

TEST RESULTS: Bond Strength

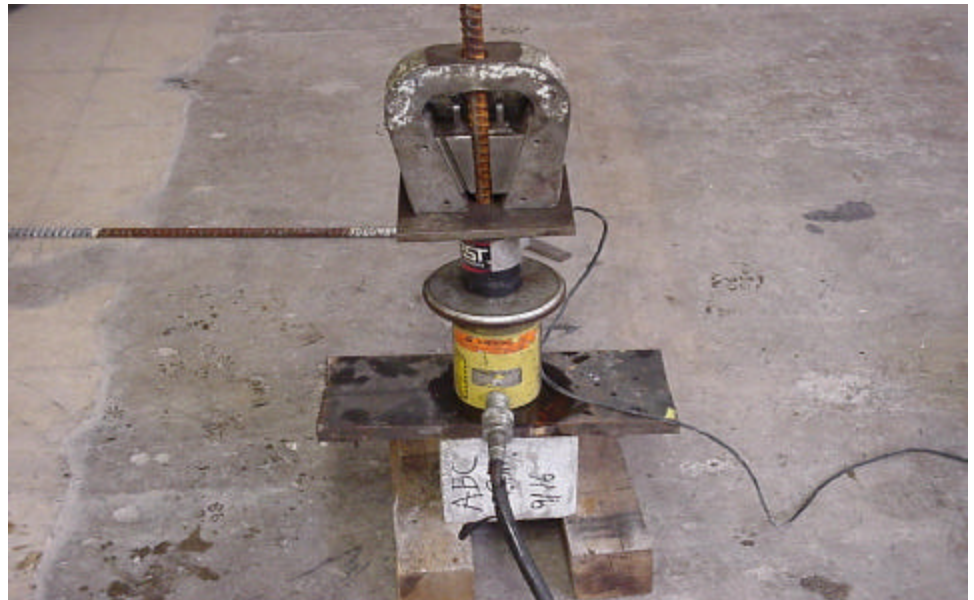


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Summary: The addition of ABC Fibers does not adversely affect the bond strength of the concrete and primary reinforcement.

Background: Bond Strength test were performed on samples with and without ABC Fibers. The tests began on September 27, 1999 in accordance with ICBO, AC32, Section 5.4, and ASTM C-234. Data below reflect the average of three samples.

Data:

	Control	Fiber
Load at Failure, lb.	16,430	17,003
Area, Sq.In.	14.14	14.14
Load, psi.	1,160	1,203

Bond Strength Testing was done by :

Twin City Testing Corporation
662 Cromwell Avenue
St. Paul, MN 55114-1776

Test Supervisor:
Mr. John D. Lee, PE
Senior Staff Engineer
Construction Materials Department.

Testing began on September 27, 1999. The results were published as Project 99-09552 on October 28, 1999. Mr. Lee can be reached at 651.659.7340.

The goal of the bond strength test is to determine if the addition of ABC Fibers to concrete adversely affects the bond strength between the concrete and the primary reinforcement. The tests were performed in accordance with ICBO AC-32, Section 5.4 and ASTM C-234. The reinforcing bars used in the test were #6 bars documented at 26,880 pounds. (Tensile strength 61,100 psi.) A test fixture with a hydraulic ram and load cell were used to apply the loads. The six concrete samples were cured 27 days. Three of the samples were control samples and three samples contained ABC Fibers added at a rate of 1.5 pounds of fiber per cubic yard of concrete. The load was applied at an approximate rate of 4,000 pounds per minute. The load cell was calibrated and traceable to NIST. No capping compound was used during the testing.

The conditions for acceptance are that the average bond strength for the steel reinforcement embedded in the concrete with the fibers must be equal to the average bond strength in the control sample.

In summary, the addition of ABC Fibers

Materials:

Cement: Type I Portland Cement (ASTM:C150)

Fine Aggregate: Shiely Aggregates Inc. Meeting the grading requirements of ASTM: C494 and C33.

Coarse Aggregate: Shiely Aggregates Inc. Meeting the grading requirements of ASTM:C494 and C33.

Admixtures: DARAVAIR by W.R. Grace (ASTM: C260) ABC Fibers. (Fibers not in control.)

Mix Design:

Mix Number:	1 and 2
Mixture Type	Control and Fiber
Portland Cement, Lb.:	517
Fine Aggregate, Lb.:	1,365
Coarse Aggregate, Lb.:	1,750
Net Water, Lb.:	257
Admixtures:	
DARAVAIR, Oz.	4.1
ABC Fibers, Lb./cu.yd.	1.5 (not in control)

Concrete Test Data: Control		Fiber
Slump, Inches	3-3/4	2-1/4
Air Content, %	6.5	5.9
Temperature, Deg F.	76	75
Unit Weight, Lb./cf	147.0	147.3

Both Control and Fiber samples moist cured 27 days in accordance with ASTM:C-234.

Sample type: Control

	1	2	3
Load at Failure, lb.	16,700	17,010	15,580
Area, Sq.In.	14.14	14.14	14.14
Load, psi.	1,180	1,200	1,100
Failure Type	—Concrete Failure—		

Sample type: Fiber

	1	2	3
Load at Failure, lb.	16,550	17,470	16,990
Area, Sq.In.	14.14	14.14	14.14
Load, psi.	1,170	1,240	1,200
Failure Type	—Concrete Failure—		