

DATE: June 5, 2007

Material Testing • Non-Destructive Testing
Product Evaluation • Construction Materials

TO: Mr. Paul Bracegirdle
Mix Design Methods
PO Box 88
Langhorne, PA 19047

662 Cromwell Avenue
St. Paul, MN 55114
USA

Telephone : (651) 645-3601
Telefax : (651) 659-7348
Website : www.storktct.com

PROJECT: PERFORMANCE EVALUATION
SYNTHETIC FIBERS

PROJECT NO.: 307051.1

PAGE: 1 of 4

TESTING OF CONCRETE WITH SYNTHETIC FIBERS

INTRODUCTION:

This report presents the results of our laboratory testing work conducted on samples of concrete containing MDM Fiber (1.5 lb/yd³ dosage rate). Our work was requested and authorized by Mr. Paul Bracegirdle of Mix Design Methods on March 21 and April 10, 2007, respectively. The scope of our testing work was as follows:

1. Perform laboratory batching of concrete with and without fibers according to Section 4.0 of ICC-ES Acceptance Criteria for Concrete with Synthetic Fibers (AC32) for
 - A. Compressive Strength
2. Prepare a written report stating the results of the areas tested in accordance with AC32.

SUMMARY OF TEST RESULTS:

The following is a summary of the test results:

<u>Test</u>	<u>Control</u>	<u>Test - (Fibers)</u>	<u>% of Control</u>	<u>ICC Criteria</u>
Compressive	37.58 MPa (5,450 psi)	38.47 MPa (5,580 psi)	102.4	≥ Control

CONCLUSIONS:

Based on these test results, the MDM Fiber does not adversely affect the concrete performance when tested for the above-referenced properties. Therefore, the MDM Fiber at a dosage rate of 0.89 kg/m³ (1.5 lbs/yd³), meets the ICC-ES Acceptance Criteria for Concrete with Synthetic Fibers (AC32) in the tested areas.

TEST PROCEDURES:

The testing was initiated on April 23, 2007 and subsequent dates using applicable portions of the ICC-ES AC32 (Section 3.0 Test and Performance Requirements). Based on our understanding of Section 4.0, the comparative test mixes and procedures are those that are outlined in ASTM:C494 Sections 11-15. Applicable portions of these sections were used and no special manufactures mixing procedure was provided or employed. The mix design used is included in the Concrete Materials section of this report along with the other pertinent information. Additional ASTM procedures were also used in conjunction with the ICC-ES Criteria. All of the samples were prepared using concrete mixtures fabricated by Stork Twin City Testing Corporation personnel at our facility located in St. Paul, Minnesota.

This agreement shall be governed exclusively by the general terms and conditions of sale and performance of testing services by Stork Twin City Testing, Inc. a North Carolina business corporation ("TCT") dd. 05/01/2001. In no event shall Stork Twin City Testing, Inc. be liable for any consequential, special or indirect loss or any damages above the cost of the work. Payment is due within 30 days of invoice.

PROJECT NO: 307051.1

DATE: June 5, 2007

PAGE: 2 of 4

TESTING OF CONCRETE WITH SYNTHETIC FIBERS

FIBER DATA:

The client identified, selected and shipped the fiber samples to Stork TCT, from which Stork TCT personnel selected the fibers necessary to cast the various test specimens. The sample fiber packaging had no product label.

Synthetic Fibers: MDM Fibers
Date Submitted: April 12, 2007
Application/mixing: 5 minutes

CONCRETE MATERIALS:

Concrete Trial Mixtures

Mix Number	1	2
Mixture Type	Control	Fiber
Cement Content, kg/m ³ (lbs/yd ³)	306.7 (517)	306.7 (517)
Slump, mm (in.)	76-102 (3-4)	76-102 (3-4)
Nominal Coarse Aggregate, mm (in.)	19 (3/4)	19 (3/4)
Air Content, %	5.0-7.0 ¹	5.0-7.0 ¹
Specified Minimum		
Compressive Strength, MPa (psi)	27.6 (4,000)	27.6 (4,000)

¹An air content of 5-7 percent was used for the casting of the compressive strength samples. An entraining agent was used to achieve the desired air content.

Materials

Cement	Lehigh Type I Portland Cement (ASTM:C150)
Fine Aggregate	Quikrete (All-Purpose Sand Meeting the Requirements of ASTM:C33 and C494)
Coarse Aggregate	Aggregate Industries Inc. (Limestone Size Number 57 Meeting the Requirements of ASTM:C33 and C494)
Admixtures	MDM Fibers Masterbuilders AE90

PROJECT NO: 307051.1

DATE: June 5, 2007

PAGE: 3 of 4

TESTING OF CONCRETE WITH SYNTHETIC FIBERS

Batch Weights, per m³ (yd³)

Mix Design Number	1	2
Mixture Type	Control	Fiber
Portland Cement, kg (lbs)	306.7 (517)	306.7 (517)
Admixture:		
Fibers, kg (lbs)	---	0.89 (1.5)
Air Entrainment, ml (oz) ¹	158.5 (4.1)	158.5 (4.1)
Fine Aggregate, kg (lbs)	809.8 (1,365)	809.8 (1,365)
Total Coarse Aggregate, kg (lbs)	1008.6 (1,700)	1008.6 (1,700)
Water, kg (lbs)	172.1 (290)	172.1 (290)

Mix design numbers 1 and 2 were used in casting of all samples.

TEST RESULTS:

Concrete Test Data (Compressive Strength Samples)

Mix Number	1	2
Mixture Type	Control	Fiber
Date	4/23/07	4/23/07
Slump, mm (in.)	88.9 (3-1/2)	82.6 (3-1/4)
Air Content, %	5.0%	5.2%
Temperature, °C (°F)	16.1 (61)	16.1 (61)
Unit Weight, kg/m ³ (lbs/ft ³)	2,318 (144.7)	2,315 (144.5)

Compressive Strength - ASTM:C39

Sample Type:	Control	Control	Control
Mix Number:	1	1	1
Diameter, mm (in):	153 (6.02)	153 (6.02)	153 (6.02)
Height, mm (in):	305 (12.00)	305 (12.00)	305 (12.00)
Area, cm ² (in ²):	183.61 (28.46)	183.61 (28.46)	183.61 (28.46)
Days Moist Cured-ASTM:C192:	27	27	27
Age of sample at test, days:	28	28	28
Type of Fracture:	Shear	Shear	Shear
Load at Failure, kN (lbs):	688.5 (154,770)	701.0 (157,600)	681.3 (153,160)
Strength, MPa (psi):	37.51 (5,440)	38.20 (5,540)	37.09 (5,380)

PROJECT NO: 307051.1

DATE: June 5, 2007
PAGE: 4 of 4

TESTING OF CONCRETE WITH SYNTHETIC FIBERS

TEST RESULTS: (cont.)

Sample Type:	Fiber	Fiber	Fiber
Mix Number:	2	2	2
Diameter, mm (in):	153 (6.02)	153 (6.02)	153 (6.02)
Height, mm (in):	305 (12.00)	305 (12.00)	305 (12.00)
Area, cm ² (in ²):	183.61 (28.46)	183.61 (28.46)	183.61 (28.46)
Days Moist Cured-ASTM:C192:	27	27	27
Age of sample at test, days:	28	28	28
Type of Fracture:	Shear	Shear	Shear
Load at Failure, kN (lbs):	691.7 (155,510)	715.9 (160,940)	711.1 (159,860)
Strength, MPa (psi):	37.65 (5,460)	38.96 (5,650)	38.75 (5,620)

*Unbonded caps were used on all samples.

REMARKS:

The samples were discarded at the completion of testing.

If you have any questions concerning this report, or if we may be of further assistance, please contact me at (651) 659-7399.

STORK TWIN CITY TESTING CORPORATION



Thaddeaus Harnois, P.E.
Staff Engineer



Thomas A. Kolden, P.E.
Manager of Building Product Testing

F:\BMC\2007CME\CONSTRUCTION\307051\MDM AC32 Report.doc