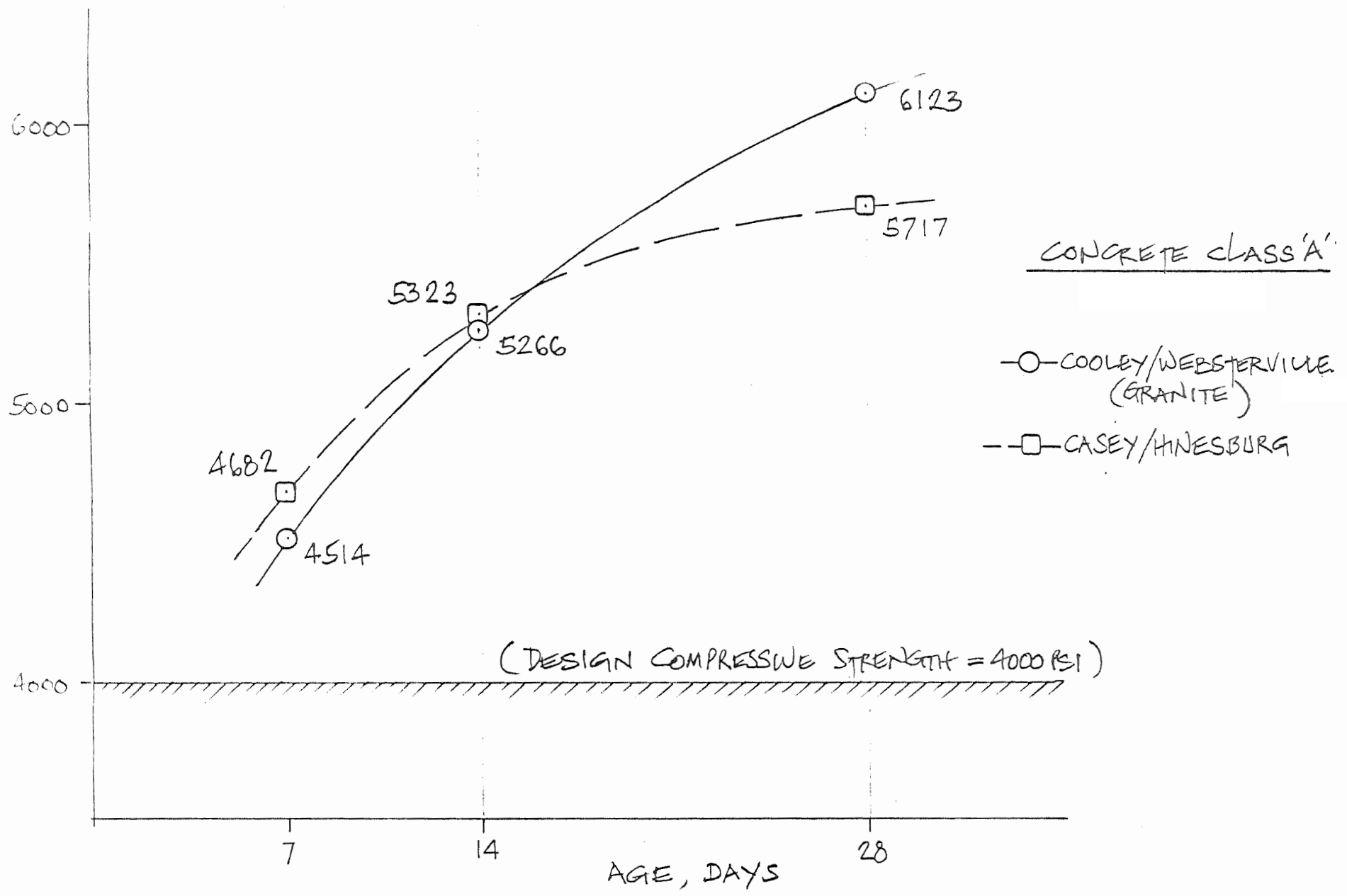
## RESULTS

Final Report 81-6, January, 1983

The results of freeze-thaw tests are as follows:

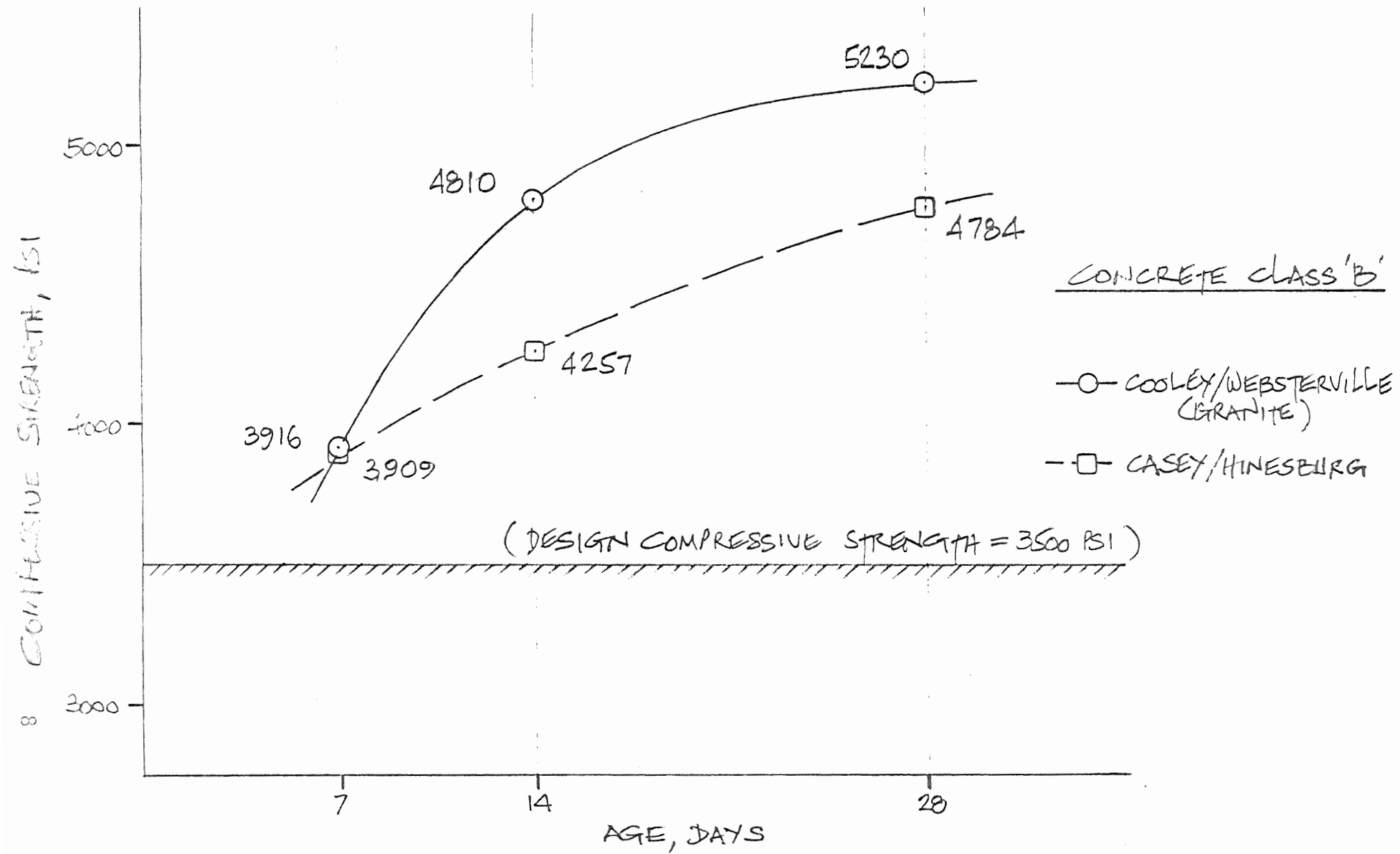
Hinesburg Coarse Aggregate	Class A	Class B	Class C
Freeze-Thaw Durability, percent loss			
25 cycles	6.6	15.4	18.9
50 cycles	8.7	20.1	22.2
75 cycles	10.4	22.1	24.5
100 cycles	11.8	23.1	25.5
Reference Coarse Aggregate	Class A	Class B	Class C
Freeze-Thaw Durability, percent loss			
25 cycles	16.7	21.5	17.4
50 cycles	19.5	25.9	20.2
75 cycles	20.9	27.7	22.4
100 cycles	22.2	29.3	23.4

Compressive Strength, psi



Compressive Strength vs Age  
Concrete Class A

Figure I

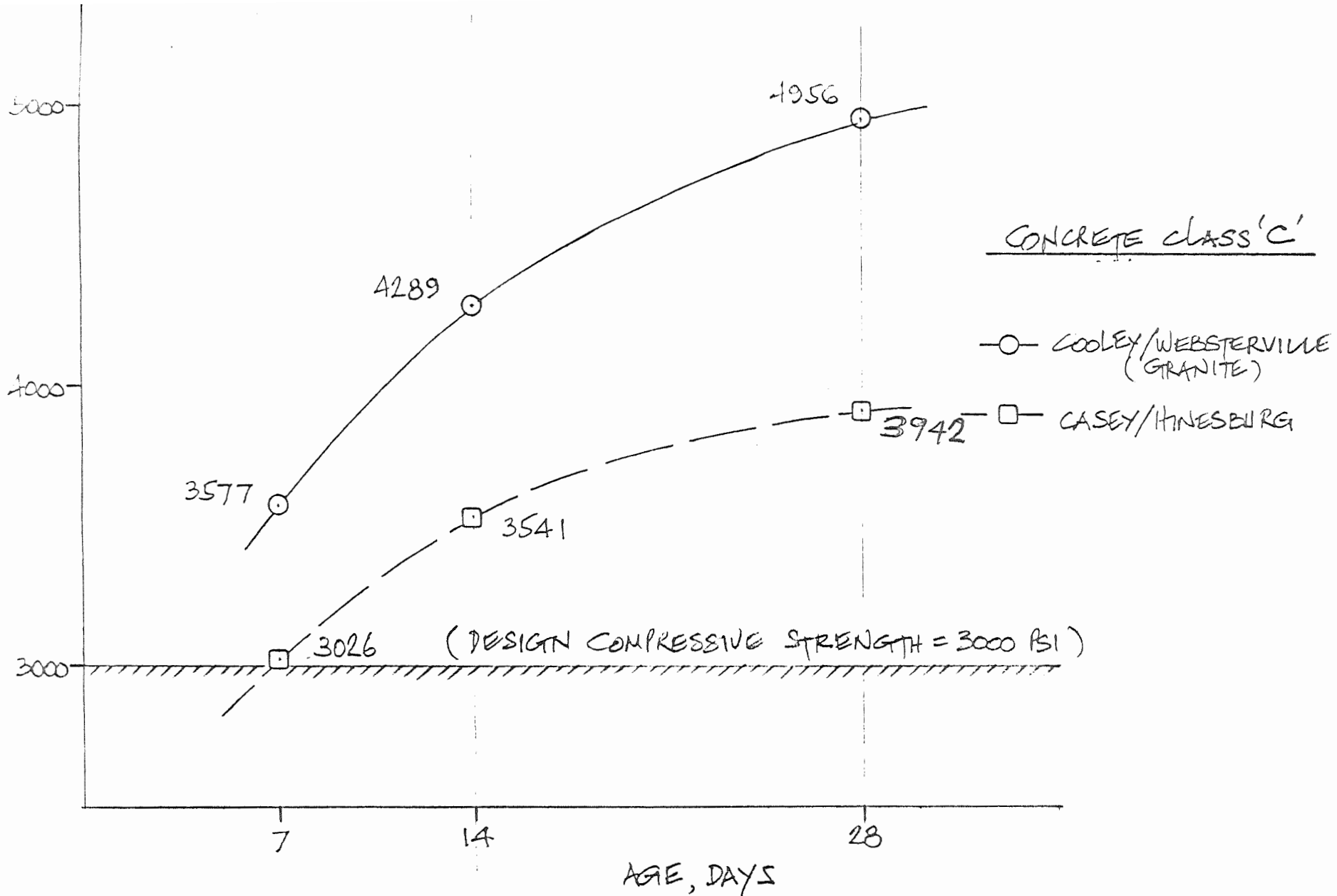


Compressive Strenath vs Age

Concrete Class B

Figure II

COMPRESSION STRENGTH, PSI



Compressive Strength vs Age

Concrete Class C

Figure III

## CONCLUSIONS AND RECOMMENDATIONS

Initial Report 81-6, December, 1981

1. The 3/4" crushed gravel coarse aggregate from Hinesburg Sand and Gravel Co., Inc., Hinesburg, Vermont, complied with all requirements of Section 704.02 when tested in conjunction with this evaluation.
2. Although compressive strengths obtained from concretes using the Hinesburg aggregate did not reach the same levels as the reference concretes, the Hinesburg strengths were acceptable.
3. It is recommended that the Hinesburg 3/4" crushed gravel be approved for use in structural concrete subject to freeze-thaw test results.
4. A final report will be prepared when data from freeze-thaw tests is available.

Final Report 81-6, January, 1983

1. The Class A and Class B concretes containing the Hinesburg coarse aggregate had greater freeze-thaw durability than the reference concretes. The Class C reference concrete performed slightly better, in freeze-thaw testing, than the Class C concrete using the Hinesburg coarse aggregate.
2. It is recommended that the present Hinesburg Sand and Gravel Co., Inc. facility in Hinesburg, Vt. continue to be approved as a source of crushed gravel coarse aggregate for use in structural concrete.

APPENDIX A

STATE OF VERMONT  
AGENCY OF TRANSPORTATION  
MATERIALS & RESEARCH DIVISION - STRUCTURAL CONCRETE SUBDIVISION

PROCEDURE FOR THE EVALUATION OF NEW STRUCTURAL CONCRETE AGGREGATE  
SOURCES TO DETERMINE COMPLIANCE WITH AOT SPECIFICATIONS

The evaluation of a new structural concrete aggregate source (i.e. one on which the Materials & 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.

The Materials and Research Division shall perform all Phase I and Phase II tests.

Phase I

1. A written request shall be made to the Materials & Research Engineer by the person requesting the evaluation, describing the type of material, quantity available for sampling, and the location of the stockpiles.
2. The Structural Concrete Engineer shall determine from a site visit,
  - a) Does a stockpile of at least a day's production 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 the necessary arrangements and obtain samples from the stockpiles designated by the producer.
4. The material shall be tested at the Materials & Research Division using the Structural Concrete Subdivision Annual Aggregate Testing Program procedure.
5. Report the results (as a Preliminary Sample) on the standard Materials and Research Division forms, and send a copy of the test results to the aggregate producer.

Phase II

1. Aggregates which meet the requirements of the Phase I evaluation will then be tested in concrete. The Structural Concrete Engineer will inform the person requesting the evaluation of the Phase II requirements. The performance-in-concrete tests shall be carried out on Ready Mixed concrete containing the aggregate being evaluated. At the same time concrete with a control aggregate (selected by the Structural Concrete Engineer) will also be processed. Costs for processing the aggregate thru the Ready-Mix plant will be borne by the requesting party. The Phase II tests shall

conform to the Materials & Research Division Performance-in-Concrete  
Procedure for Evaluating a New Aggregate Source.

2. The Materials and Research Division shall carry out the work necessary for both the Phase I and Phase II sections of this evaluation process in a period of not more than 45 calendar days from the date the aggregate is available for testing. Any delays beyond the control of the Materials & Research Division shall be documented and the person requesting the evaluation shall be notified of the consequent extension of time required to complete the testing. Failure of the aggregate to pass the requirements of the Phase I section would terminate the evaluation.
3. Test results shall be the basis upon which the Structural Concrete Engineer shall recommend acceptance, further testing, or rejection to the Materials and Research Engineer.
4. The Materials and Research Engineer shall inform the person making the request of the acceptability of the aggregate, when the Phase II tests have been completed.



APPENDIX A  
STATE OF VERMONT  
AGENCY OF TRANSPORTATION  
MATERIALS & RESEARCH DIVISION - STRUCTURAL CONCRETE SUBDIVISION

PERFORMANCE-IN-CONCRETE

PROCEDURE FOR EVALUATING A NEW AGGREGATE SOURCE

1. Mix proportions shall be submitted for each class of concrete required; or designed by, the Materials and Research Division and shall conform to Table 501.03A.
2. Test shall be run on both Field and Laboratory Concrete.
3. Field Concrete shall be produced at an approved Ready-Mixed Concrete Plant. Cement, sand, water, and admixtures shall all be the same as in current use at the plant, and as approved by the Agency of Transportation.
4. Laboratory Concrete shall be prepared at the Central Laboratory with the same materials used in the Ready Mixed Concrete.
5. An approved aggregate in normal use at the Ready-Mixed Concrete plant shall be used as a control in a separate batch for both Field and Laboratory Concrete.
6. At least one cubic yard of Ready Mixed concrete shall be produced for each class of concrete containing each new and control aggregate being evaluated.
7. Test cylinders shall be fabricated and cured in accordance with AASHTO T23-76.
8. Tests of Slump, Air Content, Unit Weight, and Yield, shall be in accordance with AASHTO T119-74, AASHTO T152-80I, and AASHTO T121-79I respectively.
9. Batching, mixing, field testing, and specimen fabrication using Field Concrete shall be witnessed by a representative of the Materials and Research Division.
10. Cylinder specimens shall be tested at the Materials and Research Laboratory for compressive strength at ages 7, 14, and 28 days in accordance with AASHTO T22.
11. The Materials and Research Division's involvement in the evaluation shall be documented in a Materials & Research Division report. The procedure in current use by the Research Subdivision shall be followed (including the drafting and approval of a Work Plan before work has begun).

STATE OF VERMONT  
AGENCY OF TRANSPORTATIONCover  
Central file:MATERIALS & RESEARCH DIVISION  
Montpelier, Vermont 05602APPENDIX B

## REPORT ON SAMPLE OF AGGREGATE

Report August 21, 1981Laboratory No. A81 0913Tested By M. LavinName Coarse Aggregate for Concrete 501Identification Marks Preliminary Sample Crushed GravelSubmitted by M. Morissette Title PFP Address \_\_\_\_\_Sampled 7-29, 1981 Received 7-29, 1981Sample from Stockpile @ Hinesburg S & G, Hinesburg

Quantity Represented \_\_\_\_\_

Source of Material Hinesburg S & G, HinesburgLocation used or to be used Possible Future UseExamined for Item 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>29.7</u>
3"	_____	No. 16	_____	'B' Grading	_____
2 1/2"	_____	No. 8	_____	Fractured Faces, %	<u>56</u>
2"	_____	No. 4	_____	Thin & Elongated	_____
1 3/4"	_____	Fineness Modulus = _____		Pieces, %	<u>2</u>
1 1/2"	_____	Comments:		Soundness, % Loss	
1"	<u>100</u>			<u>0.60</u>	
3/4"	<u>99</u>	This material was examined for gradation, wear, fractured faces, T & E, and Soundness. The results are as indicated.			
5/8"	_____				
1/2"	_____				
3/8"	<u>35</u>				
No. 4	<u>3</u>				
No. 8	<u>2</u>				
No. 10	_____				
No. 16	_____				
No. 30	_____				
No. 50	_____	Sand Portion		S. J. Gage, P.E., Chief Engineer	
No. 100	_____	_____			
No. 200	_____	_____			
				By: <u>R. F. Nicholson</u> 1987	

STATE OF VERMONT  
AGENCY OF TRANSPORTATION2  
Cover  
Central filesMATERIALS & RESEARCH DIVISION  
Montpelier, Vermont 05602

## APPENDIX B

## REPORT ON SAMPLE OF AGGREGATE

Report October 22,, 1981Laboratory No. G8100701Tested By J. AbairName Coarse Aggregate for Concrete, Item 501Identification Marks Evaluation Sample, 3/4" Crushed GravelSubmitted by J. Abair Title PFP Address Sampled 10-3, 19 81 Received 10-3, 19 81Sample from Stockpile @ A. G. Anderson, Berlin, Vt.Quantity Represented 20 cySource of Material Hinesburg S & G, Hinesburg, Vt.Location used or to be used W.P. 81-C-19Examined 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 _____	
1"	_____				
3/4"	_____ 100				
5/8"	_____	Comments:			
1/2"	_____				
3/8"	_____ 34	This material was examined for gradation. The results are as indicated.			
No. 4	_____ 6				
No. 8	_____ 3				
No. 10	_____				
No. 16	_____				
No. 30	_____				
No. 50	_____	Sand Portion _____			
No. 100	_____				
No. 200	_____				

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

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

By: R. F. Nicholson 10/27  
R. F. Nicholson, P.E., Materials & Research Engineer

Project Name

STATE OF VERMONT  
AGENCY OF TRANSPORTATION2  
Cover  
Central files

W.P. 81-C-19

Project Number

MATERIALS AND RESEARCH DIVISION  
Montpelier, Vermont 05602

## Report on Concrete Test Beam or Cylinders

## APPENDIX C

Laboratory No. C8101231 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81Pay Item 501.20 Type of Sample PreliminarySubmitted by M. Morissette Title PFP Address Source of Material A.G. Anderson, Berlin Quantity Represented 1 cyCoarse Aggregate Hinesburg S & G, Hinesburg Fine Aggregate A.G. Anderson, Highgate, Vt.Cement Brand Northeast Type II Lbs. 660Air Entraining Admixture Darex AEA Dosage 5 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy  Total Aggregate, Dry Wgt. 2944Field Tested by Morissette Lab. Tested by EatonSampled from Trk. #37 @ plant Date Sampled: 10-5-81Location Used or to be Used Examined for Mod. of Rupture  Compressive Strength 4000 psi @ 28 days

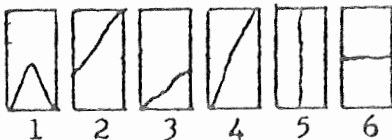
## TEST RESULTS

Unit Weight Fresh Concrete 145.92 Air: Pressure 4.4% Chace Total Water, Gal/Cy Used  Slump 2 1/2" Temperature, Concrete 60°F Ambient 48°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
HA 1	147	10-8	10-13	7	8		4775	4589	4682		
	146										
3	147	10-8	10-19	14	14		5234	5411	5323		
	146										
5	147	10-8	11-2	28	28		5871	5562	5717		
	146										
7	147	10-8									

\*S = Standard Cured; F = Field Cured

Types of Breaks:



mlm

Comments:  
TA 183H Rev.  
2M 4/81

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

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

Project Name

STATE OF VERMONT  
AGENCY OF TRANSPORTATION2  
Cover  
Central files

W.P. 81-C-19

Project Number

MATERIALS AND RESEARCH DIVISION  
Montpelier, Vermont 05602

APPENDIX C

## Report on Concrete Test Beam or Cylinders

Laboratory No. C8101233 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81Pay Item 501.25 Type of Sample PreliminarySubmitted by Morissette Title PFP Address Source of Material A.G. Anderson - Berlin Quantity Represented 1 cyCoarse Aggregate Hinesburg S & G, Hinesburg Fine Aggregate A.G. Anderson - Highgate, Vt.Cement Brand Northeast Type II Lbs. 611Air Entraining Admixture Darex AEA Dosage 4 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy  Total Aggregate, Dry Wgt. 2997Field Tested by Morissette Lab. Tested by EatonSampled from Trk. #41 @ plant Date Sampled: 10-5-81Location Used or to be Used Examined for Mod. of Rupture  Compressive Strength 3500 psi @ 28 days

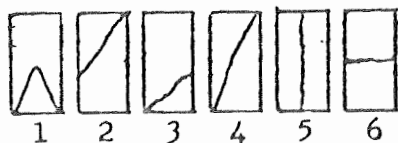
## TEST RESULTS

Unit Weight Fresh Concrete 143.13 Air: Pressure 5.4% Chace Total Water, Gal/Cy Used  Slump 3½ Temperature, Concrete 54°F Ambient 44°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
HB 1	144	10-8	10-13	7	8		3936	3882	3909		
	144										
	144										
	144										
2	144	10-8	10-19	14	14		4226	4288	4257		
	144										
	144										
	144										
3	144	10-8	11-2	28	28		4651	4916	4784		
	144										
	144										
	144										
4	144	10-8									
	144										
	144										
	144										
5	144	10-8									
	144										
	144										
	144										
6	144	10-8									
	144										
	144										
	144										
7	144	10-8									
	144										
	144										
	144										

\*S = Standard Cured; F = Field Cured

Types of Breaks:



mlm

Comments:

TA 182K Rev.

2M 4/81

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

By:

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

Project Name

STATE OF VERMONT  
AGENCY OF TRANSPORTATION2  
Cover  
Central filesW.P. 81-C-19  
Project NumberMATERIALS AND RESEARCH DIVISION  
Montpelier, Vermont 05602

## APPENDIX C

## Report on Concrete Test Beam or Cylinders

Laboratory No. C8101234 (28) Report of 7,14,28 Day Breaks Date typed 11-3-81Pay Item 501.30 Type of Sample PreliminarySubmitted by M. Morissette Title PFP Address Source of Material A.G. Anderson - Berlin Quantity Represented 1 cyCoarse Aggregate Hinesburg S & G, Hinesburg Fine Aggregate A.G. Anderson - HighgateCement Brand Northeast Type II Lbs. 565Air Entraining Admixture Darex AEA Dosage 5 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy  Total Aggregate, Dry Wgt. Field Tested by Morissette Lab. Tested by EatonSampled from Trk. #37 @ plant Date Sampled: 10-5-81Location Used or to be Used Examined for Mod. of Rupture  Compressive Strength 3000 psi @ 28 days

## TEST RESULTS

Unit Weight Fresh Concrete 139.62 Air: Pressure 7.5% Chace Total Water, Gal/Cy Used  Slump 3 1/2 Temperature, Concrete 52°F Ambient 44°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
HC	1	140									
	2	140	10-8	10-13	7		3010	3042	3026		
	3	140									
	4	140	10-8	10-19	14		3563	3519	3541		
	5	140									
	6	140	10-8	11-2	28		3997	3837	3942		
	7		10-8								

\*S = Standard Cured; F = Field Cured

Types of Breaks:



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

*R. F. Nicholson* / MRDBy: R. F. Nicholson, P.E., Materials & Research EngineerComments:  
TA 183H Rev.  
2M 4/81

Project Name  
W.P. 81-C-19

STATE OF VERMONT  
AGENCY OF TRANSPORTATION

2  
Cover  
Central files

Project Number

MATERIALS AND RESEARCH DIVISION  
Montpelier, Vermont 05602

APPENDIX C

Report on Concrete Test Beam or Cylinders

Laboratory No. C8101230 (28) Report of 7,14,28 Day Breaks Date typed 11-3-81  
Pay Item 501.20 Type of Sample Preliminary  
Submitted by M. Morissette Title PFP Address \_\_\_\_\_  
Source of Material A.G. Anderson, Berlin Quantity Represented 1 cy  
Coarse Aggregate Cooley - Websterville Fine Aggregate A.G. Anderson, Highgate  
Cement Brand Northeast Type II Lbs. 660  
Air Entraining Admixture Darex AEA Dosage 5 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwt  
Maximum allowable water content, Gal/Cy \_\_\_\_\_ Total Aggregate, Dry Wgt. 2812  
Field Tested by M. Morissette Lab. Tested by Eaton  
Sampled from TK #41 @ plant Date Sampled: 10-5-81  
Location Used or to be Used \_\_\_\_\_  
Examined for Mod. of Rupture \_\_\_\_\_ Compressive Strength 4000 psi @ 28 days

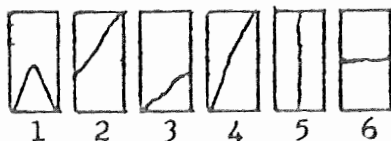
TEST RESULTS

Unit Weight Fresh Concrete 143.41 Air: Pressure 4.6% Chace \_\_\_\_\_  
Total Water, Gal/Cy Used \_\_\_\_\_ Slump 1½" Temperature, Concrete 60°F Ambient 53°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
RA 1	144										
	2	10-8	10-13	7	8		4447	4580	4514		
	3	10-8	10-19	14	14		5190	5341	5266		
	4	10-8	11-2	28	28		6163	6083	6123		
5	144	10-8									
6	143	10-8									
7	143	10-8									

\*S = Standard Cured; F = Field Cured

Types of Breaks:



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

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

Comments:  
TA 183H Rev.  
2M 4/81

Project Name

STATE OF VERMONT  
AGENCY OF TRANSPORTATION2  
Cover  
Central files

W.P. 81-C-19

Project Number

MATERIALS AND RESEARCH DIVISION  
Montpelier, Vermont 05602

APPENDIX C

## Report on Concrete Test Beam or Cylinders

Laboratory No. C8101232 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81Pay Item 501.25 Type of Sample PreliminarySubmitted by Morissette Title PFP Address Source of Material A.G. Anderson, Berlin, Vt. Quantity Represented 1 cyCoarse Aggregate Cooley - Websterville Fine Aggregate A.G. Anderson - Highgate, Vt.Cement Brand Northeast Type II Lbs. 611Air Entraining Admixture Darex AEA Dosage 4 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy  Total Aggregate, Dry Wgt. 2953Field Tested by M. Morissette Lab. Tested by EatonSampled from Trk. #43 @ plant Date Sampled: 10-5-81Location Used or to be Used Examined for Mod. of Rupture  Compressive Strength 3500 psi @ 28 days

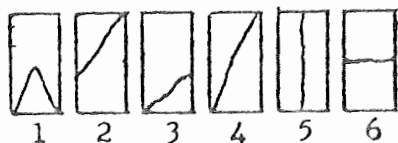
## TEST RESULTS

Unit Weight Fresh Concrete 140.53 Air: Pressure 5.8% Chace Total Water, Gal/Cy Used  Slump 3 Temperature, Concrete 60°F Ambient 53°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
RB 1	142	10-8	10-13	7	8		3827	4005	3916		
	142										
3	142	10-8	10-19	14	14		4845	4775	4810		
	142										
5	141	10-8	11-2	28	28		5314	5146	5230		
	142										
7	142	10-8									

\*S = Standard Cured; F = Field Cured

Types of Breaks:



1 2 3 4 5 6

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

By:

*R. F. Nicholson* /MRB

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

Comments:

TA 183H Rev.  
2M 4/81



Project Name

STATE OF VERMONT  
AGENCY OF TRANSPORTATION2  
Cover  
Central files

W.P. 81-C-19

Project Number

MATERIALS AND RESEARCH DIVISION  
Montpelier, Vermont 05602

## APPENDIX C

## Report on Concrete Test Beam or Cylinders

Laboratory No. C8101229 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81Pay Item 501.30 Type of Sample PreliminarySubmitted by M. Morissette Title PFP Address Source of Material A.G. Anderson, Berlin Quantity Represented 1 cyCoarse Aggregate Cooley - Websterville Fine Aggregate A.G. Anderson, Highgate, Vt.Cement Brand Northeast Type II Lbs. 565Air Entraining Admixture Darex AEA Dosage 5 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwtMaximum allowable water content, Gal/Cy  Total Aggregate, Dry Wgt. 3060Field Tested by M. Morissette Lab. Tested by EatonSampled from Trk. #43 @ plant Date Sampled: 10-5-81Location Used or to be Used Examined for Mod. of Rupture  Compressive Strength 3000 psi @ 28 days

## TEST RESULTS

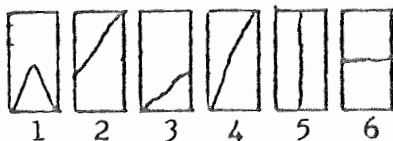
Unit Weight Fresh Concrete 144.13 Air: Pressure 6.4% Chace Total Water, Gal/Cy Used  Slump 4" Temperature, Concrete 58°F Ambient 50°F

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
RC 1	140	10-8	10-13	7	8		3549	3604	3577		
	141										
3	140	10-8	10-19	14	14		4324	4253	4289		
4	140										
5	139	10-8	11-2	28	28		4916	4996	4956		
6	140										
7	140	10-8									

\*S = Standard Cured; F = Field Cured

Types of Breaks:

mlm



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

*R. F. Nicholson* /MRDBy: R. F. Nicholson, P.E., Materials & Research EngineerComments:  
TA 183H Rev.  
2M 4/21

STATE OF VERMONT  
AGENCY OF TRANSPORTATION  
MATERIALS & RESEARCH DIVISIONAPPENDIX DRESEARCH INVESTIGATIONWork Plan No. 81-C-19Subject Performance-In-Concrete Evaluation Of The Hinesburg Sand and Gravel 3/4" Crushed Gravel.Investigation Requested By Hinesburg Sand & Gravel, Inc. Date July 14, 1981Date Information Required As Soon As PossiblePurpose of Investigation To determine whether 3/4" crushed gravel from Hinesburg Sand & Gravel Inc. performs satisfactorily in concrete.Proposed Tests or Evaluation Procedure

1. Mix proportions for each Class of concrete shall conform to Table 501.03A. This data shall either be submitted by the person requesting the evaluation, or it shall be supplied by the Structural Concrete Subdivision from mix design procedures in normal use.

2. Concrete shall be produced at an approved Ready-Mixed Concrete Plant. Cement, sand, water and admixtures shall be the same as in current use at the plant, and as approved by the Agency of Transportation.

3. An approved aggregate in normal use at the Ready-Mixed Concrete Plant shall be used as a control in a separate batch for each Class of concrete.

Proposal Discussed With R. Frascoia Projected Manpower Requirements 10 man daysInvestigation To Be Conducted By Structural Concrete SubdivisionProposed Starting Date Oct. 5, 1981 Estimated Completion Date Jan. 5, 1982Approval/Disapproval by Materials & Research Engineer R. J. Nicholson 11/10/81Consents by Materials & Research Engineer Received in present form 11/10/81Materials & Research Division  
Agency of Transportation  
Date Typed: Oct. 21, 1981

Information will be  
given out in report  
form with transmittal  
letter after and upon  
completion of Report. R. J. N. 11/11/81

APPENDIX D

4. A separate batch of at least one cubic yard of concrete shall be produced for each Concrete Class/Aggregate combination.
5. Batching and Mixing shall be witnessed and documented, and all materials shall be sampled by a Materials and Research Division representative. This person shall also conduct the necessary testing and fabrication of the test specimens.
6. Tests of Slump, Air Content, Unit Weight, and Yield shall be in accordance with AASHTO T119-74, AASHTO T152-80I, and AASHTO T121-79I respectively; also ambient and concrete temperatures shall be measured and recorded.
7. Standard 6" cylinder specimens shall be fabricated and cured in accordance with AASHTO T23-76. Seven specimens shall be fabricated from each batch, six of which shall be tested at the Materials and Research Laboratory for compressive strength at ages 7, 14, and 28 days in accordance with AASHTO T22. The remaining cylinder specimen from each batch, shall be cured with the 28 day compressive strength specimens. At age 28 days, three 2" cubes shall be cut from each of these cylinders, and tested for freeze-thaw durability in accordance with Vermont A.O.T. test procedure No. 25. The test shall be terminated for each set of three cubes, when twenty-five percent average weight-loss has occurred.
8. The details of the testing procedure, and the data obtained shall be documented in a Materials & Research Division report. The procedure in current use by the Research Subdivision shall be followed.