



Summit Testing & Inspection Company

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December, 1991

Applied Concrete Technology, Inc.

P.O. Box 4015

Arlington Heights, Illinois 60006-4015

Attention: David Johnson, President

RE: PROTECRETE-MWC AND PROTECRETE-CDS COMPRESSIVE STRENGTH TESTING

Our personnel placed a concrete test slab outside of our testing facility. The concrete was delivered in two loads of 1.5 cubic yards each by a local ready-mix company. Mixture specifications were as follows:

Type 1 Cement	500 lbs./C.Y.
Water, Total	28 gals./C.Y.
#57 White Rock Limestone	1,660 lbs./C.Y.
Hugo Concrete Sand	1,450 lbs./C.Y.
Master Builders Micro-Air	5 oz./C.Y.

To the first load was added PROTECRETE-MWC. This was done by mixing PROTECRETE-MWC with the batch water at the rate of 10 fluid ounces per CWT Portland cement prior to charging other ingredients into the transit mixed batch.

Upon delivery, approximately half of the load was discharged prior to obtaining a sample for conducting air content, slump, temperature tests, and molding cylinder (12) and beam (2) specimens. The results of these tests are:

Slump:	2.75 inches
Air Content:	6.0 percent
Temperature:	68 °F

After pouring out the rest of this load, transit mixer was sent for balance. The concrete was consolidated by internal vibration, screeded, and bull floated. A bulkhead was placed to separate the two loads.

The second load without PROTECRETE-MWC was placed and tested much the same as the first. The same tests and number of samples were cast as on the first load. The results are:

Slump:	4.0 inches
Air Content:	7.1 percent
Temperature:	67 °F

Consolidation and initial finishing were the same. The final finishing operation of brooming was done to both loads at the appropriate time. All cylinder specimens were covered with tight fitting plastic caps to prevent loss of water with no other precautions being observed.

The compression (cylinder) and flexure (beam) test specimens were subsequently handled in the following manner:

Cylinders: Left outside in their covered molds for 20 hours \pm , stripped then capped with high strength sulfur compound and placed in baths of lime saturated water until tested.

Beams: Left out of doors in their steel molds uncovered until the 7th day, third point loading flexure tests were made. Then, the larger piece (of the 6" x 6" x 36" specimen) resulting from the test was placed in the lime water baths until the 28 day test date.

Laboratory reports for cylinder and beam tests will be submitted separately as they are completed. In addition, it is anticipated that various other tests will be conducted on samples obtained at various times from the slab. It is our understanding that these may include rapid chloride permeability and water soluble chloride ion determinations and core compression tests, the purpose of which will be for this writer to assess and form an opinion on the performance of various other products of the future.

REPORT OF CONCRETE CYLINDER LABORATORY TESTING

With PROTECRETE-MWC and CDS at 4 and 7 days

FIELD TEST DATA: Set Number: 1 of 2 from East end of slab to 62' West
Slump: 2.75 inches
Air: 6.0 percent
Temperature: 68°F
Curing Other Than Moist: 1 Day Field Cured
Mix P.S.I. Design: 3,000 At 28 Days

MIX DESIGN DATA: Cement: 500 Lbs. Type 1 Per C.Y.
Water: 28 Gallons Per C.Y.
Coarse Aggregate: 1,660 Lbs. #57 Limestone (SSD) Per C.Y.
Fine Aggregate: 1,450 Lbs. Concrete Sand (SSD) Per C.Y.
PROTECRETE-MWC: 10 Oz. Per CWT (100 lbs.) Portland Cement
Admixture: 4.66 Oz. Master Builders Micro-Air Per C.Y.

LABORATORY DATA:

Cylinder I.D.	Diameter Inches	Area Sq. In.	Age Days	Load Lbs.	Compressive Strength PSI	Type Of Break
1-4840	6.01	28.37	4	115,500	4,070	Shear
1-4841	6.01	28.37	4	112,000	3,950	Shear
1-4842	6.01	28.37	4	112,500	3,970	Shear
1-4843	6.01	28.37	7	138,000	4,860	Shear
1-4844	6.01	28.37	7	137,500	4,850	Shear
1-4845	6.01	28.37	7	138,500	4,880	Shear

Without PROTECRETE-MWC and CDS at 4 and 7 days

FIELD TEST DATA: Set Number: 2 of 2 62" from West end of the slab
 Slump: 4 inches
 Air: 7.1 percent
 Temperature: 67°F
 Curing Other Than Moist: 1 day field cured
 Mix P.S.I. Design: 3,000 at 28 days

MIX DESIGN DATA: Cement: 500 Lbs. Type 1 Per C.Y.
 Water: 28 Gallons Per C.Y.
 Coarse Aggregate: 1,660 Lbs. #57 Limestone (SSD) Per C.Y.
 Fine Aggregate: 1,450 Lbs. Concrete Sand (SSD) Per C.Y.
 Admixture: 4.66 Oz. Master Builders Micro-Air Per C.Y.

LABORATORY DATA:

Cylinder I.D.	Diameter Inches	Area Sq. In.	Age Days	Load Lbs.	Compressive Strength PSI	Type Of Break
1-4852	6.01	28.37	4	95,000	3,350	Shear
1-4853	6.01	28.37	4	94,000	3,310	Shear
1-4854	6.01	28.37	4	95,500	3,370	Shear
1-4855	6.01	28.37	7	109,000	3,840	Shear
1-4856	6.01	28.37	7	108,500	3,820	Shear
1-4857	6.01	28.37	7	110,500	3,880	Shear

With PROTECRETE-MWC and CDS at 28 days

FIELD TEST DATA: Set Number: 1 of 2 from East end of slab to 62" West
 Slump: 2.75 inches
 Air: 6.0 percent
 Temperature: 68°F
 Curing Other Than Moist: 1 day field cured
 Mix P.S.I. Design: 3,000 at 28 days

MIX DESIGN DATA: Cement: 500 lbs Type 1 per C.Y.
 Water: 28 gallons per C.Y.
 Coarse Aggregate: 1,660 lbs. #57 limestone (SSD) per C.Y.
 Fine Aggregate: 1,450 lbs. concrete sand (SSD) per C.Y.
 PROTECRETE-MWC: 10 oz. per CWT (100 lbs.) Portland cement
 Admixture: 4.66 oz. Master Builders Micro-Air per C.Y.

LABORATORY DATA:

Cylinder I.D.	Diameter Inches	Area Sq. In.	Age Days	Load Lbs.	Compressive Strength PSI	Type Of Break
1-4846	6.01	28.37	28	169,500	5,970	Cone-Shear
1-4847	6.01	28.37	28	170,000	5,990	Shear
1-4848	6.01	28.37	28	168,000	5,920	Shear
1-4849	6.01	28.37			Spare	
1-4850	6.01	28.37			Spare	
1-4851	6.01	28.37			Spare	

FIELD TEST DATA: Set Number: 2 of 2 62" from the West end of the slab
 Slump: 4 inches
 Air: 7.1 percent
 Temperature: 67°F
 Curing Other Than Moist: 1 day field cured
 Mix P.S.I. Design: 3,000 at 28 days

MIX DESIGN DATA: Cement: 500 lbs Type 1 per C.Y.
 Water: 28 gallons per C.Y.
 Coarse Aggregate: 1,660 lbs. #57 limestone (SSD) per C.Y.
 Fine Aggregate: 1,450 lbs. concrete sand (SSD) per C.Y.
 Admixture: 4.66 oz. Master Builders Micro-Air per C.Y.

LABORATORY DATA:

Cylinder I.D.	Diameter Inches	Area Sq. In.	Age Days	Load Lbs.	Compressive Strength PSI	Type Of Break
1-4858	6.01	28.37	28	135,000	4,760	Cone-Shear
1-4859	6.01	28.37	28	137,000	4,830	Shear
1-4860	6.01	28.37	28	138,000	4,860	Shear
1-4861	6.01	28.37			Spare	
1-4862	6.01	28.37			Spare	
1-4863	6.01	28.37			Spare	

SUMMARY RESULTS OF COMPRESSIVE STRENGTH TESTING:

PURPOSE: To determine what affect PROTECRETE-MWC and CDS would have on strength development of concrete.

REMARKS: Cylinders cast at time of placement were used to judge PROTECRETE-MWC and CDS effects. A core specimen was drilled in an effort to determine if variations arose.

RESULTS:

AVERAGE CYLINDER COMPRESSIVE STRENGTH (PSI)

<u>Age of Test</u>	<u>With PROTECRETE-MWC</u>	<u>Without PROTECRETE-MWC</u>
4 Days	4,000	3,340
7 Days	4,860	3,850
28 Days	5,960	4,820

INTERPRETATION AND CONCLUSIONS:

The trial batch containing PROTECRETE-MWC consistently demonstrated significantly higher compressive strengths in comparison to the batch without PROTECRETE-MWC. By percent increase over the control batch these are: At 4 days - 19.8%
 At 7 days - 26.2%
 At 28 days - 23.7%

REPORT OF CONCRETE CORE COMPRESSION TESTING

With PROTECRETE-MWC and CDS at 12 days

FIELD TEST DATA: Set Number: 1 of 2 from East end of slab to 62 " West
Slump: 2.75 inches
Air: 6.0 percent
Temperature: 68°F
Curing Other Than Moist: 1 Day Field Cured
Mix P.S.I. Design: 3,000 At 28 Days

MIX DESIGN DATA: Cement: 500 Lbs. Type 1 Per C.Y.
Water: 28 Gallons Per C.Y.
Coarse Aggregate: 1,660 Lbs. #57 Limestone (SSD) Per C.Y.
Fine Aggregate: 1,450 Lbs. Concrete Sand (SSD) Per C.Y.
PROTECRETE-MWC: 10 Oz. Per CWT (100 lbs.) Portland Cement
Admixture: 4.66 Oz. Master Builders Micro-Air Per C.Y.

LABORATORY DATA:

Test Slab Number	Core I.D.	Diameter Inch	Area Sq. In.	Test Length Inch	Age Day	Total Load		Type of Break
						Compression Pounds	Strength P.S.I.	
1	A	3.71	10.81	5.49	12	52,000	4,608	Shear
1	B	3.71	10.81	7.27	12	46,000	4,255	Shear
1	C	3.71	10.81	7.29	12	50,500	4,672	Shear
AVERAGE ...							4,512	

Without PROTECRETE-MWC and CDS at 12 days

FIELD TEST DATA: Set Number: 2 of 2 62" from West end of the slab
Slump: 4 inches
Air: 7.1 percent
Temperature: 67°F
Curing Other Than Moist: 1 day field cured
Mix P.S.I. Design: 3,000 at 28 days

MIX DESIGN DATA: Cement: 500 Lbs. Type 1 Per C.Y.
Water: 28 Gallons Per C.Y.
Coarse Aggregate: 1,660 Lbs. #57 Limestone (SSD) Per C.Y.
Fine Aggregate: 1,450 Lbs. Concrete Sand (SSD) Per C.Y.
Admixture: 4.66 Oz. Master Builders Micro-Air Per C.Y.

LABORATORY DATA:

Test Slab Number	Core I.D.	Diameter Inch	Area Sq. In.	Test Length Inch	Age Day	Total Load		Type of Break
						Compression Pounds	Strength P.S.I.	
2	A	3.71	10.81	6.28	12	35,000	3,157	Shear
2	B	3.71	10.81	7.25	12	36,500	3,377	Shear
2	C	3.71	10.81	7.31	12	35,000	3,238	Shear
AVERAGE ...							3,257	

SUMMARY RESULTS OF CORE COMPRESSION TESTING

REMARKS: Compressive strength has been corrected for length/diameter ratios other than 2.0 (per ASTM C42).

The test length includes the high strength sulfur caps.

RESULTS: AVERAGE CORE COMPRESSION STRENGTH (PSI)

<u>Age of Test</u>	<u>With PROTECRETE-MWC</u>	<u>Without PROTECRETE-MWC</u>
12 Days	4,510	3,260

For the core test, if one considers the test results from slab section 2 core, in comparison to slab section 1 core, the increase is 38.3% (at 12 days).

REPORT OF FLEXURAL STRENGTH TESTING

With PROTECRETE-MWC and CDS at 7 and 28 days

Set 1: Unit weight = 145.5 PCF. Two (2) 6" x 6" x 36" long beams were cast with these cylinders. Each was kept outside in the mold for seven (7) days before stripping and testing for flexural strength by the third point loading method. The larger resulting piece was placed in a lime water bath until the 28 day tests. The test results are:

Test Beam	Area	Unit Weight	Age/Days	Strength PSI
Set 1	6" x 6" x 36"	145.5 PCF	7	936
Set 1	6" x 6" x 36"	145.5 PCF	7	986
Set 1	6" x 6" x 36"	145.5 PCF	28	973
Set 1	6" x 6" x 36"	145.5 PCF	28	1066

Without PROTECRETE-MWC and CDS at 7 and 28 days

Set 2: Plastic unit weight = 143.6 PCF. Two (2) 6" x 6" x 36" long beams were cast with these cylinders. Each was kept outside in the molds for seven (7) days before stripping and testing for flexural strength by the third point loading method. The larger resulting piece was placed in a lime water bath until the 28 day tests. The test results are:

Test Beam	Area	Unit Weight	Age/Days	Strength PSI
Set 2	6" x 6" x 36"	143.6 PCF	7	734
Set 2	6" x 6" x 36"	143.6 PCF	7	737
Set 2	6" x 6" x 36"	143.6 PCF	28	958
Set 2	6" x 6" x 36"	143.6 PCF	28	888

SUMMARY RESULTS OF FLEXURAL STRENGTH TESTING

PURPOSE: To demonstrate an increase in flexural strength by using PROTECRETE-MWC.

REMARKS: Tested in accordance with ASTM C78 (third point loading). At 7 days, the beams were stripped and tested, with the larger piece being placed in lime water until the 28 day test.

RESULTS:

AVERAGE (OF 2) FLEXURAL STRENGTH TESTS (PSI)

<u>Age of Test</u>	<u>With PROTECRETE-MWC</u>	<u>Without PROTECRETE-MWC</u>
7 Days	961	736
28 Days	1,020	923

INTERPRETATION AND CONCLUSIONS:

The increase in flexural (in percent) was 30.6% and 10.5% at 7 and 28 days respectively. This significant, particularly at the early age.

FINAL SUMMARY

At this point in the testing process it is apparent that PROTECRETE-MWC is, in our opinion, responsible for increased compressive and flexural strengths. This can lead to a shorter curing and/or winter protection durations, quicker form removal, backfill, and load application schedules. Further, within certain limits, it could result in reduced cement factors in the concrete mix.

Should you have questions concerning these results, please do not hesitate to call.

Respectfully submitted,

SUMMIT TESTING & INSPECTION COMPANY

John Malivuk, P.E.

JM:p