Evaluation of Hinesburg 3/4" Crushed Gravel for Use In Structural Concrete

Initial Report 81-6
December, 1981

Reporting On Work Plan No. 81-C-19

State of Vermont
Agency of Transportation
Materials & Research Division

T. Evslin, Secretary of Transportation
S. J. Gage, P.E., Director of Engineering and Construction
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Prepared by
W. L. Meyer, Technician C

Reviewed By:

R. F. Nicholson

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

Date: January 13, 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 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.

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^3	-	103.27

Reference Coarse Aggregate:

Bulk Specific Gravity	-	2.59
Absorption, percent	-	1.1
Dry Rodded Unit Weight, lbs/ft^3	-	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

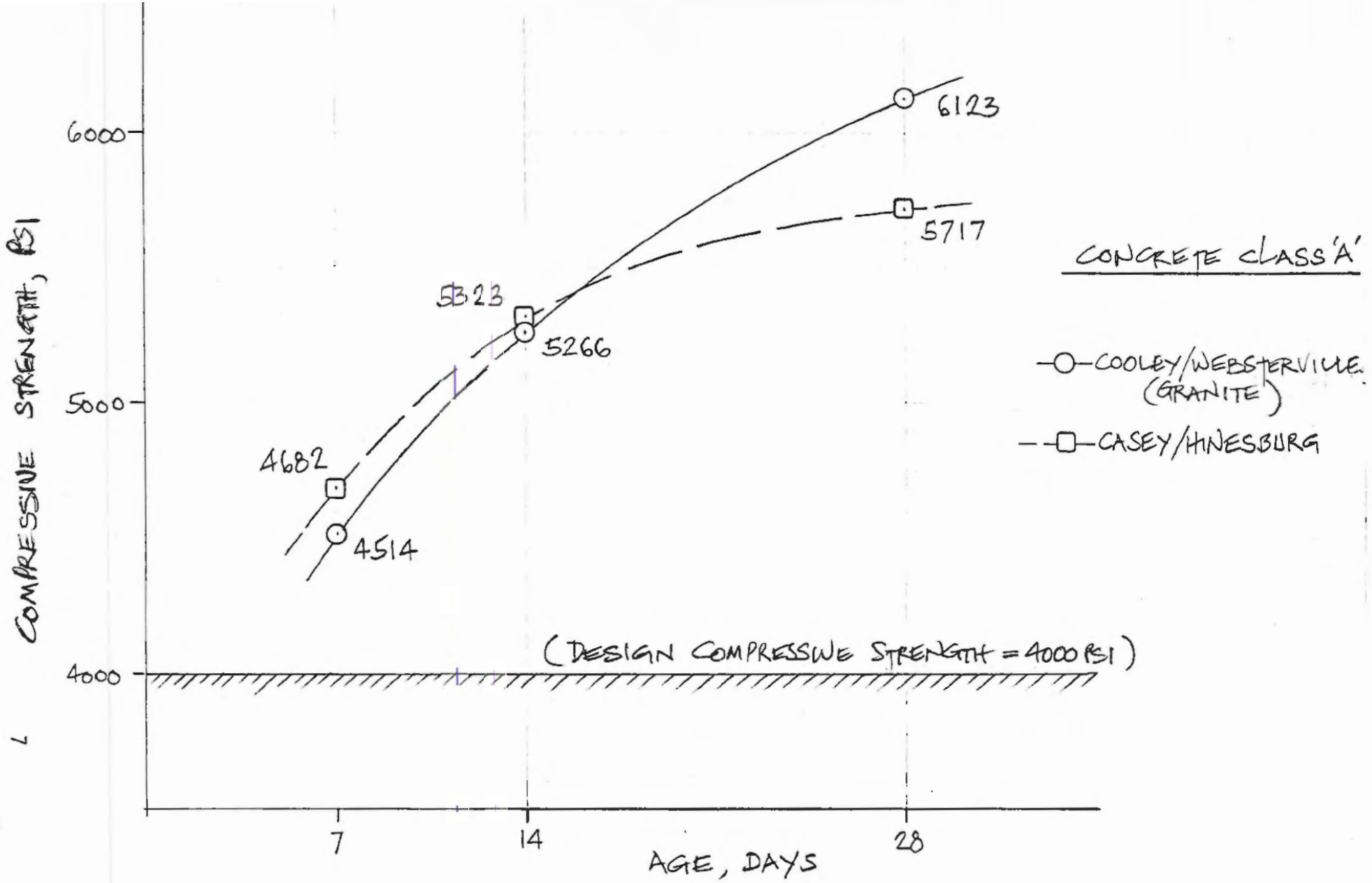
The results of tests performed are as follows:

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^3	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^3	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.

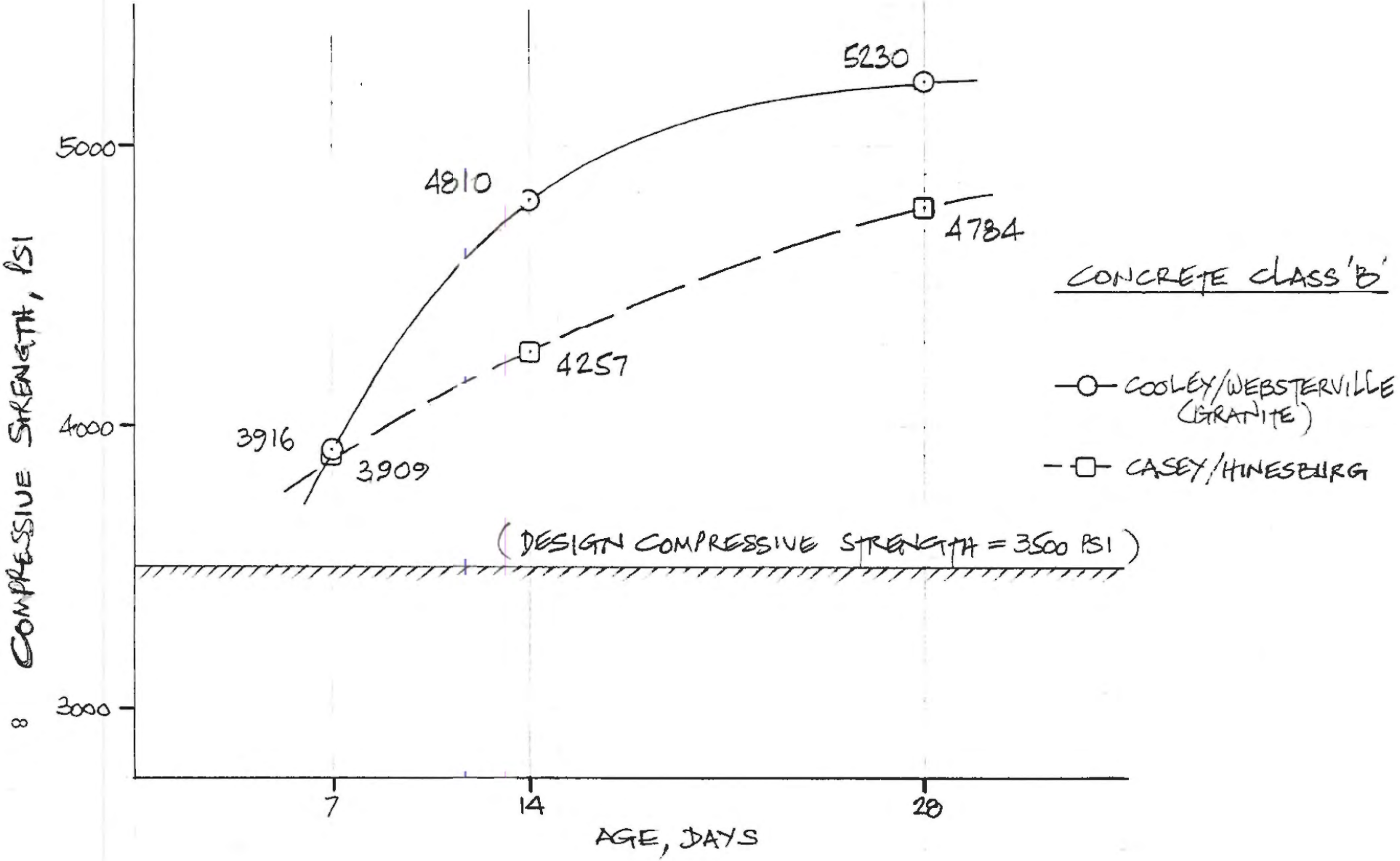
Freeze-thaw test results will be available following the completion of testing.



Compressive Strength vs Age

Concrete Class A

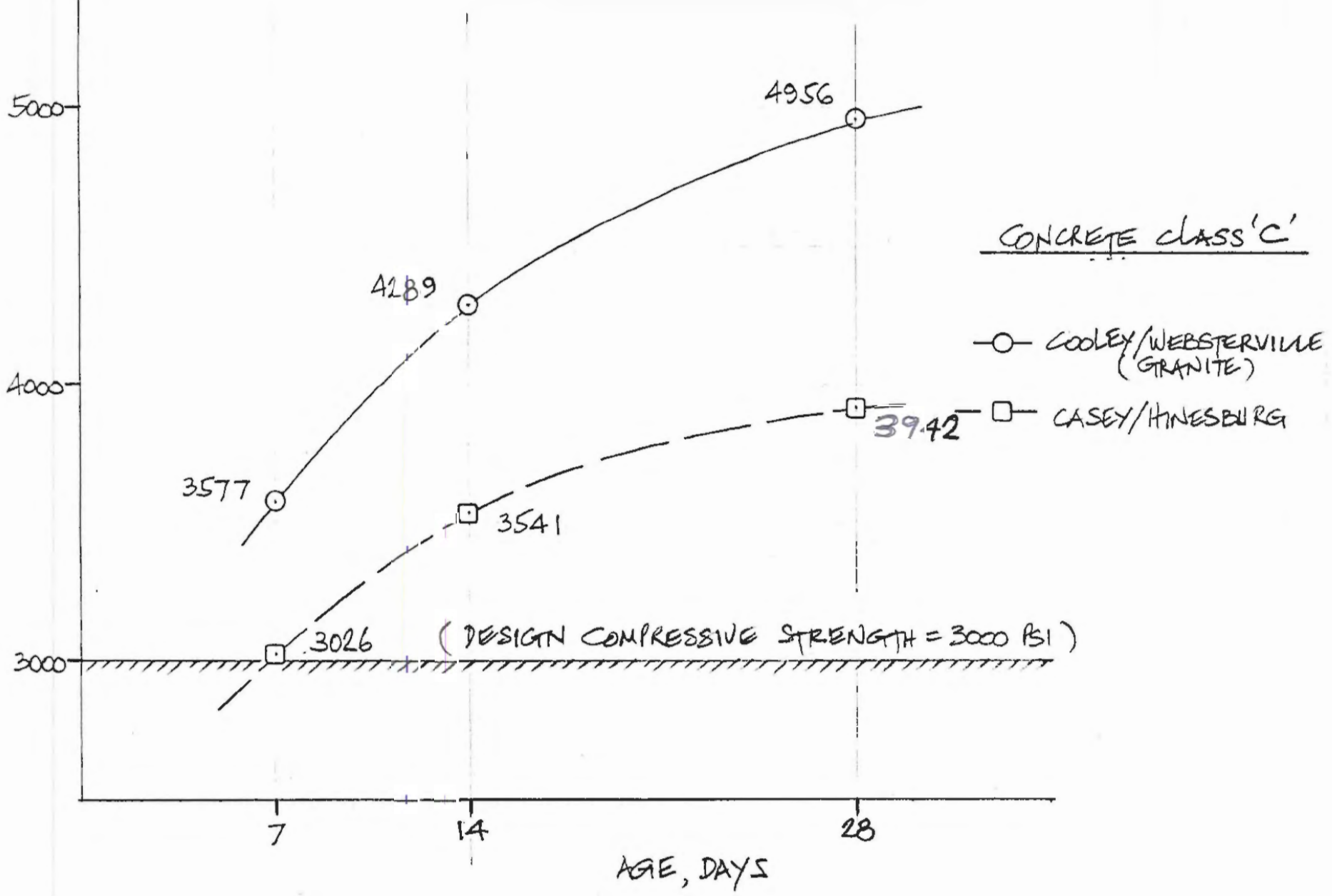
Figure I



Compressive Strength vs Age

Concrete Class B

Figure II



Compressive Strength vs Age

Concrete Class C

Figure III

CONCLUSIONS AND RECOMMENDATIONS

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.

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.

Prepared By: P.A. Cover
Date: May 5, 1981

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).

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MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

APPENDIX B

REPORT ON SAMPLE OF AGGREGATE

Report August 21, , 19 81

Laboratory No. A81 0913 Tested By M. Lavin

Name Coarse Aggregate for Concrete 501

Identification Marks Preliminary Sample Crushed Gravel

Submitted by M. Morissette Title PFP Address

Sampled 7- 29, 19 81 Received 7-29, 1981

Sample from Stockpile @ Hinesburg S & G, Hinesburg

Quantity Represented

Source of Material Hinesburg S & G, Hinesburg

Location used or to be used Possible Future Use

Examined for Item 704.02

TEST RESULTS

Total Sample Sieve Size	% Passing
4 1/2"	
4"	
3 1/2"	
3"	
2 1/2"	
2"	
~~1 3/4"~~	
1 1/2"	
1"	100
3/4"	99
5/8"	
1/2"	
3/8"	35
No. 4	3
No. 8	2
No. 10	
No. 16	
No. 30	
No. 50	
No. 100	
No. 200	

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

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96 29.7
'B" Grading
Fractured Faces, % 56
~~Thin & Elongated~~ Pieces, % 2
Soundness, % Loss 0.60

Comments:

This material was examined for gradation, wear, fractured faces, T & E, and Soundness. The results are as indicated.

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

By: R. F. Nicholson 1947
R. F. Nicholson, P.E., Materials & Research Engineer

mlm

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AGENCY OF TRANSPORTATION

MATERIALS & RESEARCH DIVISION
Montpelier, Vermont 05602

APPENDIX B

REPORT ON SAMPLE OF AGGREGATE

Report October 22, , 19 81

Laboratory No. G8100701 Tested By J. Abair

Name Coarse Aggregate for Concrete, Item 501

Identification Marks Evaluation Sample, 3/4" Crushed Gravel

Submitted by J. Abair Title PFP Address

Sampled 10-3, 19 81 Received 10-3, 19 81

Sample from Stockpile @ A. G. Anderson, Berlin, Vt.

Quantity Represented 20 cy

Source of Material Hinesburg S & G, Hinesburg, Vt.

Location used or to be used W.P. 81-C-19

Examined for 704.02

TEST RESULTS

Total Sample Sieve Size	% Passing
4 1/2"	
4"	
3 1/2"	
3"	
2 1/2"	
2"	
1 3/4"	
1 1/2"	
1"	
3/4"	100
5/8"	
1/2"	
3/8"	34
No. 4	6
No. 8	3
No. 10	
No. 16	
No. 30	
No. 50	
No. 100	
No. 200	

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

Fineness Modulus =

Comments:

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

Sand Portion

Percent of Wear

AASHTO T3
AASHTO T4
AASHTO T96

Fractured Faces, %

~~Thin & Elongated~~ Pieces, %

Soundness, % Loss

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

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

mlm

Project Name

W.P. 81-C-19

Project Number

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

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Report on Concrete Test Beam or Cylinders APPENDIX C

Laboratory No. C8101231 (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 Hinesburg S & G, Hinesburg Fine Aggregate A.G.Anderson, Highgate,Vt.

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. 2944

Field Tested by Morissette Lab. Tested by Eaton

Sampled from Trk. #37 @ 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 145.92 Air: Pressure 4.4% Chace

Total Water, Gal/Cy Used Slump 2½" 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	Break Type 2
HA 1	147	10-8	10-13	7	8		~~4775~~	~~4589~~	~~4682~~		
2	146										
3	147	10-8	10-19	14	14		5234	5411	5323		
4	146										
5	147	10-8	11-2	28	28		5871	5562	5717		
6	146										
7	147	10-8									

*S = Standard Cured; F = Field Cured

Types of Breaks:

mlm

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

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

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

Project Name

W.P. 81-C-19

Project Number

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

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APPENDIX C

Report on Concrete Test Beam or Cylinders

Laboratory No. C8101233 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81

Pay Item 501.25 Type of Sample Preliminary

Submitted by Morissette Title PFP Address

Source of Material A.G. Anderson - Berlin Quantity Represented 1 cy

Coarse Aggregate Hinesburg S & G, Hinesburg Fine Aggregate A.G. Anderson - Highgate, Vt.

Cement Brand Northeast Type II Lbs. 611

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

Maximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 2997

Field Tested by Morissette Lab. Tested by Eaton

Sampled from Trk. #41 @ plant Date Sampled: 10-5-81

Location 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	Break Type 2
1	144										
HB 2	144	10-6	10-13	7	8		3936	3882	3909		
3	144										
4	144	10-8	10-19	14	14		4226	4288	4257		
5	144										
6	143	10-8	11-2	28	28		4651	4916	4784		
7	144	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 /MRB

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

Project Name

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AGENCY OF TRANSPORTATION
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Montpelier, Vermont 05602

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APPENDIX C

Report on Concrete Test Beam or Cylinders

Laboratory No. C8101234 (28) Report of 7,14,28 Day Breaks Date typed 11-3-81

Pay Item 501.30 Type of Sample Preliminary

Submitted by M. Morissette Title PFP Address

Source of Material A.G. Anderson - Berlin Quantity Represented 1 cy

Coarse Aggregate Hinesburg S & G, Hinesburg Fine Aggregate A.G. Anderson - Highgate

Cement Brand Northeast Type II Lbs. 565

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.

Field Tested by Morissette Lab. Tested by Eaton

Sampled from Trk. #37 @ plant Date Sampled: 10-5-81

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength 3000 psi @ 28 days

TEST RESULTS

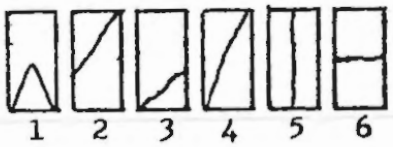
Unit Weight Fresh Concrete 139.62 Air: Pressure 7.5% Chace

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	Break Type 2
HC 1	140	10-8	10-13	7	8		3010	3042	3026		
2	140										
3	140	10-8	10-19	14	14		3563	3519	3541		
4	140										
5	140	10-8	11-2	28	28		3997	3837	3942		
6	140										
7		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

mlm

Comments:
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2M 4/81

Project Name

W.P. 81-C-19

Project Number

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Montpelier, Vermont 05602

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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

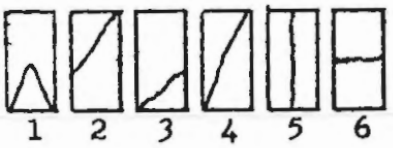
Unit Weight Fresh Concrete 143.41 Air: Pressure 4.6% Chace

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	Break Type 2
1 RA	144	10-8	10-13	7	8		4447	4580	4514		
2	143										
3	144	10-8	10-19	14	14		5190	5341	5266		
4	144										
5	144	10-8	11-2	28	28		6163	6083	6123		
6	143										
7	143	10-8									

*S = Standard Cured; F = Field Cured

Types of Breaks:



mlm

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

By: R. F. Nicholson /MRD

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

Project Name

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AGENCY OF TRANSPORTATION
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Montpelier, Vermont 05602

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APPENDIX C

Report on Concrete Test Beam or Cylinders

Laboratory No. C8101232 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81

Pay Item 501.25 Type of Sample Preliminary

Submitted by Morissette Title PFP Address

Source of Material A.G. Anderson, Berlin, Vt. Quantity Represented 1 cy

Coarse Aggregate Cooley - Websterville Fine Aggregate A.G. Anderson - Highgate, Vt.

Cement Brand Northeast Type II Lbs. 611

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

Maximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 2953

Field Tested by M. Morissette Lab. Tested by Eaton

Sampled from Trk. #43 @ plant Date Sampled: 10-5-81

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength 3500 psi @ 28 days

TEST RESULTS

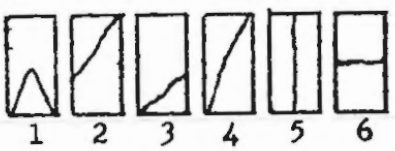
Unit Weight Fresh Concrete 140.53 Air: Pressure 5.8% Chace

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	Break Type 2
RB 1	142	10-6	10-13	7	8		3827	4005	3916		
2	142										
3	142	10-8	10-19	14	14		4845	4775	4810		
4	142										
5	141	10-8	11-2	28	28		5314	5146	5230		
6	142										
7	142	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 /MRD
R. F. Nicholson, P.E., Materials & Research Engineer

Project Name

W.P. 81-C-19
Project Number

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

2
Cover
Central files

APPENDIX C

Report on Concrete Test Beam or Cylinders

Laboratory No. C8101229 (28) Report of 7, 14, 28 Day Breaks Date typed 11-3-81

Pay Item 501.30 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, Vt.

Cement Brand Northeast Type II Lbs. 565

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. 3060

Field Tested by M. Morissette Lab. Tested by Eaton

Sampled from Trk. #43 @ plant Date Sampled: 10-5-81

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength 3000 psi @ 28 days

TEST RESULTS

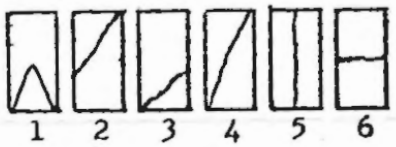
Unit Weight Fresh Concrete 144.13 Air: Pressure 6.4% Chace

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	Break Type 2
1	140	10-8	10-13	7	8		3549	3604	3577		
RC 2	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

By: R. F. Nicholson /MRD

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

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

TA 565 Rev. 4/79

Prepared By: P. Cover PC
Date: Oct. 13, 1981
Sheet 1 of 2

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

APPENDIX D

RESEARCH INVESTIGATION

Work Plan No. 81-C-19

Subject Performance-In-Concrete Evaluation Of The Hinesburg Sand and Gravel 3/4" Crushed Gravel.

Investigation Requested By Hinesburg Sand & Gravel, Inc. Date July 14, 1981

Date Information Required As Soon As Possible

Purpose 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 days

Investigation To Be Conducted By Structural Concrete Subdivision

Proposed Starting Date Oct. 5, 1981 Estimated Completion Date Jan. 5, 1982

Approval/Disapproval by Materials & Research Engineer R.F. Nicholson 11/5/81,

Comments by Materials & Research Engineer Received impreset form 11/4/81 R.F.N.. Information will be given out in report form with transm. Hal letter after and upon completion of Report. R.F.N. 11/5/81

Materials & Research Division
Agency of Transportation
Date Typed: Oct. 21, 1981

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.