EVALUATION OF PIKE/WATERFORD
3/4" CRUSHED STONE FOR USE
IN STRUCTURAL CONCRETE

INITIAL REPORT 81-9
DECEMBER 1981

REPORTING ON WORK PLAN 81-C-6

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

T. EVSLIN, SECRETARY OF TRANSPORTATION
S. J. GAGE, P.E., DIRECTOR OF ENGINEERING & CONSTRUCTION
R. F. NICHOLSON, P.E., MATERIALS & RESEARCH ENGINEER
P. A. COVER, STRUCTURAL CONCRETE ENGINEER

Prepared By
P. A. Cover

Reviewed By:
Date: January 15, 1982
"The contents of this report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation. Anyone, other than the Agency using this report does so with awareness that the Agency does not guarantee the opinions, findings, or conclusions contained therein."
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>1</td>
</tr>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Testing Program</td>
<td></td>
</tr>
<tr>
<td>Phase I - Section 704.02 Tests</td>
<td>3</td>
</tr>
<tr>
<td>Phase II - Performance-In-Concrete Tests</td>
<td>3</td>
</tr>
<tr>
<td>Materials</td>
<td>3</td>
</tr>
<tr>
<td>Field Concrete</td>
<td>4</td>
</tr>
<tr>
<td>Laboratory Concrete</td>
<td>5</td>
</tr>
<tr>
<td>Tables 1, 2, 3, 4, 5, 6, 7, and 8</td>
<td>5 - 8</td>
</tr>
<tr>
<td>Figures I, II, and III</td>
<td>10, 11, 12</td>
</tr>
<tr>
<td>Conclusions and Recommendations</td>
<td>9</td>
</tr>
<tr>
<td>Appendix A</td>
<td></td>
</tr>
<tr>
<td>Procedure For Evaluation of New Structural Concrete Aggregate Sources to Determine Compliance with A.O.T. Specifications</td>
<td>73 - 15</td>
</tr>
<tr>
<td>Appendix B - (One report)</td>
<td></td>
</tr>
<tr>
<td>Section 704.02 Test Results, Laboratory Report No. A81-0218</td>
<td>16</td>
</tr>
<tr>
<td>Appendix C - (Twelve reports)</td>
<td></td>
</tr>
<tr>
<td>Compressive Strength Test Results, Laboratory Report Nos. C8100251 to C8100256 and C8100306 to C8100311</td>
<td>17 - 28</td>
</tr>
<tr>
<td>Appendix D</td>
<td></td>
</tr>
<tr>
<td>Work Plan No. 81-C-6</td>
<td>29 - 30</td>
</tr>
</tbody>
</table>
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 stone produced by Pike Industries Incorporated at their facility in Waterford, Vermont.

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

There have been instances in the past, where a source of aggregate for Structural Concrete has conformed to Section 700 requirements, but has subsequently failed to produce concrete of acceptable strength. A procedure called "Procedure For The Evaluation Of New Structural Concrete Aggregate Sources To Determine Compliance With Agency of Transportation Specifications"; (PENCAS), was recently developed to provide, in addition to the existing Section 704.02 tests of physical properties, a basis to determine whether concrete containing a new aggregate, could achieve acceptable strength. (see Appendix A for PENCAS). Pike Industries Incorporated, of Tilton, New Hampshire, requested late in January 1981 that the Agency approve 3/4 inch Crushed Stone being produced at their crushing operation in Waterford, Vermont for possible use in Structural Concrete on the Waterford-St. Johnsbury I 93 projects.

This material was sampled by Materials and Research Division representatives and tested for compliance with Section 704.02 of the Standard Specifications. The PENCAS procedure was then used to compare concrete mixtures containing this aggregate, with mixtures containing a reference aggregate. Concrete was produced under both laboratory and field conditions. The field concrete was produced at the Lawrence Sangravco Plant in St. Johnsbury, Vermont at the request of Pike Industries, Inc. Laboratory concrete was produced at the Central Laboratory of the Materials and Research Division.
TESTING PROGRAM

PHASE I - SECTION 704.02 TESTS

Pike/Waterford 3/4 inch crushed stone was sampled from an existing stockpile at Pike's quarry in Waterford, Vermont on February 24, 1981. This material was found not to conform to the Gradation requirement, being deficient in the 3/8 inch fraction, and also appeared to be a blend of crushed gravel and crushed stone.

Pike Industries subsequently screen-blended this material with 1/2 inch stone to adjust the 3/8 inch deficiency and created a new stockpile. This new stockpile was sampled on April 17, 1981 and was found to comply with Section 704.02 requirements. The report on Laboratory No. A81-0218 which documents the Section 700 tests is in Appendix B.

PHASE II - PERFORMANCE IN CONCRETE TESTS

As required by PENCAS, after the aggregate had been tested to determine conformance with Section 700 requirements, it was tested in concrete under both laboratory and field conditions. Mixtures were designed by Structural Concrete personnel for Class A, Class B, and Class C concrete using the following materials:

Coarse Aggregate:

A. Proposed New Aggregate
   3/4 inch Crushed Rock
   Pike Industries, Inc., Waterford, Vt.

   B. Reference Aggregate
   3/4 inch Crushed Gravel
   Lawrence Sangravco, Guildhall, Vt.

Fine Aggregate:

Lawrence Sangravco, Guildhall, Vt.
Cement:
  Glens Falls Type II
  Glens Falls, New York

Air Entraining Admixtures:
  Darex AEA

Water Reducing Admixture:
  WRDA with Hycol

Aggregate properties used for preparing mix designs are as follows:

Pike Coarse Aggregate:
  Bulk Specific Gravity - 2.94
  Absorption, percent - 0.5
  Dry rodded unit weight, lbs./ft³ - 107.13

Guildhall Coarse Aggregate:
  Bulk Specific Gravity - 2.74
  Absorption, percent - 0.9
  Dry rodded unit weight, lbs./ft³ - 101.80

Guildhall Fine Aggregate:
  Bulk Specific Gravity - 2.64
  Absorption, percent - 1.3
  Fineness modulus - 2.90

FIELD CONCRETE

Ready mixed concrete was produced and tested at the Lawrence Sangravco plant in St. Johnsbury, Vermont during the day of May 15, 1981. Moisture content of the aggregates was determined prior to the start of mixing, and aggregate weights were adjusted. Concrete was mixed in a standard truck
mixer with batch size being one cubic yard. Batches were prepared for each Class A, Class B, and Class C concrete containing the Pike 3/4 inch Crushed Stone, as well as for Class A, Class B, and Class C concrete containing the reference aggregate; Guildhall 3/4 inch Crushed Gravel.

LABORATORY CONCRETE

Laboratory concrete was produced and tested in the Central Laboratory on the day of May 20, 1981. Aggregates were dried prior to mixing, which was carried out in a Lancaster pan mixer. Batch size was approximately 1.75 cubic feet. Batches were prepared for each Class A, Class B, and Class C concrete containing the Pike 3/4 inch Crushed Rock, as well as for Class A, Class B, and Class C concrete containing the reference aggregate. Mix proportions for the Lab-produced concrete are as shown in Tables 1 and 2, and for the Field-produced concrete in Tables 3 and 4.

TABLE 1
REFERENCE AGGREGATE
LAB MIXTURES - BATCH QUANTITIES PER CY.

<table>
<thead>
<tr>
<th></th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Reference Coarse Aggregate, lbs.</td>
<td>1692</td>
<td>1692</td>
<td>1692</td>
</tr>
<tr>
<td>*Fine Aggregate, lbs.</td>
<td>1275</td>
<td>1428</td>
<td>1535</td>
</tr>
<tr>
<td>Cement, lbs.</td>
<td>660</td>
<td>611</td>
<td>565</td>
</tr>
<tr>
<td>Air Entraining Admixture, oz.</td>
<td>4</td>
<td>3</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Water Reducing Admixture, oz.</td>
<td>19.8</td>
<td>18.3</td>
<td>17.0</td>
</tr>
<tr>
<td>Net Water, Gals.</td>
<td>33.1</td>
<td>33.3</td>
<td>36.3</td>
</tr>
</tbody>
</table>

*Aggregates batched dry, weights converted to saturated surface-dry condition.
### TABLE 2
NEW AGGREGATE
LAB MIXTURES - BATCH QUANTITIES PER CY.

<table>
<thead>
<tr>
<th></th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*New Coarse Aggregate, lbs.</td>
<td>1773</td>
<td>1773</td>
<td>1773</td>
</tr>
<tr>
<td>*Fine Aggregate, lbs.</td>
<td>1290</td>
<td>1438</td>
<td>1550</td>
</tr>
<tr>
<td>Cement, lbs.</td>
<td>660</td>
<td>611</td>
<td>565</td>
</tr>
<tr>
<td>Air Entraining Admixture, oz.</td>
<td>4</td>
<td>3</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Water Reducing Admixture, oz.</td>
<td>19.8</td>
<td>18.3</td>
<td>17.0</td>
</tr>
<tr>
<td>Net Water, Gals.</td>
<td>34.3</td>
<td>35.0</td>
<td>34.2</td>
</tr>
</tbody>
</table>

*Aggregates batched dry, weights converted to saturated surface-dry condition.

### TABLE 3
REFERENCE AGGREGATE
FIELD MIXTURES - BATCH QUANTITIES PER CY.

<table>
<thead>
<tr>
<th></th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Reference Coarse Aggregate, lbs.</td>
<td>1692</td>
<td>1692</td>
<td>1692</td>
</tr>
<tr>
<td>*Fine Aggregate, lbs.</td>
<td>1275</td>
<td>1428</td>
<td>1535</td>
</tr>
<tr>
<td>Cement, lbs.</td>
<td>660</td>
<td>611</td>
<td>565</td>
</tr>
<tr>
<td>Air Entraining Admixture, oz.</td>
<td>3 1/2</td>
<td>3</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Water Reducing Admixture, oz.</td>
<td>19.8</td>
<td>18.3</td>
<td>17.0</td>
</tr>
<tr>
<td>Net Water, Gals.</td>
<td>30.1</td>
<td>28.9</td>
<td>25.5</td>
</tr>
</tbody>
</table>

*Weights converted to saturated surface-dry condition.

### TABLE 4
NEW AGGREGATE
FIELD MIXTURES - BATCH QUANTITIES PER CY.

<table>
<thead>
<tr>
<th></th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*New Coarse Aggregate, lbs.</td>
<td>1773</td>
<td>1773</td>
<td>1773</td>
</tr>
<tr>
<td>*Fine Aggregate, lbs.</td>
<td>1290</td>
<td>1438</td>
<td>1550</td>
</tr>
<tr>
<td>Cement, lbs.</td>
<td>660</td>
<td>611</td>
<td>565</td>
</tr>
<tr>
<td>Air Entraining Admixture, oz.</td>
<td>3 1/2</td>
<td>3</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Water Reducing Admixture, oz.</td>
<td>19.8</td>
<td>18.3</td>
<td>17.0</td>
</tr>
<tr>
<td>Net Water, Gals.</td>
<td>29.6</td>
<td>25.5</td>
<td>28.1</td>
</tr>
</tbody>
</table>

*Weights converted to saturated surface-dry condition.
Tests were performed on the fresh concrete to determine; Air Content, Unit Weight, Slump and Yield. Seven standard 6" φ x 12" cylinders were prepared from each batch. Six of the cylinders were tested for compressive strength, two each at ages 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 the Agency of Transportation Test Procedure No. 25 for freeze-thaw durability. The results of tests on the fresh and hardened concrete are shown in Tables 5, 6, 7, and 8.

**TABLE 5**
REFERENCE AGGREGATE
LAB MIXTURES; TEST RESULTS

<table>
<thead>
<tr>
<th>Class</th>
<th>Slump, inches</th>
<th>Air Content, percent</th>
<th>Unit Weight, lbs/ft³</th>
<th>Relative yield, percent</th>
<th>Compressive strength, psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>2 3/4</td>
<td>5.4</td>
<td>148.01</td>
<td>97.6</td>
<td>3489</td>
</tr>
<tr>
<td>Class B</td>
<td>2 1/4</td>
<td>4.2</td>
<td>148.97</td>
<td>99.7</td>
<td>3192</td>
</tr>
<tr>
<td>Class C</td>
<td>3</td>
<td>4.8</td>
<td>148.05</td>
<td>102.4</td>
<td>3356</td>
</tr>
</tbody>
</table>

(Design compressive strength, psi) (4000) (3500) (3000)

**TABLE 6**
NEW AGGREGATE
LAB MIXTURES; TEST RESULTS

<table>
<thead>
<tr>
<th>Class</th>
<th>Slump, inches</th>
<th>Air Content, percent</th>
<th>Unit Weight, lbs/ft³</th>
<th>Relative yield, percent</th>
<th>Compressive strength, psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>2 1/2</td>
<td>5.0</td>
<td>152.03</td>
<td>97.7</td>
<td>3616</td>
</tr>
<tr>
<td>Class B</td>
<td>2</td>
<td>4.9</td>
<td>151.60</td>
<td>100.5</td>
<td>3214</td>
</tr>
<tr>
<td>Class C</td>
<td>2</td>
<td>4.4</td>
<td>152.08</td>
<td>102.2</td>
<td>3365</td>
</tr>
</tbody>
</table>

(Design compressive strength, psi) (4000) (3500) (3000)
### TABLE 7  
**REFERENCE AGGREGATE**  
**FIELD MIXTURES; TEST RESULTS**

<table>
<thead>
<tr>
<th>Slump, inches</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 1/4</td>
<td>3 1/2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Air content, percent</td>
<td>3.4</td>
<td>6.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Unit weight, lbs/ft³</td>
<td>149.67</td>
<td>144.95</td>
<td>147.91</td>
</tr>
<tr>
<td>Relative yield, percent</td>
<td>95.2</td>
<td>100.6</td>
<td>99.4</td>
</tr>
<tr>
<td>Compressive strength, psi</td>
<td>4435</td>
<td>3701</td>
<td>3577</td>
</tr>
<tr>
<td>7 days</td>
<td>4747</td>
<td>4069</td>
<td>4085</td>
</tr>
<tr>
<td>28 days</td>
<td>5292</td>
<td>4819</td>
<td>4505</td>
</tr>
</tbody>
</table>

(Design Compressive Strength, psi) (4000) (3500) (3000)

### TABLE 8  
**NEW AGGREGATE**  
**FIELD MIXTURES; TEST RESULTS**

<table>
<thead>
<tr>
<th>Slump, inches</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 1/2</td>
<td>3</td>
<td>2 1/2</td>
<td></td>
</tr>
<tr>
<td>Air content, percent</td>
<td>3.6</td>
<td>3.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Unit weight, lbs/ft³</td>
<td>151.40</td>
<td>152.12</td>
<td>150.56</td>
</tr>
<tr>
<td>Relative yield, percent</td>
<td>96.5</td>
<td>96.0</td>
<td>100.7</td>
</tr>
<tr>
<td>Compressive strength, psi</td>
<td>4713</td>
<td>4315</td>
<td>3639</td>
</tr>
<tr>
<td>7 days</td>
<td>4719</td>
<td>4315</td>
<td>3639</td>
</tr>
<tr>
<td>14 days</td>
<td>4755</td>
<td>4753</td>
<td>4094</td>
</tr>
<tr>
<td>28 days</td>
<td>5655</td>
<td>5186</td>
<td>4643</td>
</tr>
</tbody>
</table>

(Design Compressive Strength, psi) (4000) (3500) (3000)
In Appendix C the results of compressive strength tests are shown on Laboratory Report Nos. C8100251 to C8100256 for the field produced concrete, and Nos. C8100306 to C8100311 for the lab-produced concrete. Strength-age plots for the field and lab-produced concrete are shown in Figures I, II, and III.

The results of the Freeze-thaw tests will be reported, in a final version of this report.

CONCLUSIONS AND RECOMMENDATIONS

1. The 3/4" crushed stone coarse aggregate from Pike Industries, Inc., Waterford, Vermont complied with all requirements of Section 704.02 when tested in conjunction with this evaluation.

2. For all classes of concrete using Guildhall sand, whether produced in the laboratory or as ready mixed concrete; the Pike/Waterford concrete had strengths equal to or greater than the reference concrete.

3. It is recommended that 3/4 inch crushed stone from the Pike Industries Inc. quarry in Waterford, Vermont be approved for use in structural concrete, subject to freeze-thaw test results.

4. The results of the Freeze-thaw tests will be reported when available, in a final version of this report.
CONCRETE CLASS 'A'

FIELD

- PIKE/WATERFORD
- LAWRENCE/GUILDHALL

LAB.

- PIKE/WATERFORD
- LAWRENCE/GUILDHALL

(Design Compressive Strength = 4000 psi)
COMPRESSIVE STRENGTH VS AGE
CLASS B
FIGURE II
CONCRETE CLASS 'C'

FIELD
- - PIKE/WATERFORD
- - LAWRENCE/GUILDHALL

LAB
- - PIKE/WATERFORD
- - LAWRENCE/GUILDHALL

COMPRESSIVE STRENGTH VS AGE
CLASS C
FIGURE III

(Design Compressive Strength = 3000 psi)
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 Mix 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).
Laboratory No. A81-0218

Name Coarse Aggregate for Concrete 501

Identification Marks Preliminary Sample Crushed Stone

Submitted by M. Morissette Title PFP Address

Sampled 4/17, 1981 Received 4/20, 1981

Sample from Stockpile @ Pike Waterford

Quantity Represented

Source of Material Pike Waterford

Location used or to be used Possible Future Use

Examined for Item 704.02

TEST RESULTS

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing</th>
<th>Fineness Modulus</th>
<th>% Coarser Than</th>
<th>Percent of Wear</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 1/2&quot;</td>
<td>100</td>
<td>No. 100</td>
<td>100</td>
<td>AASHTO T3</td>
</tr>
<tr>
<td>4&quot;</td>
<td></td>
<td>No. 50</td>
<td></td>
<td>AASHTO T4</td>
</tr>
<tr>
<td>3 1/2&quot;</td>
<td></td>
<td>No. 30</td>
<td></td>
<td>AASHTO T96 16.4</td>
</tr>
<tr>
<td>3&quot;</td>
<td></td>
<td>No. 16</td>
<td></td>
<td>Fractured Faces, % 100</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td></td>
<td>No. 8</td>
<td></td>
<td>Thin &amp; Elongated Pieces, % 9</td>
</tr>
<tr>
<td>2&quot;</td>
<td></td>
<td>No. 4</td>
<td></td>
<td>Soundness, % Loss</td>
</tr>
<tr>
<td>1 3/4&quot;</td>
<td></td>
<td>Fineness Modulus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>100</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>97</td>
<td></td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>5/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>31</td>
<td></td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>No. 4</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>No. 8</td>
<td>3</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>No. 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sand Portion

Comments:

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

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

By: R. F. Nicholson, P.E., Materials & Research Engineer
Lab No. C8100251 (28)  Report of 7, 14, 28  Day Breaks  Date typed 6-15-81

Performance in Concrete  Type of Sample  Field

Submitted by M. Morissette  Title  PFP

Source of Material Lawrence - St. Johnsbury  Quantity Represented 1 cy

Coarse Aggregate Lawrence, Guildhall  Fine Aggregate Lawrence - Guildhall

Cement Brand 'Glens Falls  Type II  Lbs. 565

Air Entraining Admixture Darex AEA Dosage 1½ oz/cy AdmixtureWRDA Hycol Dosage 3 oz/cwt

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

Field Tested by M. Morissette Lab. Tested by Eaton

Sampled from Trk #26 @ plant Date Sampled: 5-15-81

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength

**TEST RESULTS**

Unit Weight Fresh Concrete 147.91 Air: Pressure 4.0 Chace

Total Water, Gal/Cy Used Slump 3 Temperature, Concrete 71ºC Ambient 70ºC

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit</th>
<th>Date</th>
<th>Date</th>
<th>Desired</th>
<th>Age at</th>
<th>Type</th>
<th>Break 1</th>
<th>Break 2</th>
<th>Ave.</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyl. Unit Wgt. P.C.F.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>GC 2</td>
<td>151</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>3616</td>
<td>3537</td>
<td>3577</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>151</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>3616</td>
<td>3537</td>
<td>3577</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>151</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>3616</td>
<td>3537</td>
<td>3577</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>151</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>3616</td>
<td>3537</td>
<td>3577</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>151</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>3616</td>
<td>3537</td>
<td>3577</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

Types of Breaks:

![Diagram of Break Types]

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


Comments: TA 1/31, Rev. 00/4/21
# Laboratory Report on Concrete Test Beam or Cylinders

## Appendix C

**Report on Concrete Test Beam or Cylinders**

**Laboratory No.:** C 81002522

**Date of Report:** 7/28/81

**Date of Day Breaks:** 6-15-81

**Owners:**
- **Project Name:** State of Vermont
- **Agency of Transportation:** Materials and Research Division
- **State:** Vermont
- **Project Number:** W.P. No. 81-C-6

**Central files**

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Performance in Concrete</th>
<th>Type of Sample</th>
<th>Field</th>
</tr>
</thead>
</table>

**Submitted by:** M. Morissette

**Title:** PFP

**Address:**

**Source of Material:** Lawrence - St. Johnsbury

**Quantity Represented:** 1 cy

**Coarse Aggregate:** Lawrence - Guildhall

**Fine Aggregate:** Lawrence - Guildhall

**Cement Brand:** Glens Falls

**Type:** Type II

**Lbs.:** 660

**Air Entraining Admixture:**
- Darex AEA
- Dosage: 3 oz/cy

**Admixture:**
- WRDA
- Hycol
- Dosage: 3 oz/cwt

**Maximum allowable water content, Gal/Cy:**

**Total Aggregate, Dry Wgt.:**

**Field Tested by:** M. Morissette

**Lab. Tested by:** Eaton

**Sampled from:** Trk. #40 @ plant

**Date Sampled:** 5-15-81

**Location Used or to be Used:**

**Examined for Mod. of Rupture:**

**Compressive Strength:**

## Test Results

### Unit Weight Fresh Concrete

- **149.67**

### Air: Pressure
- **3.4**

### Total Water, Gal/Cy Used
- **Slump:** 3 1/4

### Temperature, Concrete
- **72°**

### Ambient
- **68°**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Cyl.</th>
<th>Unit</th>
<th>Date</th>
<th>Date</th>
<th>Desired</th>
<th>Age at</th>
<th>Type</th>
<th>Break 1</th>
<th>Break 2</th>
<th>Ave.</th>
<th>Break 1</th>
<th>Break 2</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Unit</td>
<td>Wgt.</td>
<td>Rec'd</td>
<td>Broken</td>
<td>age at break</td>
<td>Break</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 GA 2</td>
<td>152</td>
<td>152</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>4492</td>
<td>4377</td>
<td>4435</td>
<td>4435</td>
<td>4435</td>
<td>4435</td>
<td>4435</td>
</tr>
<tr>
<td>3</td>
<td>152</td>
<td>152</td>
<td>5-18</td>
<td>5-22</td>
<td>13</td>
<td>13</td>
<td>4860</td>
<td>4633</td>
<td>4747</td>
<td>4747</td>
<td>4747</td>
<td>4747</td>
<td>4747</td>
</tr>
<tr>
<td>5</td>
<td>152</td>
<td>152</td>
<td>5-18</td>
<td>6-12</td>
<td>28</td>
<td>28</td>
<td>5208</td>
<td>5376</td>
<td>5292</td>
<td>5292</td>
<td>5292</td>
<td>5292</td>
<td>5292</td>
</tr>
</tbody>
</table>

**S = Standard Cured; F = Field Cured**

**Types of Breaks:**

- **mlm**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Cyl.</th>
<th>Unit</th>
<th>Date</th>
<th>Date</th>
<th>Desired</th>
<th>Age at</th>
<th>Type</th>
<th>Break 1</th>
<th>Break 2</th>
<th>Ave.</th>
<th>Break 1</th>
<th>Break 2</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Unit</td>
<td>Wgt.</td>
<td>Rec'd</td>
<td>Broken</td>
<td>age at break</td>
<td>Break</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 GA 2</td>
<td>152</td>
<td>152</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>4492</td>
<td>4377</td>
<td>4435</td>
<td>4435</td>
<td>4435</td>
<td>4435</td>
<td>4435</td>
</tr>
<tr>
<td>3</td>
<td>152</td>
<td>152</td>
<td>5-18</td>
<td>5-22</td>
<td>13</td>
<td>13</td>
<td>4860</td>
<td>4633</td>
<td>4747</td>
<td>4747</td>
<td>4747</td>
<td>4747</td>
<td>4747</td>
</tr>
<tr>
<td>5</td>
<td>152</td>
<td>152</td>
<td>5-18</td>
<td>6-12</td>
<td>28</td>
<td>28</td>
<td>5208</td>
<td>5376</td>
<td>5292</td>
<td>5292</td>
<td>5292</td>
<td>5292</td>
<td>5292</td>
</tr>
</tbody>
</table>

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

**By:**

**Comments:**

- **Rev. 1A 9/31**
- **Rev. 2/1/81**

---

- **Comprehensible Diagram:**
  - [Diagram of testing setup and equipment]

---

- **By:**
  - [Signature: R. F. Myerson]
Report on Concrete Test Beam or Cylinders

Laboratory No. C8100253 (28) Report of 7, 14, 28 Day Breaks Date typed 6-15-81

Pay Item Performance in Concrete Type of Sample Field

Submitted by M. Morissette Title Address

Source of Material Lawrence - St. Johnsbury Quantity Represented 1 cy
Coarse Aggregate Lawrence - Guildhall Fine Aggregate Lawrence - Guildhall

Cement Brand Glens Falls Type II Lbs. 611
Air Entraining Admixture Darex AEA Dosage 3 oz/cy Admixture WRDA Hycol dosage 2 oz/cwt

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

Field Tested by M. Morissette Lab. Tested by Eaton

Sampled from Trk. #39 @ plant Date Sampled: 5-15-81

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 152.12 Air: Pressure 3.7 Chace
Total Water, Gal/Cy Used Slump 3 Temperature, Concrete 71 Ambient 70

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit Wgt. P.C.F.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type* S - F</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I. 1 2</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB 1 2</td>
<td>155 154</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>4288</td>
<td>4341</td>
<td>4315</td>
<td></td>
</tr>
<tr>
<td>3 4</td>
<td>155 156</td>
<td>5-18</td>
<td>5-28</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>4748</td>
<td>4868</td>
<td>4753</td>
<td></td>
</tr>
<tr>
<td>5 6</td>
<td>156 156</td>
<td>5-18</td>
<td>6-12</td>
<td>28</td>
<td>28</td>
<td>S</td>
<td>5102</td>
<td>5270</td>
<td>5186</td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

Types of Breaks:

![Diagram of break types]

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

By: [Signature]
APPENDIX C

Report on Concrete Test Beam or Cylinders

Laboratory No. C8100254  (28)  Report of 7, 14, 28 Day Breaks  Date typed 6-15-81

Pay Item Performance in Concrete  Type of Sample Field

Submitted by M. Morisette  Title PFP  Address

Source of Material  Lawrence - St. Johnsbury  Quantity Represented  Icy

Coarse Aggregate Lawrence - Guildhall  Fine Aggregate Lawrence - Guildhall

Cement Brand Glens Falls  Type II  Lbs. 611

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

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

Field Tested by M. Morisette  Lab. Tested by Eaton

Sampled from Trk #39 @ plant  Date Sampled: 5-15-81

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 144.95  Air: Pressure 6.2  Chace

Total Water, Gal/Cy Used  Slump 3 1/2  Temperature, Concrete 72°  Ambient 70°

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit Wgt.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>148 P.C.F.</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3705</td>
<td>3696</td>
<td>3701</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>148</td>
<td>5-18</td>
<td>5-18</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>4145</td>
<td>3993</td>
<td>4069</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>148</td>
<td>5-18</td>
<td>5-18</td>
<td>28</td>
<td>28</td>
<td>S</td>
<td>4845</td>
<td>4729</td>
<td>4819</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured;  F = Field Cured

Types of Breaks:

m.m.

1 2 3 4 5 6

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

By: R. F. Nicholson, P.E., Materials & Research Engineer
Report on Concrete Test Beam or Cylinders

Laboratory No. C8100255 (28) Report of 7, 14, 28 Day Breaks Date typed 6-15-81

Pay Item Performance in Concrete Type of Sample 1 cy

Submitted by M. Morissette Title PFP Address

Source of Material Lawrence Quantity Represented 1 cy

Coarse Aggregate Pike, Waterford Fine Aggregate Lawrence - Guildhall

Cement Brand Glens Falls Type II Lbs. 565

Air Entraining Admixture Darex AEA Dosage 1 1/2 oz/cy Admixture WRDA Hycol Dosage 3 oz/cwt

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

Field Tested by M. Morissette Lab. Tested by Eaton

Sampled from Trk #50 @ plant Date Sampled: May 15, 1981

Location Used or to be Used

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 150.56 Air: Pressure 4.4 Chace

Total Water, Gal/Cy Used 2 Slump 2 1/2 Temperature, Concrete 74°F Ambient 70°F

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit</th>
<th>Wgt. P.C.F.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 PC 2</td>
<td>153</td>
<td>153</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3643</td>
<td>3634</td>
<td>3639</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>153</td>
<td>153</td>
<td>5-18</td>
<td>5-28</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>4023</td>
<td>4165</td>
<td>4094</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>153</td>
<td>153</td>
<td>5-18</td>
<td>6-12</td>
<td>28</td>
<td>28</td>
<td>S</td>
<td>4669</td>
<td>4616</td>
<td>4643</td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

Types of Breaks:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Comments: TA 183h Rev. 2/4/31

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

By: R. F. Nicholson, P.E., Materials & Research Engineer
## Report on Concrete Test Beam or Cylinders

**Laboratory No. C8100256 (28)**
**Report of 7, 14, 28 Day Breaks**
**Date typed 6-15-81**

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Performance in Concrete</th>
<th>Type of Sample</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Submitted by** M. Morissette  
**Title** PFPM  
**Address**

**Source of Material** Lawrence - St. Johnsbury  
**Quantity Represented** 1 cu yd

**Coarse Aggregate** Pike - Waterford  
**Fine Aggregate** Lawrence & Guildhall

**Cement Brand** Glens Falls  
**Type** II  
**Lbs.** 660

**Air Entraining Admixture** Darex AEA  
**Dosage** 3/8 oz/cy  
**Admixture WRDA Hycol** Dosage 3 oz/cwt

**Maximum allowable water content, Gal/Cy**

**Total Aggregate, Dry Wgt.**

**Field Tested by** M. Morissette  
**Lab. Tested by** Eaton

**Sampled from** Trk # 5 @ plant  
**Date Sampled:** 5-15-81

**Location Used or to be Used**

**Examined for Mod. of Rupture**

**Compressive Strength**

### TEST RESULTS

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit Wgt. P.C.F.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type 1</th>
<th>Break Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>155</td>
<td>5-18</td>
<td>5-22</td>
<td>7</td>
<td>7</td>
<td>S-F</td>
<td>4633</td>
<td>4792</td>
<td>4713</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>155</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>155</td>
<td>5-18</td>
<td>5-28</td>
<td>13</td>
<td>13</td>
<td>S-F</td>
<td>5188</td>
<td>5210</td>
<td>5199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>156</td>
<td>5-18</td>
<td>6-12</td>
<td>28</td>
<td></td>
<td>S-F</td>
<td>5491</td>
<td>5818</td>
<td>5655</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>156</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured;  F = Field Cured

**Types of Breaks:**

```
1 2 3 4 5 6
```

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

By: [Signature]

**Comments:** TA 183h Rev. 2 4/31
Report on Concrete Test Beam or Cylinders

Laboratory No. C8100306 (28) Report of 7, 14, 28 Day Breaks Date typed 6-18-81

Pay Item Performance in Concrete Type of Sample

Submitted by W. Meyer Title CLP Address

Source of Materials Materials & Research, Berlin, Vt. Quantity Represented 1.75 cf


Cement Brand Glens Falls Type II Lbs. 565

Air-Entraining Admixture Darex AEA Dosage 1/2 oz/cy Admixture WRDA Hycoldosage 3 oz/cwt

Maximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 3294

Field Tested by W. Meyer Lab. Tested by Eaton

Sampled from Lancaster Mixer Date Sampled: 5-20-81

Location Used or to be Used Test Mix

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 152.08 Air: Pressure 4.4% Chance

Total Water, Gal/Cy Used 37.1 Slump 2" Temperature, Concrete 70° Ambient

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Wgt. P.C.F.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type* S - F</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPC 1</td>
<td>152</td>
<td>5-27</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3316</td>
<td>3431</td>
<td>3365</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPC 2</td>
<td>152</td>
<td>6-2</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>3908</td>
<td>3970</td>
<td>3939</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>152</td>
<td>6-17</td>
<td>28</td>
<td>28</td>
<td>S</td>
<td>4279</td>
<td>4226</td>
<td>4253</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>152</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>153</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>153</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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, P.E., Chief Engineer
**Report on Concrete Test Beam or Cylinders**

**Laboratory No.** C8100307 (28)  
**Report of** 7, 14, 28  
**Day Breaks**  
**Date typed** 6-18-81

**Pay Item** Performance in Concrete  
**Type of Sample** Lab

**Submitted by** W. Meyer  
**Title** CLP  
**Address**

**Source of Material** Materials & Research Lab, Berlin  
**Quantity Represented** 1.75 cf

**Coarse Aggregate** Lawrence - Guildhall, VT  
**Fine Aggregate** Lawrence - Guildhall, VT

**Cement Brand** Glens Falls  
**Type** II  
**Lbs.** 565

**Air Entraining Admixture** Darex AEA  
**Dosage** 1 1/2 oz/cy  
**Admixture** WRDA Hycol  
**Dosage** 3 oz/cwt

**Maximum allowable water content, Gal/Cy**  
**Total Aggregate, Dry Wgt.** 3193

**Field Tested by** W. Meyer  
**Lab. Tested by** Eaton

**Sampled from** Lancaster Mixer  
**Date Sampled:** 5-20-81

**Location Used or to be Used Reference Mix**

**Examined for Mod. of Rupture** Compressive Strength

**TEST RESULTS**

**Unit Weight Fresh Concrete** 148.05  
**Air: Pressure** 4.8%  
**Chace**

**Total Water, Gal/Cy Used** 36.4  
**Slump** 3"  
**Temperature, Concrete** 72° Ambient

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit Wgt. P.C.F.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type 1</th>
<th>Break Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGC 1</td>
<td>150</td>
<td>148</td>
<td>5-27</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3360</td>
<td>3351</td>
<td>3356</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LGC 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>149</td>
<td>150</td>
<td>6-2</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>3820</td>
<td>3894</td>
<td>3857</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

**Types of Breaks:**

```
  1  2  3  4  5  6
```

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

**Comments:**

TA 183h: Rev.  
24 4/81
Report on Concrete Test Beam or Cylinders

Laboratory No. CB100308 (28)  Report of July 14, 1981  Day Breaks Date typed 6-18-81

Pay Item Performance in Concrete Type of Sample Lab

Submitted by W. Meyer Title CLP Address

Source of Material Materials & Research Lab, Berlin Quantity Represented 1.75 cf

Coarse Aggregate Lawrence, Guildhall, Vt.  Fine Aggregate Lawrence - Guildhall, Vt.

Cement brand Glens Falls Type II Lbs. 611

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

Maximum allowable water content, Gal/Cy Total Aggregate, Dry Wgt. 3087

Field Tested by W. Meyer Lab. Tested by Eaton

Sampled from Lancaster Mixer Date Sampled: 5-20-81

Location Used or to be Used Reference Mix

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 148.97 Air: Pressure 4.2% Chace

Total Water, Gal/Cy Used 33.4 Slump 2½ Temperature, Concrete 70° Ambient

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type 1</th>
<th>Break Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGB 1</td>
<td>150</td>
<td></td>
<td>5-27</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3210</td>
<td>3174</td>
<td>3192</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LGB 2</td>
<td>150</td>
<td></td>
<td>5-27</td>
<td>7</td>
<td>7</td>
<td>F</td>
<td>3210</td>
<td>3174</td>
<td>3192</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>150</td>
<td></td>
<td>6-2</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>3130</td>
<td>3917</td>
<td>3524</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>151</td>
<td></td>
<td>6-2</td>
<td>13</td>
<td>13</td>
<td>F</td>
<td>3130</td>
<td>3917</td>
<td>3524</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>150</td>
<td></td>
<td>6-17</td>
<td>28</td>
<td>28</td>
<td>S</td>
<td>4209</td>
<td>4571</td>
<td>4390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>150</td>
<td></td>
<td>6-17</td>
<td>28</td>
<td>28</td>
<td>F</td>
<td>4209</td>
<td>4571</td>
<td>4390</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

Types of Breaks:

<table>
<thead>
<tr>
<th>Gage</th>
<th>P.E., Chief Engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. J. Gage, P.E., Chief Engineer</td>
<td></td>
</tr>
</tbody>
</table>

By: ____________________________

Comments: TA 1833h Rev.

24-4/21
## Laboratory Report on Concrete Test Beam or Cylinders

### Laboratory No.: C8100309

- **Report of:** 7, 14, 28 Day Breaks
- **Date typed:** 6-18-81

#### Pay Item Performance in Concrete

- **Type of Sample Lab:**

#### Submitted by:

- **W. Meyer**
- **Title:** CLP
- **Address:**

#### Source of Materials:

- **Materials & Research Lab, Berlin**
- **Quantity Represented:** 1.75 cu.

#### Coarse Aggregate

- **L.M. Pike, Waterford, Vt.**

#### Fine Aggregate

- **Lawrence - Guildhall**

#### Cement Brand

- **Glens Falls**
- **Type:** II
- **Lbs.:** 611

#### Air Entraining Admixture

- **Darex AEA**
- **Dosage:** 3 oz/cy
- **Admixture:** WRDA Hycol
- **Dosage:** 3 oz/cwt

#### Maximum allowable water content

- **Total Aggregate, Dry Wgt.:** 3184

#### Field Tested by:

- **W. Meyer**
- **Lab. Tested by:** Eaton

#### Sampled from

- **Lancaster Mixer**
- **Date Sampled:** 5-20-81

#### Location Used or to be Used

- **Test Mix**

#### Examined for Mod. of Rupture

- **Compressive Strength**

### Test Results

#### Unit Weight Fresh Concrete: 151.60

#### Air: Pressure: 4.9% Change

#### Total Water, Gal/Cy Used: 35.0

#### Slump: 2

#### Temperature, Concrete: 72° Ambient

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. No.</th>
<th>Unit Wgt. P.C.F.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired Age at Break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type 1</th>
<th>Break Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>152</td>
<td></td>
<td>5-27</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3227</td>
<td>3201</td>
<td>3214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>152</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>152</td>
<td></td>
<td>6-2</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>3846</td>
<td>4023</td>
<td>3935</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>153</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>152</td>
<td></td>
<td>6-17</td>
<td>-28</td>
<td>28</td>
<td>S</td>
<td>4669</td>
<td>4518</td>
<td>4594</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>152</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

### Types of Breaks:

1. Chace
2. Field Cured Breaks
3. Standard Cured Breaks

### Comments:

- "TA 197"  
- "W1 197"  

### Signature:

- S. J. Gage, P.E., Chief Engineer
APPENDIX C

Report on Concrete Test Beams or Cylinders

Laboratory No. C8100310 (28) Report of 7, 14, 28 Day Breaks Date typed 6-18-81

Pay Item Performance in Concrete Type of Sample

Submitted by W. Meyer Title CLP Address

Source of Material Materials & Research Lab, Berlin Quantity Represented 1.75 cf

Coarse Aggregate L.M. Pike, Waterford, Vt. Fine Aggregate Lawrence, Guildhall

Cement Brand Glens Falls Type II Lbs. 660

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. 3037

Field Tested by W. MEyer Lab. Tested by Eaton

Sampled from Lancaster Mixer Date Sampled: 5-20-81

Location Used or to be Used test mix

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 152.03 Air: Pressure 5.0% Chace

Total Water, Gal/Cy Used 34.2 Slump 2½" Temperature, Concrete 70° Ambient

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit</th>
<th>Date</th>
<th>Date</th>
<th>Desired</th>
<th>Age at</th>
<th>Type*</th>
<th>Break 1</th>
<th>Break 2</th>
<th>Ave.</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit Wgt.</td>
<td>Rec'd</td>
<td>Broken</td>
<td>age at</td>
<td>Break 1</td>
<td>P.S.I.</td>
<td>Break 2</td>
<td>P.S.I.</td>
<td>P.S.I.</td>
<td>1</td>
</tr>
<tr>
<td>LPA 1 2</td>
<td>152</td>
<td>152</td>
<td>5-27</td>
<td>7</td>
<td>3563</td>
<td>3669</td>
<td>3616</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3 4</td>
<td>152</td>
<td>152</td>
<td>6-2</td>
<td>13</td>
<td>4219</td>
<td>4124</td>
<td>4172</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5 6</td>
<td>152</td>
<td>152</td>
<td>6-17</td>
<td>.28</td>
<td>4403</td>
<td>5128</td>
<td>4766</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

*S = Standard Cured; F = Field Cured

Types of Breaks: S F

Comments: TA 183K Rev. 27 2/81

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

P.E. Nicholson, P.E., Materials & Research Engineer
Report on Concrete Test Beams or Cylinders

Laboratory No. C8100311 (28) Report of 7, 14, 28 Day Breaks Data typed 6-18-81

Pay Item Performance in Concrete Type of Sample Lab

Submitted by W. Meyer Title CLP Address

Source of Material Materials & Research Lab, Berlin Quantity Represented 1.75 cf

Coarse Aggregate Lawrence, Guildhall, Vt. Fine Aggregate Lawrence, Guildhall, Vt.

Cement Brand Glens Falls Type II Lbs. 660

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. 3036

Field Tested by W. Meyer Lab. Tested by Eaton

Sampled from Lancaster Mixer Date Sampled: 5-20-81

Location Used or to be Used Reference mix

Examined for Mod. of Rupture Compressive Strength

TEST RESULTS

Unit Weight Fresh Concrete 148.01 Air: Pressure 5.4% Chace

Total Water, Gal/Cy Used 33.2 Slump 2 3/4" Temperature, Concrete 70° Ambient

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Cyl. Unit Wgt.</th>
<th>Date Rec'd</th>
<th>Date Broken</th>
<th>Desired age at break</th>
<th>Age at Break</th>
<th>Type*</th>
<th>Break 1 P.S.I.</th>
<th>Break 2 P.S.I.</th>
<th>Ave. P.S.I.</th>
<th>Break Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGA</td>
<td>148</td>
<td>5-27</td>
<td>7</td>
<td>7</td>
<td>S</td>
<td>3431</td>
<td>3546</td>
<td>3489</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>148</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>149</td>
<td>6-2</td>
<td>13</td>
<td>13</td>
<td>S</td>
<td>4244</td>
<td>4023</td>
<td>4134</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>148</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>148</td>
<td>6-17</td>
<td>28</td>
<td>28</td>
<td>S</td>
<td>4722</td>
<td>4669</td>
<td>4696</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* S = Standard Cured; P = Field Cured

Types of Breaks:

Types of Breaks:

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

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

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

RESEARCH INVESTIGATION

Work Plan No. 81-C-6

Subject: Performance evaluation of new coarse aggregate source, Pike Ind., Inc., Waterford, Vt.

Investigation Requested By: Pike Industries, Inc. Date: April 10, 1981

Date Information Required: June 2, 1981

Purpose of Investigation: To evaluate the Pike Industries Inc. crushed stone and washed sand from their Waterford quarry as a structural concrete aggregate source.

Proposed Tests or Evaluation Procedure: See Performance in Concrete Procedure (attached).

Proposal Discussed With R. J. Foggia

Projected Manpower Requirements: 10 man days

Investigation To Be Conducted By: Structural Concrete Subdivision

Proposed Starting Date: April 29, 1981 Estimated Completion Date: June 2, 1981

Approval/Disapproval by Materials & Research Engineer: R. F. Nicholas

Comments by Materials & Research Engineer: 5/5/81

Materials & Research Division
Agency of Transportation
Date Typed: 4/27/81
APPENDIX D

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).