2009 NTPEP Report Series

NTPEP Report 9007.2

TWO YEAR REPORT OF FIELD PERFORMANCE AND LABORATORY EVALUATIONS OF RAPID SETTING PATCHING MATERIALS FOR PORTLAND CEMENT CONCRETE

JUNE 2006 PRODUCT SUBMISSIONS

January 2009

American Association of State Highway and Transportation Officials (AASHTO)

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PROLOGUE

General Facts about NTPEP Reports

- NTPEP Reports contain data collected according to laboratory testing and field evaluation protocols developed through consensus-based decision by the AASHTO's NTPEP Oversight Committee. These test and evaluation protocols are described in the *Project Work Plan* found in the Appendix of this Report.

- Products are voluntarily submitted by manufacturers for testing by NTPEP. Testing fees are assessed from manufacturers to reimburse AASHTO member departments for conducting testing and to report results. AASHTO member departments provide a voluntary yearly contribution to support the administrative functions of NTPEP.

- AASHTO/NTPEP does not endorse any manufacturer's product over another. Use of certain proprietary products as "test control specimens" does not constitute endorsement of those products.

- AASHTO/NTPEP does not issue product approval or disapproval; rather, test data is furnished for the User to make judgement for product prequalification or approval for their transportation agency.

Guidelines for Proper Use of NTPEP Results

- The User is urged to carefully read any Introductory notes at the beginning of this Report. Also, to consider any special clauses, footnotes or conditions which may apply to any test reported herein. Any of these notes may be relevant to the proper use of NTPEP test data.

- The User of this Report must be sufficiently familiar with the product performance requirements and/or (standard) specification of their agency in order to determine which test data is relevant to meeting those qualifying factors.

- NTPEP test data is intended to be predictive of actual product performance. Where a transportation agency has successful historical experience with a given product it is suggested to factor that precedence in granting or withholding product approval or prequalification.

NTPEP Report Special Advisory for Rapid Set Concrete Patching Materials (RSCP)

- For transportation agencies who desire to have *Rapid Set Concrete Patching Materials* periodically resubmitted for NTPEP evaluation, the RSCP Project Panel recommends a retest period of five (5) years, with a survey of member departments to be taken in 2003. (Adopted May 1999)

- The User is urged to establish QC/QA protocols for project-level acceptance of products. This NTPEP Report is useful only for expediting product prequalification and does not take the place of a managed QC/QA program.

- For specific questions regarding this NTPEP Report or for advice on how to implement NTPEP data furnished in this Report the User is encouraged to contact the NTPEP Program Manager at (202) 624-7830 for a listing of NTPEP Lead States.

***Ross Mills,* (KY)**
Chairman, RSCP Technical Committee

***Curt Niehaus,* (KS)**
Vice Chairman, RSCP Technical Committee

2009 NTPEP Report Series

National Transportation Product Evaluation Program

LABORATORY AND HORIZONTAL FIELD EVALUATIONS OF RAPID SETTING PATCHING MATERIALS FOF PORTLAND CEMENT CONCRETE

JUNE 2006 PRODUCT SUBMISSIONS

NTPEP Report 9007.2

Report by:

Ohio Department of Transportation

Field Testing by:

Ohio Department of Transportation

Lab Testing by:

Kansas Department of Transportation

New York State Department of Transportation

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Background Information

The purpose of the American Association of State Highway and Transportation Officials' National Transportation Product Evaluation Program (AASHTO/NTPEP) is to provide an efficient, cost effective way of evaluating products that are used by member transportation departments in the construction of transportation facilities.

Manufacturers/suppliers who wish to have their products considered for use on transportation projects submit their materials to a central/lead agency, which coordinates a testing program using one or more testing facilities. A report is generated showing the results of the testing, and distributed to member departments for their use in determining the applicability of the product(s) for use in their state.

The NTPEP Project Panel on Rapid Setting Patching Materials for Portland Cement Concrete developed the procedures for this program work plan. These procedures will be reviewed each year at the annual Oversight NTPEP committee meeting. This annual review will respond to the changing needs of Member Departments and the technical improvements provided by the industry.

The NTPEP reports the results of these evaluations, but does not accept or reject products. However, transportation officials may choose to use the results of the evaluations in the development and maintenance of product prequalification lists.

Under agreement with The American Traffic Safety Surfaces Association (ATSSA), this panel has two industry representatives. This ensures that industry concerns, experience and technical knowledge are considered in the testing and evaluation of products, material, and/or devices that are commonly used by the AASHTO Member Departments.

Laboratory Testing

Laboratory Testing Material Criteria

The study will look at both water based and non water based rapid setting materials used to patch Portland cement concrete. These will include cementitious, latex modified, polymer resin, magnesium phosphate, and other materials expressly designed for patching Portland cement concrete bridge decks and Portland cement concrete pavements. In order to be classified as fast setting, the product must reach a traffic loadable condition (1200 psi compressive strength) in less than three hours.

Materials will be limited to two (2) per manufacturer, per year.

Testing to be Performed

There are certain standard lab tests which should be used to evaluate Rapid Setting Patching Materials for Portland Cement Concrete. There are also some non-standard procedures which can prove to be valuable in assuring that materials procured by users are of the same quality as those originally tested.

The amount of water to be used shall be the maximum allowed as designated on the manufacturers' shipping container.

The test for time of set will be made in accordance with ASTM C 266.

Compressive strength tests shall be made at 1 hour, 3 hours, 1 day, and 7 days in accordance with ASTM C 39, using 4 inch x 8 inch cylinders.

Two Freeze thaw tests shall be in accordance with ASTM C 666; Procedure B, and Procedure B with salt water.

Coefficient of Thermal Expansion and Shrinkage shall be measured in accordance with ASTM C 531 with the following modifications: “Measure at 1 day, 3 days, 7 days, and 11 days. The samples are stored at 73F for the first 7 days, then placed in oven at 210F for 3 more days, then let cool a minimum of 16 hours at 73F”.

Bond strength shall be measured by slant shear in accordance with ASTM C 882 for polymer systems, and ASTM C 928 for cementitious systems.

UV Stability shall be measured in accordance with ASTM D 4587 (QUV), Method D, Type B bulb. Testing will be with the neat material only. The specimen will be 3-1/2 inches long by 2-1/4 inch wide, by 3/4 inches thick, with two specimens per sample. Testing will be for 1000 hours, or until complete failure is noted.

Extender aggregate shall be tested for soundness in accordance with AASHTO T103 Procedure A, gradation in accordance with AASHTO T27, and for absorption in accordance with AASHTO T84 and T85.

Summary of Tests

The following lists the applicable ASTM specifications for testing both water based and non water based patching materials.

Water Based Materials

Test	Specification
* Compression, Cylinders	ASTM C 39
* Freeze / Thaw	ASTM C 666
* Freeze / Thaw	ASTM C 666 with salt water
* Set Time	ASTM C 266
* Bond Strength using Slant Shear	ASTM C 928
Thermal Expansion and Shrinkage	ASTM C 531 modified

Non Water Based Materials

Test	Specification
* Compression, Cylinders	ASTM C 39
* Freeze / Thaw	ASTM C 666
* Set Time	ASTM C 266
* Bond Strength using Slant Shear	ASTM C 882
Thermal Expansion and Shrinkage	ASTM C 531 modified
UV Stability	ASTM D 4587, Method D, (Type B bulb)

Extender Aggregate

Test	Specification
Gradation	AASHTO T27
Soundness	AASHTO T103
Absorption	AASHTO T84 or T85

*Test material as supplied (neat) and as extended with the maximum amount of extender aggregate allowed as per the manufacturer's written instructions.

Laboratory evaluation of the more sophisticated or exotic patching materials should be made for reference purposes and as described in manufacturer's product data information.

Manufacturers shall indicate if the product is to be wet or dry cured

Dry cure will be in the Lab at a 50% Relative Humidity and 73F.

Field Performance Testing

Site Selection: One test bridge location will be selected. Sites will generally have the following characteristics:

- Full depth Portland Cement Concrete bridge deck surface, no overlays or membranes.
- Wet freeze climate.
- Patches should be located away from expansion joints and end dams.
- Boundaries of the patch area will be original sound concrete.
- Patch areas will be similar of size (Nominal 9ft x 3ft x 4 inches deep).
- All patch edges will be saw cut.

Installation: The manufacturer will supply all labor and equipment to completely install the properly sampled and marked material, including water and extender aggregate, if required. The Field Testing State will provide the necessary traffic control and will prepare a patch hole of the appropriate size by using concrete saws and jack hammers. The manufacturer's representative will certify that their patching material is installed in accordance with their written instructions and to their satisfaction. If the representative feels their installation was unsatisfactory, they will inform the representative of the Field Testing State of this fact in writing, within one week of the installation. Upon notification, the Field Testing State may drop that manufacturer's installation from further testing without a refund of fees. If no written notification is received within the first week, the installation will be accepted and included in the field test. Only one patch will be installed for each material submitted

Field Observations: Testing will commence upon completion of the installation and continue for two years. Field observations will be made during the installation, at 12 months (interim) and at 24 months (final).

Measurements/reporting requirements:

- Material characteristics and installation procedures.
- Photos of the installation procedure, and at each evaluation. Color photos are available in the online report located at: http://www.ntpep.org/
- Patch dimensions.
- Site characteristics – Average daily traffic, percent trucks, and area weather data.
- Percent of delamination, edge/cross patch cracking width, and percent spalling.

Subjective rating of the patch material performance is based on the following table:

Rating	Cracking or Edge Debonding		Delamination or Hollow		Spalling
1	Over 1/8 inch	and	Over 90%	and	Over 90%
2	1/16 inch	or	Over 70%	and	Over 70%
3	1/32 inch	or	Over 50%	and	Over 50%
4	Hairline	or	Over 30%	or	Over 30%
5	None	and	None	or	Slight

* Schmidt Hammer may be used as a tool for measuring delamination.

2006 Product Submissions

NTPEP Number	Manufacturer	Product Trade Name	Lab Tested	Field Tested
RSCP(2006)-01	Roklin Systems Inc.	Flexset	Yes	Yes
RSCP(2006)-02	Roklin Systems Inc	Concrete Welder	Yes	Yes
RSCP(2006)-03	The Quikrete Companies	Commercial Grade FastSet DOT Mix w/ Fibers	Yes	Yes
RSCP(2006)-04	Williamette Valley Company	FastPatch	Yes	No
RSCP(2006)-05	US Concrete Products	HP DOT Grade Repair Mortar	Yes	Yes
RSCP(2006)-07	CTS Cement. Manufacturing Corp.	Rapid Set DOT Repair Mix	Yes	Yes
RSCP(2006)-08	Mineral Resource Technologies (MRT), Inc., A CEMEX Company	ArmorFast Rapid Hardening Hydraulic Mortar	Yes	Yes

NTPEP and State DOT Contacts

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Summary of Field Site Characteristics

The field testing site was bridge deck LUC-75-0490 ER. This is an off ramp bridge from I-75 NB to Jeep Parkway, just north of the I-75 / 475 interchange in Toledo, Ohio.

The structure is a continuous steel beam bridge built in 1972. The deck has minor cracking and in general is in good condition. The deck has no significant debonding or delamination and is sound dense concrete.

The 2007 traffic survey data indicated the bridge carried 1852 ADT, with 6% trucks.

The average weather data for the area is summarized in the follow table.

Average Temperature Range (deg. F)	22.5 – 72.1
Average Temperature (deg. F)	48.5
Average Annual Rainfall (inches)	33.0
Average Annual Snowfall (inches)	37.1
Average # Days Below 32 deg. F	138
Average # Days Above 90 deg. F	14

Summary of Product Installations

The products were installed on Sunday October 7, 2006. The preparation of the patch holes began on Saturday evening and continued through the early morning hours. The bridge was shut down to traffic for the preparation of the holes and the installation of the patches. Traffic control, saw cutting and removal of the patch area concrete, and cleaning of the patch area with compressed air, was performed by the Ohio DOT.

The patches were placed across the deck in the order of their NTPEP number. Patch locations were determined by finding areas with no previous patches, no cracking, no spalling, and had sound concrete across the 3ft by 9ft patch area. All patches were a nominal 3ft by 9ft by 3.5 inches deep.

Product installations started around 8:30 am and were completed by 11:30 am. The road was opened back to traffic at 5 pm that day. No issues were encountered during these installations.

The weather conditions for the day(s) of the installation are shown in the table below

Date	Time	Temperature (F)	Wind Speed (mph)
10/7/06	4am	46	Calm
	6am	44	Calm
	8am	44	Calm
	10am	59	Calm
	12 noon	61	Calm
	2pm	62	4
	4pm	61	Calm
	6pm	59	Calm
	8pm	54	Calm
	10pm	50	Calm
	12 Midnight	49	Calm

Project Note:
In August 2008, the bridge deck was shut down to traffic due to emergency repairs that were required on an adjacent structure. This was two months short of the complete two year cycle.

Product Descriptions and Installation Instructions

NTPEP # RSCP-	Manufacturer / Product	Product Description	Product Generic Description	Summarized Installation Instructions
(2006) – 01	Roklin Systems Inc / Flexset	Two part polymer concrete kit	Polymer A and Polymer B with specially treated, naturally rounded, aggregate	Apply product to stable, clean, uncoated dry surfaces. Mix polymers and sand using a simple pail mixer and heavy duty drill. Pour and trowel product over deteriorated concrete. Top with aggregate. After products sets up, open to traffic.
(2006) – 02	Roklin Systems Inc / Concrete Welder	Thin flowing rapid setting polymer concrete designed for concrete slab stabilization	Polymer A and Polymer B	Product is designed for filling cracks in concrete. For use as a patch material fill dry, clean hole first to within ½" of surface with clean dry aggregate. Flood patch with product at a rate of one gallon per 100 sq ft. Immediately broadcast sand to refusal into uncured liquid. When cured sweep off excess sand.
(2006) – 03	The Quikrete Companies / Commercial Grade FastSet DOT Mix w/ Fibers	Rapid setting material specifically designed to meet ASTM C928 R3 for a high performance repair material	Blend of rapid hardening cement, sand, special additives, and fibers	Surface must be clean and free of foreign substances. Remove all spalled areas and areas of unsound concrete. Hole should have a vertical edge of ½" or more. Dampen hole with clean water. Mechanically mix product for a minimum of 3 minutes using a concrete or mortar mixer. Use 1 gallon of water per 55lb bag or 80lb bag extended. Adjust water as needed to achieve a placeable consistency (slump between 3 and 7"). Place material using light rodding to eliminate bubbles. Mechanical vibration should be avoided in areas that will be exposed to de-icing salts. Strike off with a straight board and float immediately. Apply Quikrete Concrete Sealer (#8800) by spray, brush or roller.
(2006)-04	Williamette Valley Company / FastPatch	Rapid set polymer resin for repair of holes and spalls in concrete roadways	Two component polyurethane	(This product was lab tested only) Sweep patch hole and remove heavy debris. Use compressed air to blow out dust. Surface should be free of dirt, oils, latents, dust, and 100% free of water. Open kit and remove resin and isocyanate. Leave gravel in bucket. Shake resin jug for 30 sec. Pour resin into bucket with gravel. Mix resin and gravel with drill and concrete mixing blade. Add isocyanate to gravel mixture and thoroughly mix with concrete mixing blade for a minimum of 60 sec. Pour mixed product into hole and spread material for proper leveling. Avoid overfilling. Add topping sand to refusal on surface.

Product Descriptions and Installation Instructions (cont.)

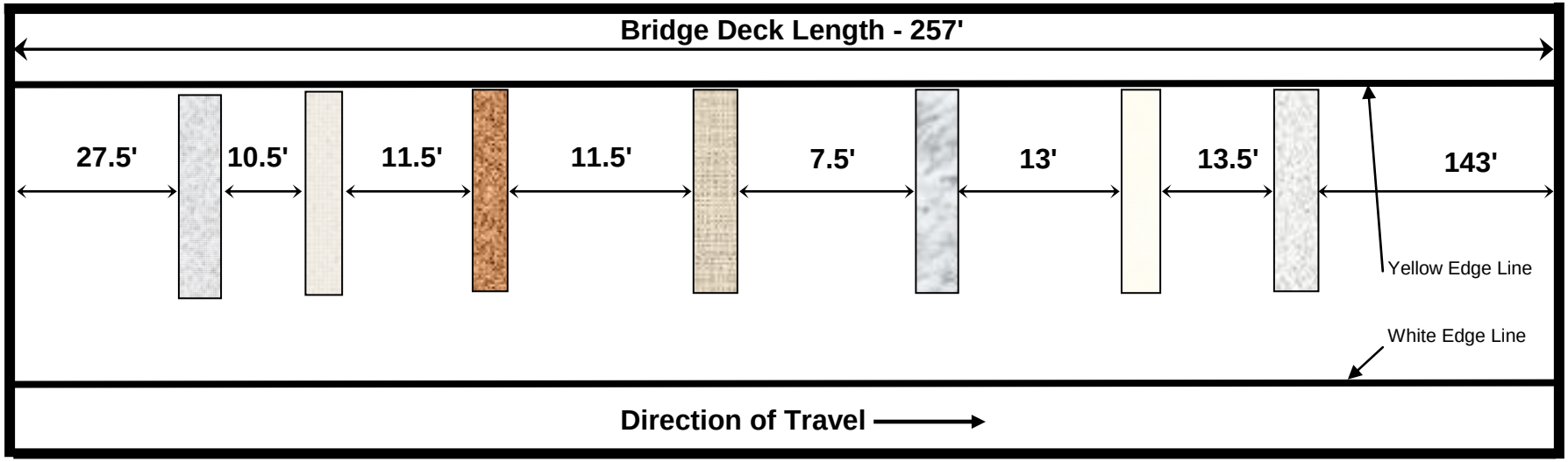
NTPEP # RSCP-	Manufacturer / Product	Product Description	Product Generic Description	Summarized Installation Instructions
(2006) – 05	US Concrete Products / HP DOT Grade Repair Mortar	Single component, high early strength repair mortar.	Portland cement, aggregate, and internal corrosion inhibitor	Remove all loose debris, surface laitance, paint, oil, dust, or any foreign material that would inhibit a good bond. Chip deteriorated concrete to sound, tight surface with exposed aggregate using best possible mechanical means. All embedded steel should be cleaned to an exposed white metal condition. Mix product in a rotary drum or other suitable mechanical mixer. Introduce measured amount of water to mixer (no more than 4 quarts per bag). If adding aggregate, add ¾ the required water to the aggregate in the operating mixer. Add product to water and aggregate. Add remaining amount of water. Mix for no more than 3 minutes to obtain desired consistency. Immediately place material into properly prepared substrate. Cure as soon as possible after repaired area has hardened. For best results cover with wet burlap and polyethylene. Curing compounds may be used when water is not practical.
(2006) – 07	CTS Cement. Manufacturing Corp. / Rapid Set DOT Repair Mix	Rapid strength gain, high durability and low shrinkage mix for general concrete repair	Blend of high performance Rapid Set cement, graded sand, and select additives	Concrete repair surfaces should be clean, sound, and free from any materials that might inhibit bond such as oil, asphalt, curing compounds, acids, dirt and loose debris. Roughen surface and remove all unsound concrete. Immediately prior to placement the repair surface should be thoroughly saturated with non-standing water. The working time is 10-20 minutes @ 70F. See product package for amount of water to use. Follow manufacturer's recommendations for mixing in cold and hot conditions. Add water to mixer. While mixer is running, add bagged material. Mix for 1-3 minutes to achieve a uniform, lump-free consistency. Do not re-temper. Place material quickly and strike off with screed. Apply desired finish. Begin water curing immediately after finishing.

Product Descriptions and Installation Instructions (cont.)

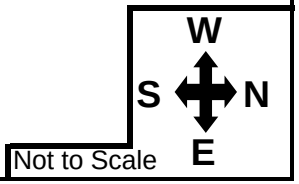
NTPEP # RSCP-	Manufacturer / Product	Product Description	Product Generic Description	Summarized Installation Instructions
(2006) – 08	Mineral Resource Technologies (MRT), Inc., A CEMEX Company / ArmorFast Rapid Hardening Hydraulic Mortar	Scientifically formulated patch material for concrete or concrete structure repair. Can be extended 100% w/ No. 57 or 7 stone.	Minerals of silica, alumina, calcium and special clays, and other proprietary compounds, cement derived primarily from recycled and activated coal fly ash	Square up patch area. The material below patch must be stable. Steel must comply with ACI 345R. All surfaces must be clean and free of foreign matter (dirt, loose debris, oil, grease, paints, sealers, ect.). Surface must be saturated with water prior to placement (no standing water). Use a machine mixer. Add correct amount of water to mixer. Add gravel to the mixer. Adjust water content based on aggregate moisture. Begin mixing and slowly add mortar to the mixture over approximately 1 minute. Mix for 6-8 minutes. If mix is still dry after 4 minutes sparingly add water and mix for at least another minute before adding more water. Repeat this step if necessary. Pour mix in place. Use a concrete vibrator to reduce air pockets. Use a vibrating power screed to strike off the surface. Float one time. When sheen starts to dissipate, broom or burlap finish. Immediately after finishing spray concrete with curing compound. Use a membrane curing compound meeting ASTM C309.

2006 NTPEP Rapid Setting Patch Material Ohio Test Deck
Product Patch Location on Bridge Deck - LUC-75-0490 ER
Off Ramp from I-75 NB to Jeep Parkway
Installed 10/7/06

(all patches were 3 ft by 9 ft by 3.5 inches deep)



NTPEP # -----	2006-01	2006-02	2006-03	2006-05	2006-07	2006-08	ODOT Control Section
Manufacture--	Roklin	Roklin	Quikrete	US Concrete Product	CTS Cement Co.	MRT	Master Builders
Product -----	Flexset	Concrete Welder	Com. Grade Fast DOT Mix w/ Fibers	HP DOT Grade Repair Mortar	Rapid Set DOT Repair Mix	ArmorFast Rapid Hardening Hydraulic Mortar	Set 45



Installation Photos: RSCP(2006)–01, Roklin Systems Inc / Flexset

Prepared patch hole

Mixing product

Placing product

Screeding product

Applying sand topping on surface

Finished product

(Note: Color photos are available in the online report located at: http://www.ntpep.org/)

Installation Photos: RSCP(2006)–02, Roklin Systems Inc / Concrete Welder

Prepared patch hole

Applying product to aggregate filled hole

Screeding product

Sand topping

Saturate sand with additional product

Finished product

Installation Photos: RSCP(2006)–03, Quikrete / Commercial Grade FastSet DOT Mix w/ Fibers

Prepared patch hole

Dampening patch hole surface

Mixing product

Placing and sceeding product

Finishing product

Finished product

Installation Photos: RSCP(2006)–05, US Concrete Products / HP DOT Grade Repair Mortar

Prepared patch hole

Dampening patch hole surface

Mixing product

Placing product

Screeding and finishing product

Finished product

Installation Photos: RSCP(2006)–07, CTS Cement. Manufacturing Corp. / Rapid Set DOT Repair Mix

Prepared patch hole

Dampening patch hole surface and mixing

Placing and screeding product

Finishing product

Broom finishing surface

Finished product

Installation Photos: RSCP(2006)–08, Mineral Resource Technologies / ArmorFast Rapid Hardening Hydraulic Mortar

Prepared patch hole

Dampening patch hole surface

Working product into crevices

Vibrating and screeding product

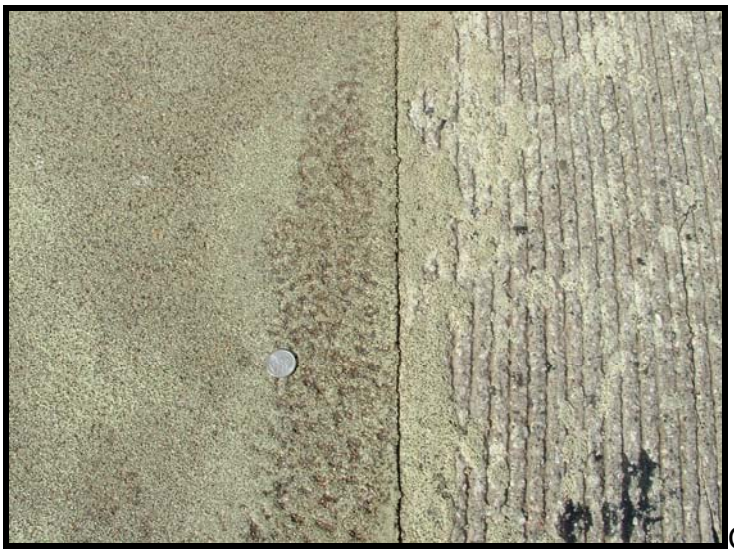
Broom finishing surface

Finished product

Year 1 Photos: RSCP(2006)–01, Roklin Systems Inc / Flexset

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

(Note: Color photos are available in the online report located at: http://www.ntpep.org/)

Year 2 Photos: RSCP(2006)–01, Roklin Systems Inc / Flexset


Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 1 Photos: RSCP(2006)–02, Roklin Systems Inc / Concrete Welder

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 2 Photos: RSCP(2006)–02, Roklin Systems Inc / Concrete Welder


Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 1 Photos: RSCP(2006)–03, Quikrete /Com. Grade FastSet DOT Mix w/ Fibers

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 2 Photos: RSCP(2006)–03, Quikrete /Com. Grade FastSet DOT Mix w/ Fibers


Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 1 Photos: RSCP(2006)–05, US Concrete Products / HP DOT Grade Repair Mortar

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 2 Photos: RSCP(2006)–05, US Concrete Products / HP DOT Grade Repair Mortar


Entire Patch

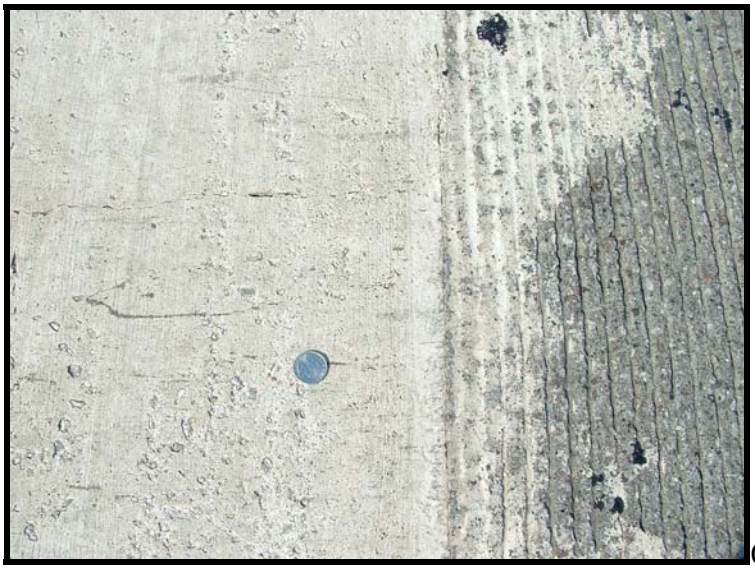

Close-up - surface


Close-up – edge (quarter is on patch)

Year 1 Photos: RSCP(2006)–07, CTS Cement. Manuf. Corp. / Rapid Set DOT Repair Mix

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 2 Photos: RSCP(2006)–07, CTS Cement. Manuf. Corp. / Rapid Set DOT Repair Mix

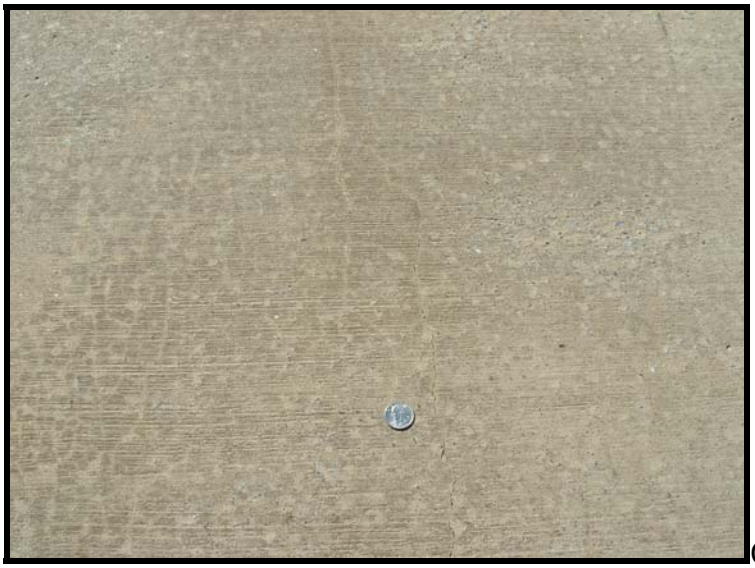

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 1 Photos: RSCP(2006)–08, MRT / ArmorFast Rapid Hardening Hydraulic Mortar

Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

Year 2 Photos: RSCP(2006)–08, MRT / ArmorFast Rapid Hardening Hydraulic Mortar


Entire Patch


Close-up - surface


Close-up – edge (quarter is on patch)

2006 NTPEP RSCP - Ohio Test Deck Weather Summary

	Average Temperatures			Precipitation
	High	Avg	Low	(inch)
Oct-06	59.4	49.6	40.8	3.3
Nov-06	50.9	43.3	36.7	1.9
Dec-06	44.3	37.7	32.1	3.3
Jan-07	37.3	31.6	25.4	2.6
Feb-07	26.4	19.7	12.7	0.2
Mar-07	50.4	40.8	32.1	2.0
Apr-07	57.8	48.0	38.7	2.9
May-07	75.2	63.9	52.5	1.7
Jun-07	83.8	72.6	60.4	3.0
Jul-07	83.8	73.1	61.9	1.5
Aug-07	84.7	74.5	65.4	5.2
Sep-07	80.3	67.3	56.2	1.1
Oct-07	70.4	59.7	50.9	1.3
Nov-07	49.0	40.8	32.8	2.0
Dec-07	36.1	30.7	25.5	2.5
Jan-08	36.6	29.3	22.3	2.6
Feb-08	33.8	26.3	19.2	3.7
Mar-08	43.0	35.0	27.5	7.9
Apr-08	62.9	51.9	41.0	2.1
May-08	68.3	58.2	48.2	1.8
Jun-08	81.2	70.9	61.6	4.2
Jul-08	85.4	74.5	63.6	4.7
Aug-08	83.1	71.6	60.9	0.8
Sep-08	78.1	66.1	55.7	2.7
Oct-08	68.4	56.2	45.3	0.4

Patch Rating Data
NTPEP / RSCP - 2006 Ohio Test Deck

SUBJECTIVE RATING *				Rating	
NTPEP #	Manuf.		Product	Year 1	Year 2
2006-01	Roklin Systems Inc		Flexset	2	2
2006-02	Roklin Systems Inc		Concrete Welder	2	2
2006-03	Quikrete		Com. Grade Fastset DOT w/ Fibers	3	3
2006-05	US Concrete Products		HP DOT Grade Repair Mortar	4	3
2006-07	CTS Cement		Rapid Set DOT Repair Mix	4	4
2006-08	MRT		ArmorFast Mortar	4	4

PATCH DISTRESS DATA				Year 1				Year 2			
NTPEP #	Manuf.		Product	Midpanel Avg. Crack Width (in) / Total Length (ft)	Patch Edge Avg. Crack Width (in) / Total Length (ft)	% Delam.	% Spall	Midpanel Avg. Crack Width (in) / Total Length (ft)	Patch Edge Avg. Crack Width (in) / Total Length (ft)	% Delam.	% Spall
2006-01	Roklin Systems Inc		Flexset	0	1/16" / 12 ft	0	0	0	1/8" / 10ft 1/16" / 14ft	22%	0
2006-02	Roklin Systems Inc		Concrete Welder	1/16" / 2.5 ft	1/32" to 1/16" / Entire perimeter	15%	0	1/16" / 2.5 ft	1/16" / 17ft 1/32" / 7ft	21%	0
2006-03	Quikrete		Com. Grade Fastset DOT w/ Fibers	1/32" / 18 ft	< 1/32" / 10 ft	0	0	1/32" / 21 ft	< 1/32" / 10 ft	0	0
2006-05	US Concrete Products		HP DOT Grade Repair Mortar	< 1/32" / 14 ft	< 1/32" / 12 ft	0	0	1/32" / 14 ft	< 1/32" / 12 ft	0	0
2006-07	CTS Cement		Rapid Set DOT Repair Mix	< 1/32" / 25 ft	0	0	0	< 1/32" / 30 ft	< 1/32" / 10 ft	4%	0
2006-08	MRT		ArmorFast Mortar	< 1/32" / 9 ft	< 1/32" / 2ft	0	0	< 1/32" / 9 ft	< 1/32" / 2ft	0	0

*Subjective Criteria Used

Rating	Cracking or edge debonding		Delamination / hollow		Spalling
1	over 1/8 inch	and	over 90%	and	over 90%
2	1/16 inch	or	over 70%	and	over 70%
3	1/32 inch	or	over 50%	and	over 50%
4	Hairline	or	over 30%	or	over 30%
5	none	and	none	or	slight

NEW YORK STATE DOT -- TECHNICAL SERVICES DIVISION -- MATERIALS BUREAU
FINAL RESULTS: 2006 NTPEP FREEZE-THAW TEST of RAPID SET CONCRETE PATCH MATERIALS

NTPEP #	BRAND	NEAT MIX RATIO	NEAT MIX TESTING				EXTENDED MIX TESTING		
			CUBES		CYLINDERS		CYLINDERS		
			Avg. % Loss [after 50 cycles]	LIMS #	Avg. % Loss [after 50 cycles]	LIMS #	MIX RATIO	Avg. % Loss [after 50 cycles]	LIMS #
RSCP(06)-1	Flexset	1 / 1 / 7.2	0.0%	867	0.0%	866	1/1/7.2/ 6.0	0.0%	1356
RSCP(06)-2	Concrete Welder	1 / 1 / 11.9	0.0%	869	0.0%	866	1/1/11.9/ 6.0	0.0%	1651
RSCP(06)-3	Com. Grade FastSet DOT Mix w/ Fiber	1 / 6.6	0.7%	3884	0.0%	3883	1 / 6.6 / 3.0	0.1%	3784
RSCP(06)-4	FASTPATCH-IT	4.4 / 1 / 10.7	0.0%	61	0.0%	60	Not Tested	----	----
RSCP(06)-5	HP DOT Grade Repair Mortar	1 / 6.6	2.8%	3734	5.3%	3735	1 / 6.6 / 6.0	4.5%	3785
RSCP(06)-6	Uniroad Repair DOT	1 / 6.85	48.8%	3730	33.1%	3731	1 / 6.85 / 1.7	45.3%	3932
RSCP(06)-7	Rapid Set DOT Repair Mix	1 / 5.3	0.0%	3732	0.1%	3733	1 / 5.3 / 5.3	0.7%	3933
RSCP(06)-8	ArmorFast Rapid Hardening Hydraulic Mortar	1 / 15	0.7%	3736	1.6%	3737	Not Tested	----	----

Notes: 1. The Test Method used was NY 502-3P, 50 cycles, 10% NaCl. **2**. Neat specimens were cast as standard 2" cubes and 3" x 6" cylinders. **3**. Extended specimens (and patch materials supplied premixed with extender aggregate) were cast as 3" x 6" cylinders. **4**. When the addition of coarse aggregate was required, crushed limestone conforming to New York State specification Type CA 1 was used. (Refer to ASTM C33 coarse aggregate size number 7.) **5**. When allowed by written instructions, the maximum allowable amount of aggregate was added to extend the mix. **6**. For water based mixes, the maximum allowed water to dry mix ratio was used. **7**. Neat mix ratios expressed as liquid to dry mix. Extended mix ratios expressed as liquid to dry mix to coarse aggregate. **8**. Mix ratios are unitless for water based mixes (ie. g/g.). **9**. Samples with obvious failure are removed before the completion of 50 cycles. **10**. Testing is not progressed if workable consistency is not achieved with maximum solvent per instructions. **11**.Pass/fail criteria from NYSDOT Standard Spec., Item 701-09, Rapid Set Concrete Repair Material -Normal Weather

2006 Rapid Setting Patching Material
Kansas DOT Lab Testing Results
(Materials Tested Neat)

NTPEP #	Initial Set Time (min)	Comp. Strength 1 Hr (psi)	Comp. Strength 3 Hr (psi)	Comp. Strength 1 Day (psi)	Comp. Strength 7 Days (psi)	Bond Strength by Slant Shear 1Day (psi)	Bond Strength by Slant Shear 7Day (psi)	Expansion @ 300 Cycles (%) or at Termination	Durability Factor @ M=300 Cycles	Linear Shrinkage 1 Day (%)	Linear Shrinkage 3 Day (%)	Linear Shrinkage 7 Day (%)	Linear Shrinkage 11 Day (%)	Coef. of Thermal Expansion (in/in/Deg F)
RSCP 2006-01	285	*	*	1610	1520	250	330	-0.019	97	0.000	0.005	0.023	0.048	0.0000322
RSCP 2006-03	35	5020	7740	8850	9530	3350	4050	0.009	99	0.028	0.047	0.057	0.348	0.0000207
RSCP 2006-04	25	530	1230	1420	1100	440	380	-0.009	99	0.069	0.076	0.069	0.154	0.0000646
RSCP 2006-06	25	2750	3720	4020	4150	2950	3440	0.020	103	0.025	0.043	0.054	0.313	0.0000069
RSCP 2006-07	60	3760	5150	6110	7130	2920	3600	0.005	104	0.049	0.077	0.093	0.855	0.0000046
RSCP 2006-08	20	2240	3820	5620	7610	2900	3510	0.015	102	0.040	0.086	0.100	0.238	0.0000065

* Unable to test, material did not set before break

UV Stability Test - RSCP(2006)-01	After 1000 hours, the specimens showed no evidence of cracking, checking, blistering, eroding, or flaking. The color of the specimens did become yelowish with curing. Digital photographs were taken at 0, 250,500,750 and 1000 hours and are available.
UV Stability Test - RSCP(2006)-04	After 1000 hours, the specimens showed no evidence of cracking, checking, blistering, eroding, or flaking. The color of the specimens did become slightly darker with curing. Digital photographs were taken at 0, 250,500,750 and 1000 hours and are available.

Product Information

NTPEP #	Manufacturer Name	Address	Phone Number	Product Identification
RSCP(2006)-01	Roklin Systems, Inc.	20541 Pascal Way Lake Forest, CA 92630	949-707-6111	FlexSet
RSCP(2006)-03	The Quikrete Companies	3490 Piedmont Road, Suite 1300 Atlanta, GA 30305	404-926-3181	Commerical Grade FastSet DOT Mix (with fibers)
RSCP(2006)-04	Willamette Valley Company	1075 Arrowsmith Street Eugene, OR 97402-9121	541-484-9621	FastPatch-It
RSCP(2006)-06	Universal Form Clamp Co.	840 South 25th Avenue Bellwood, IL 60104	800-646-3816	Uni Road Repair DOT
RSCP(2006)-07	CTS Cement Manuf. Corp.	11065 Knott Ave. Suite A Cypress, CA. 90630	714-379-8260	Rapid Set DOT Repair Mix
RSCP(2006)-08	MRT Cements/CEMEX Inc.	2700 Research Forest Drive The Woodlands, TX 77381	281-362-1060	MRT ArmorFast Rapid Hardening Mortar

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-01
Mix Number: 06-01 ABC **Neat**

Date Made: 03/13/07
N squared: 1103200

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
24	0.003	0.0001111	21	0.0023	-0.019

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
5.07	0.21	4.43270	96.66

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06-01 A	0.2371	11.91	11.98	0.59	0.00	11.98	1.0	0.00	0.00
06-01 B	0.2186	12.62	12.74	0.95	0.00	12.74	1.0	0.00	0.00
06-01 C	0.1819	11.70	11.75	0.43	0.00	11.75	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comment
06-01 A,B,C	3/27/07	14	0	0.000	0.00	1050	100	
06-01 A,B,C	3/30/07	17	24	0.000	-0..17	1002	91	
06-01 A,B,C	4/3/07	21	56	-0.003	-0.25	1003	91	
06-01 A,B,C	4/06/07	24	80	-0.006	0.4	1154	121	
06-01 A,B,C	4/10/07	28	112	-0.016	-0.19	1019	94	
06-01 A,B,C	4/13/07	32	136	-0.015	-0.16	1012	93	
06-01 A,B,C	4/17/07	35	168	-0.025	-0.16	1041	98	
06-01 A,B,C	4/20/07	39	192	-0.024	-0.16	1007	92	
06-01 A,B,C	4/24/07	42	224	-0.018	-0.11	1058	101	
06-01 A,B,C	4/27/07	46	247	-0.023	-0.16	1034	97	
06-01 A,B,C	5/1/07	49	279	-0.021	-0.16	1009	92	
06-01 A,B,C	5/4/07	52	303	-0.019	-.14	1036	97	

NTPEP # RSCP(2006)-01
Mix# 06-01 A,B,C Neat
Roklin
Flexset

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-03
Mix Number: 06-03 ABC **Neat**

Date Made: 1/03/07
N squared: 2692881

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
25	0.001	0.0000267	18	0.0005	0.009

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.20	0.01	0.14559	99.13

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06-03A	0.1651	15.73	16.03	1.91	0.00	16.03	1.0	0.00	0.00
06-03B	0.1543	16.36	15.66	1.95	0.00	15.66	1.0	0.00	0.00
06-03C	0.1303	15.49	15.8	2.00	0.00	15.80	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comment
06-03 A,B,C	1/17/07	14	0	0.000	0.00	1641	100	
06-03 A,B,C	1/23/07	20	48	0.006	0.11	1613	97	
06-03 A,B,C	1/26/07	23	72	0.009	0.13	1618	97	
06-03 A,B,C	1/30/07	27	101	0.012	0.17	1623	98	
06-03 A,B,C	2/2/07	30	124	0.014	0.23	1619	97	
06-03 A,B,C	2/6/07	34	156	0.010	0.23	1619	97	
06-03 A,B,C	2/9/07	37	180	0.012	0.30	1624	98	
06-03 A,B,C	2/13/07	41	211	0.013	0.21	1625	98	
06-03 A,B,C	2/16/07	44	226	0.014	0.34	1629	99	
06-03 A,B,C	2/20/07	48	258	0.009	0.36	1629	99	
06-03 A,B,C	2/23/07	51	282	0.009	0.36	1633	99	
06-03 A,B,C	2/26/07	54	307	0.009	0.36	1634	99	

NTPEP # RSCP(2006)-03
Mix # 06-03 A,B,C Neat
Quikrete
Com. Grade FastSet DOT Mix
w/ Fibers

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-04
Mix Number: 06-04 ABC **Neat**

Date Made: 02/28/07
N squared: 1015392

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
24	0.006	0.0002500	7	0.0017	-0.009

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
-0.26	-0.01	-0.07680	99.06

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06-04 A	0.2371	11.91	11.98	0.59	0.00	11.98	1.0	0.00	0.00
06-04 B	0.2186	12.62	12.74	0.95	0.00	12.74	1.0	0.00	0.00
06-04 C	0.1819	11.70	11.75	0.43	0.00	11.75	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comment
06-04 A,B,C	3/14/07	14	0	0.000	0.00	1008	100	
06-04 A,B,C	3/20/07	20	48	0.001	0.00	1002	99	
06-04 A,B,C	3/23/07	23	70	0.001	0.00	1007	100	
06-04 A,B,C	3/27/07	27	101	-0.002	0.00	1001	99	
06-04 A,B,C	3/30/07	30	125	0.004	0.00	1001	99	
06-04 A,B,C	4/3/07	34	157	0.004	0.00	1003	99	
06-04 A,B,C	4/6/07	37	181	0.004	-0.03	1001	99	
06-04 A,B,C	4/10/07	41	213	-0.008	-0.03	1002	99	
06-04 A,B,C	4/13/07	44	237	-0.005	0.00	1052	109	
06-04 A,B,C	4/17/07	48	269	-0.014	-0.03	1001	99	
06-04 A,B,C	4/20/07	51	293	-0.011	0.00	1003	99	
06-04 A,B,C	4/23/07	54	317	-0.005	0.00	1002	99	

NTPEP # RSCP(2006)-04
Mix # 06-04 A,B,C Neat
Willamette Valley
FASTPATCH-IT

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-06
Mix Number: 06-06 ABC **Neat**

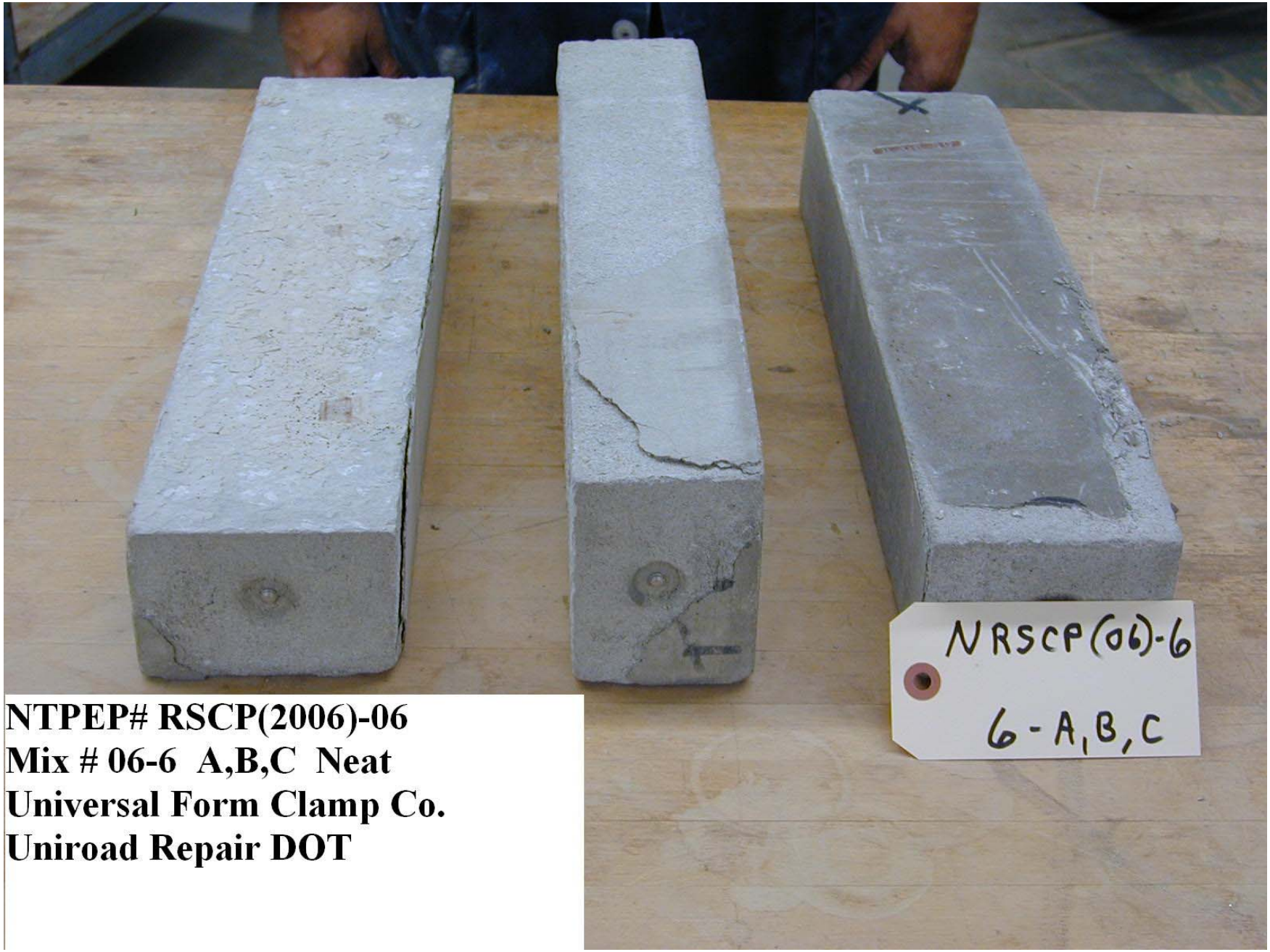
Date Made: 9/27/06
N squared: 2570678

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
24	0.001	0.0000278	14	0.0004	0.020

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.63	0.03	0.26999	103.47

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06-06 A	0.000	15.38	15.38	0.00	0.00	15.38	1.0	0.00	0.00
06-06 B	0.000	15.21	15.21	0.00	0.00	15.21	1.0	0.00	0.00
06-06 C	0.000	15.26	15.26	0.00	0.00	15.26	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comment
06-06 A,B,C	10/11/06	14	0	0.000	0.00	1603	100	
06-06 A,B,C	10/17/06	20	48	0.009	-0.57	1580	97	
06-06 A,B,C	10/20/06	23	71	0.010	-0.72	1586	98	A,B,& C top surface flaking off
06-06 A,B,C	10/24/06	27	103	0.011	-0.83	1591	98	
06-06 A,B,C	10/27/06	30	125	0.009	-0.92	1595	99	
06-06 A,B,C	10/31/06	34	157	0.013	-1.05	1599	99	
06-06 A,B,C	11/3/06	37	179	0.015	-1.31	1610	101	A,B, & C outer layer is flaking off
06-06 A,B,C	11/7/06	41	211	0.014	-1.64	1615	101	
06-06 A,B,C	11/9/06	43	227	0.014	-1.77	1621	102	
06-06 A,B,C	11/14/06	48	262	0.022	-2.18	1623	102	
06-06 A,B,C	11/17/06	51	286	0.019	-2.31	1628	103	
06-06 A,B,C	11/20/06	54	310	0.020	-2.36	1633	104	



NTPEP# RSCP(2006)-06
Mix # 06-6 A,B,C Neat
Universal Form Clamp Co.
Uniroad Repair DOT

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-07
Mix Number: 06-07 ABC **Neat**

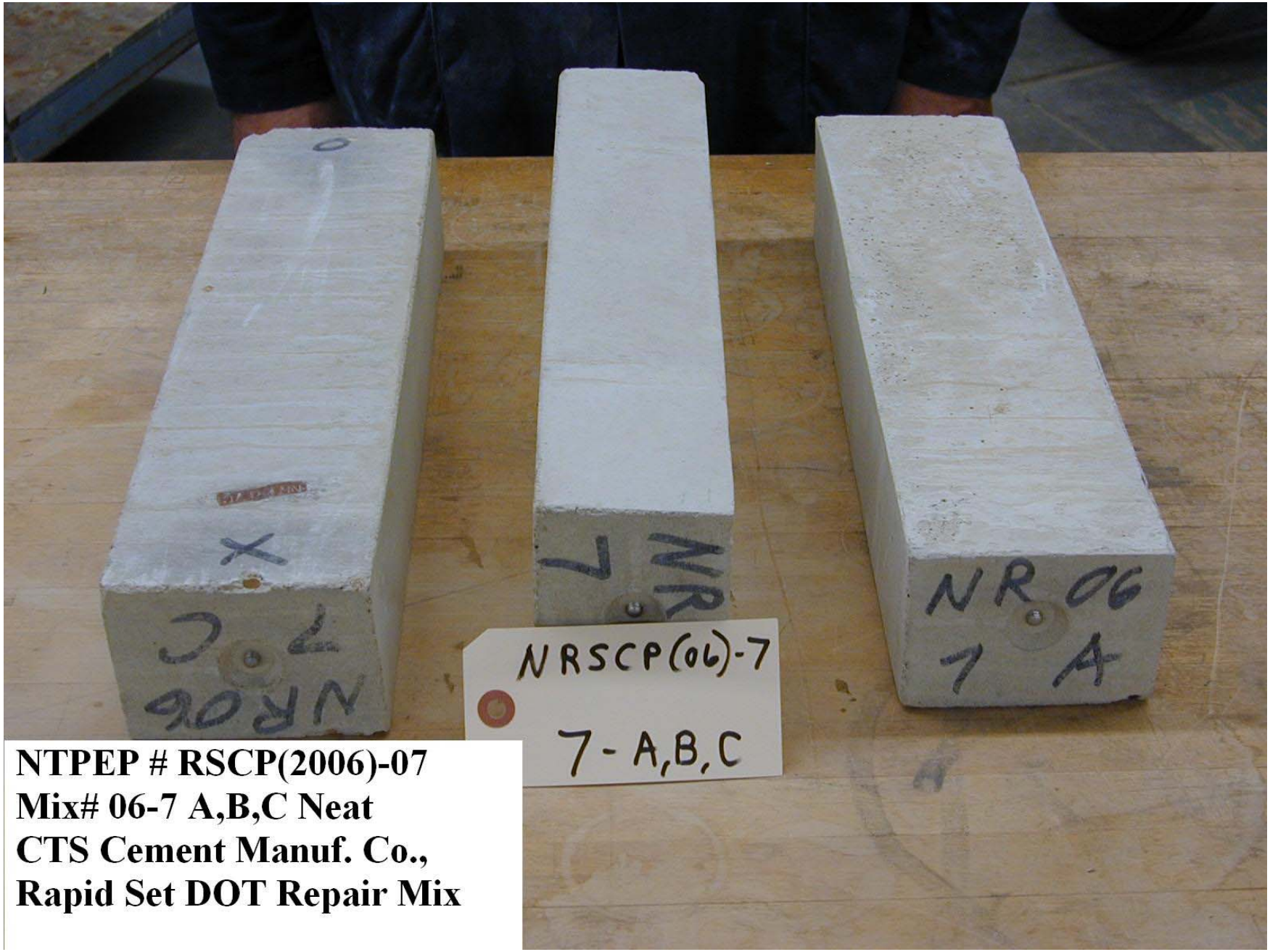
Date Made: 1/04/07
N squared: 2312427

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
25	0.003	0.0001156	25	0.0029	0.005

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.27	0.01	0.26785	103.81

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06-07A	0.1500	13.92	14.11	1.36	0.00	14.11	1.0	0.00	0.00
06-07B	0.1432	13.90	14.11	1.51	0.00	14.11	1.0	0.00	0.00
06-07C	0.1476	13.87	14.09	1.59	0.00	14.09	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comment
06-07 A,B,C	1/18/07	14	0	0.000	0.00	1521	100	
06-07 A,B,C	1/23/07	19	40	0.003	-0.07	1521	100	
06-07 A,B,C	1/26/07	22	64	0.003	0.02	1526	101	
06-07 A,B,C	1/30/07	26	93	0.004	0.05	1530	101	
06-07 A,B,C	2/2/07	29	116	0.005	0.05	1534	102	
06-07 A,B,C	2/6/07	33	148	0.001	0.05	1535	102	
06-07 A,B,C	2/9/07	36	172	0.002	0.07	1539	102	
06-07 A,B,C	2/13/07	40	204	0.006	0.17	1541	103	
06-07 A,B,C	2/16/07	43	219	0.004	0.07	1544	103	
06-07 A,B,C	2/20/07	47	251	0.001	0.09	1545	103	
06-07 A,B,C	2/23/07	50	275	0.002	0.09	1547	104	
06-07 A,B,C	2/26/07	53	300	0.005	0.09	1549	104	



NTPEP # RSCP(2006)-07
Mix# 06-7 A,B,C Neat
CTS Cement Manuf. Co.,
Rapid Set DOT Repair Mix

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-08
Mix Number: 06-08 ABC **Neat**

Date Made: 1/04/07
N squared: 3355003

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
25	0.001	0.0000444	25	0.0011	0.015

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.00	0.00	0.00000	101.83

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06-08A	0.1427	16.18	16.18	0.00	0.00	16.18	1.0	0.00	0.00
06-08B	0.1903	16.29	16.29	0.00	0.00	16.29	1.0	0.00	0.00
06-08C	0.1889	15.89	16.01	0.76	0.00	16.01	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comment
06-08 A,B,C	1/18/07	14	0	0.000	0.00	1832	100	
06-08 A,B,C	1/23/07	19	40	0.008	-0.06	1829	100	
06-08 A,B,C	1/26/07	22	64	0.006	-0.04	1834	100	
06-08 A,B,C	1/30/07	26	93	0.010	-0.02	1837	101	
06-08 A,B,C	2/2/07	29	116	0.012	-0.04	1839	101	
06-08 A,B,C	2/6/07	33	148	0.008	-0.02	1842	101	
06-08 A,B,C	2/9/07	36	172	0.009	0.06	1844	101	
06-08 A,B,C	2/13/07	40	204	0.011	0.02	1845	102	
06-08 A,B,C	2/16/07	43	219	0.011	-0.02	1847	102	
06-08 A,B,C	2/20/07	47	251	0.012	0.00	1848	102	
06-08 A,B,C	2/23/07	50	275	0.014	0.00	1848	102	
06-08 A,B,C	2/26/07	53	300	0.015	-0.02	1848	102	

NTPEP # RSCP(2006)-08
Mix# 06-8 A,B,C Neat
Mineral Resource Technologies,
ArmorFast Rapid Hardening

2006 Rapid Setting Patching Material
Kansas DOT Lab Testing Results
(Materials Tested with Extender)

NTPEP #	Comp. Strength 1 Hr (psi)	Comp. Strength 3 Hr (psi)	Comp. Strength 1 Day (psi)	Comp. Strength 7 Days (psi)	Bond Strength by Slant Shear 1Day (psi)	Bond Strength by Slant Shear 7Day (psi)	Expansion @ 300 Cycles (%) or at Termination	Durability Factor @ M=300 Cycles	Linear Shrinkage 1 Day (%)	Linear Shrinkage 3 Day (%)	Linear Shrinkage 7 Day (%)	Linear Shrinkage 11 Day (%)	Coef. of Thermal Expansion (in/in/Deg F)
RSCP 2006-02	1050	1940	3270	4840	2120	2480	-0.001	100	**NO TEST DATA REFERENCE ASTM C-192 5.4**				
RSCP 2006-03	4140	6800	7740	9700	2640	4280	0.001	97					
RSCP 2006-05	670	1560	2830	3150	1490	2090	*0.393	*19					
RSCP 2006-06	1670	3150	4040	4260	2620	3340	0.021	104					
RSCP 2006-07	1270	2930	3800	4130	2630	2950	0.003	100					
RSCP 2006-08	1530	2710	4130	5740	1600	1880	**0.801	**28					
* Test terminated at 125 cycles ** Test terminated at 275 cycles													
UV STABILITY TEST RSCP(2006) - 02	After 1000 hours, the specimens showed no evidence of cracking, checking, blistering, or flaking, there was some eroding. The color of the specimens did become yellow/yellowish-brown with curing. Digital photographs were taken at 0, 250,500,750 and 1000 hours and are available.												

Product Information				
NTPEP #	Manufacturer Name	Address	Phone Number	Product Identification
RSCP(2006)-02	Roklin Systems, Inc.	20541 Pascal Way Lake Forest, CA 92630	949-707-6111	The Concrete Welder
RSCP(20056-03	The Quikrete Companies	3490 Piedmont Road, Suite 1300 Atlanta, GA 30305	404-926-3181	Com. Grade FastSet DOT Mix (with fibers)
RSCP(2006)-05	U S Concrete Products	16 Greenmeadow Drive, Ste 111 Timonium, MD 21093	410-561-8770	HP DOT Grade Repair Mortar
RSCP(2006)-06	Univeral Form Clamp Co.	840 South 25th Avenue Bellwood, IL 60104	800-646-3816	Uni Road Repair DOT
RSCP(20056-07	CTS Cement Manufacturing Corp.	11065 Knott Ave. Suite A Cypress, CA. 90630	714-379-8260	Rapid Set DOT Repair Mix
RSCP(2006)-08	MRT Cements/CEMEX Inc.	2700 Research Foresr Drive The Woodlands, TX 77381	281-362-1060	MRT ArmorFast Rapid Hardening Mortar

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-02
Mix Number: 06+02 ABC **Extended**

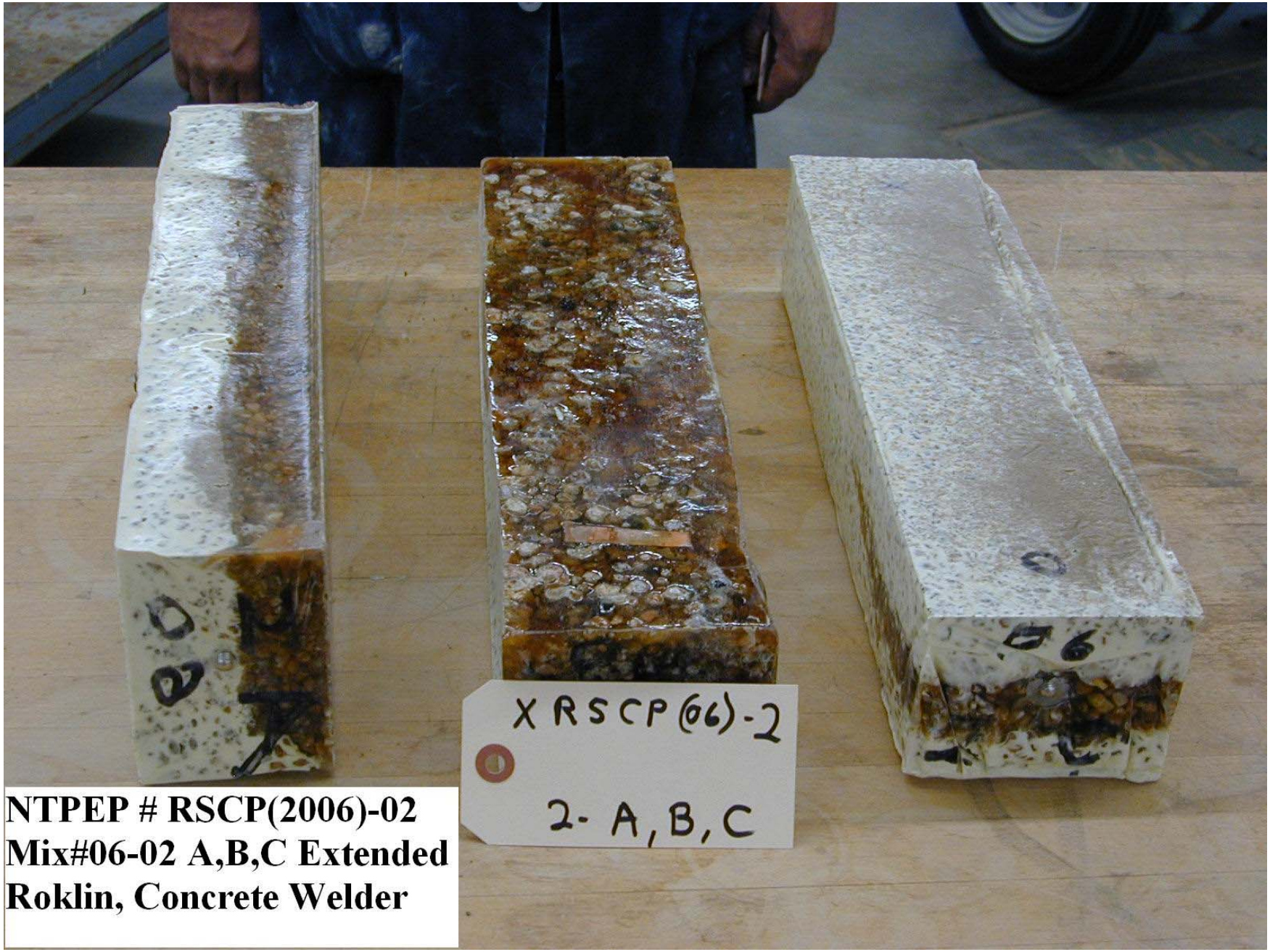
Date Made: 2/28/07
N squared: 1019427

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
24	0.006	0.0002593	7	0.0018	-0.001

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
6.25	0.26	1.82343	100.18

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06+02 A	0.2894	13.11	13.12	0.08	0.00	13.12	1.0	0.00	0.00
06+02 B	0.2347	12.42	12.43	0.08	0.00	12.43	1.0	0.00	0.00
06+02 C	0.2007	13.57	13.57	0.00	0.00	13.57	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comments
06+02 A,B,C	3/14/07	14	0	0.00	0.00	1010	100	
06+02 A,B,C	3/20/07	20	48	-0.032	0.02	1002	98	
06+02 A,B,C	3/23/07	23	70	0.005	0.00	1001	98	
06+02 A,B,C	3/27/07	27	101	0.004	0.08	1001	98	
06+02 A,B,C	3/30/07	30	125	0.006	0.08	1036	105	
06+02 A,B,C	4/3/07	34	157	0.006	0.08	1035	105	
06+02 A,B,C	4/6/07	37	181	0.008	0.05	1034	105	
06+02 A,B,C	4/10/07	41	213	0.000	0.05	1036	105	
06+02 A,B,C	4/13/07	44	237	0.002	0.08	1033	105	
06+02 A,B,C	4/17/07	48	269	-0.001	0.08	1034	105	
06+02 A,B,C	4/20/07	51	293	-0.002	0.08	1001	98	
06+02 A,B,C	4/23/07	54	317	0.004	0.10	1033	105	



NTPEP # RSCP(2006)-02
Mix#06-02 A,B,C Extended
Roklin, Concrete Welder

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-03
Mix Number: 06+03 ABC **Extended**

Date Made: 1/3/07
N squared: 2860608

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
25	-0.002	-0.0000889	18	-0.0016	0.001

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
-0.19	-0.01	-0.13987	97.12

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06+03 A	0.1774	15.94	16.16	1.38	0.00	16.16	1.0	0.00	0.00
06+03 B	0.1653	15.83	16.05	1.39	0.00	16.05	1.0	0.00	0.00
06+03 C	0.1895	16.04	16.26	1.37	0.00	16.26	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comments
06+03 A,B,C	1/17/07	14	0	0.00	0.00	1691	100	
06+03 A,B,C	1/23/07	20	48	-0.001	0.08	1654	96	
06+03 A,B,C	1/26/07	23	72	0.004	0.08	1657	96	
06+03 A,B,C	1/30/07	27	101	0.008	0.14	1662	97	
06+03 A,B,C	2/2/07	30	124	0.008	0.14	1658	96	
06+03 A,B,C	2/6/07	34	156	0.005	0.14	1657	96	
06+03 A,B,C	2/9/07	37	180	0.008	0.16	1660	96	
06+03 A,B,C	2/13/07	41	211	0.008	0.124	1662	97	
06+03 A,B,C	2/16/07	44	226	0.008	0.21	1667	97	
06+03 A,B,C	2/20/07	48	258	0.005	0.21	1665	97	
06+03 A,B,C	2/23/07	51	282	0.003	0.21	1668	97	
06+03 A,B,C	2/26/07	54	307	0.001	0.21	1666	97	

NTPEP # RSCP(2006)-03
Mix # 06-03 A,B,C Extended
Quikrete
Com. Grade FastSet DOT
Mix w/ Fibers

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-05 Date Made: 11/1/06
Mix Number: 06+05 ABC **Extended** N squared: 2937796

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
0	0.000	0.0000000	0	0.0000	0.000

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.00	0.00	0.00000	< than 300

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06+05 A	0.0000	16.67	16.67	0.00	0.00	16.67	1.0	0.00	0.00
06+05 B	0.0000	16.05	16.05	0.00	0.00	16.05	1.0	0.00	0.00
06+05 C	0.0000	16.18	16.18	0.00	0.00	16.18	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comments
06+05 A,B,C	11/15/06	14	0	0.000	0.00	1714	100	
06+05 A,B,C	11/21/06	20	48	0.033	0.22	1525	79	A, B, & C Edges are crumbling off
06+05 A,B,C	11/28/06	27	69	0.070	-1.07	1331	60	
06+05 A,B,C	12/1/06	30	93	0.164	-4.29	1293	57	
06+05 A,B,C	12/5/06	34	125	0.393	-10.58	1143	44	Stop test – excessive crumbling from sides and ends

NTPEP# RSCP(2006)-05
Mix # 06-5 A,B,C Extended
US Concrete Products,
HP DOT Grade Repair Mortar

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-06
Mix Number: 06+06 ABC **Extended**

Date Made: 9/27/06
N squared: 2593174

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
24	0.005	0.0002037	14	0.0029	0.021

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.80	0.03	0.46820	104.19

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06+06 A	0.0000	15.87	15.87	0.00	0.00	15.87	1.0	0.00	0.00
06+06 B	0.0000	15.30	15.30	0.00	0.00	15.30	1.0	0.00	0.00
06+06 C	0.0000	15.56	15.56	0.00	0.00	15.56	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comments
06+06 A,B,C	10/11/06	14	0	0.000	0.00	1610	100	
06+06 A,B,C	10/17/06	20	48	0.009	-0.77	1587	97	
06+06 A,B,C	10/20/06	23	71	0.010	-1.05	1592	98	A, B, & C Top surface is flaking off
06+06 A,B,C	10/24/06	27	103	0.021	-1.20	1594	98	
06+06 A,B,C	10/27/06	30	125	0.011	-1.35	1601	99	
06+06 A,B,C	10/31/06	34	157	0.012	-1.54	1607	100	
06+06 A,B,C	11/3/06	37	179	0.021	-1.80	1618	101	A, B, & C Outer layer is flaking off
06+06 A,B,C	11/7/06	41	211	0.012	-1.99	1626	102	
06+06 A,B,C	11/9/06	43	227	0.014	-2.19	1634	103	
06+06 A,B,C	11/14/06	48	262	0.012	-2.42	1632	103	
06+06 A,B,C	11/17/06	51	286	0.018	-2.66	1640	104	
06+06 A,B,C	11/20/06	54	310	0.023	-2.76	1646	105	

NTPEP # RSCP(2006)-06
Mix# 06-6 A,B,C Extended
Universal Form Clamp Co.,
Uniroad Repair DOT

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-07
Mix Number: 06+07 ABC **Extended**

Date Made: 1/4/07
N squared: 2191387

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
25	0.002	0.0000622	25	0.0016	0.003

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.13	0.01	0.13478	99.60

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06+07 A	0.1807	14.43	14.63	1.39	0.00	14.63	1.0	0.00	0.00
06+07 B	0.1777	14.14	14.34	1.41	0.00	14.34	1.0	0.00	0.00
06+07 C	0.1575	14.48	14.67	1.31	0.00	14.67	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comments
06+07 A,B,C	1/18/07	14	0	0.00	0.00	1480	100	
06+07 A,B,C	1/23/07	19	40	0.001	-0.16	1463	98	
06+07 A,B,C	1/26/07	22	64	0.001	4.53	1464	98	
06+07 A,B,C	1/30/07	26	93	0.003	-0.07	1472	99	
06+07 A,B,C	2/2/07	29	116	0.006	-0.02	1469	98	
06+07 A,B,C	2/6/07	33	148	0.002	-0.11	1469	98	
06+07 A,B,C	2/9/07	36	172	0.002	-0.11	1471	99	
06+07 A,B,C	2/13/07	40	204	0.004	-0.11	1473	99	
06+07 A,B,C	2/16/07	43	219	0.003	-0.09	1475	99	
06+07 A,B,C	2/20/07	47	251	0.002	-0.07	1474	99	
06+07 A,B,C	2/23/07	50	275	0.001	-0.07	1476	99	
06+07 A,B,C	2/26/07	53	300	0.003	-0.07	1477	100	

NTPEP # RSCP(2006)-07
Mix# 06-7 A,B,C Extended
CTS Cement Manuf. Co.,
Rapid Set DOT Repair Mix

Kansas DOT Freeze Thaw Evaluation

NTPEP Number: RSCP(2006)-08
Mix Number: 06+08 ABC **Extended**

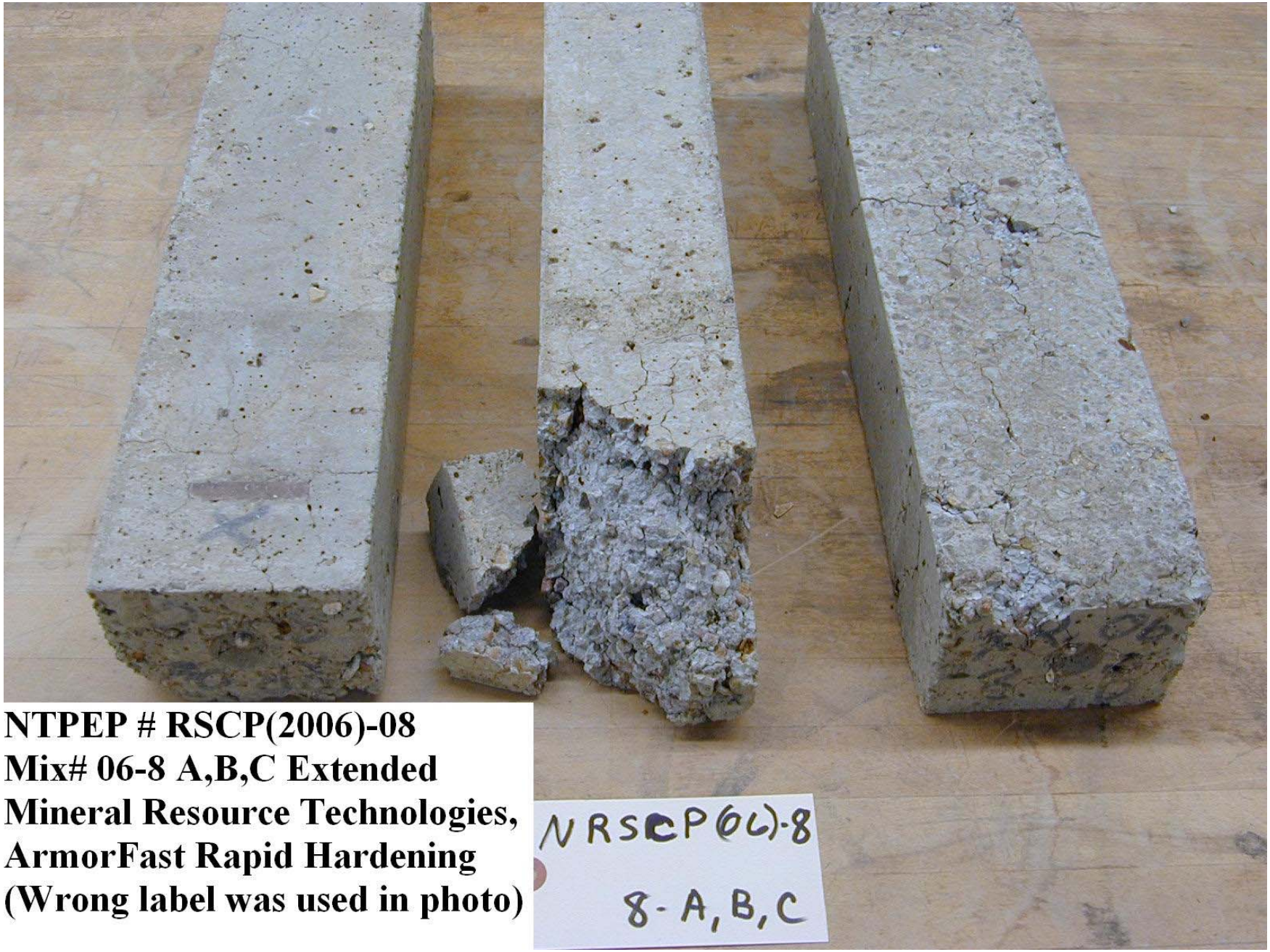
Date Made: 1/4/07
N squared: 3467044

Expansion					
Cycle Diff	**Exp Diff**	**Exp/1Cycle**	**300 Cycles**	**Diff/1**	**#@300**
0	0.000	0.0000000	0	0.0000	0.003

Durability			
PC Diff	**PC/1 Cycle**	**Diff/1**	**#@300**
0.00	0.00	0.00000	< than 300

Starting Information									
Mix #	**Exp.**	**Cure Wt.**	**Sat. Wt.**	**Abs**	**Wt. in H2O**	**Diff.**	**Spg. SSD**	**w/ Hanger**	**Hanger Wt.**
06+08 A	0.1141	16.70	16.79	0.54	0.00	16.79	1.0	0.00	0.00
06+08 B	0.1269	16.74	16.83	0.54	0.00	16.83	1.0	0.00	0.00
06+08 C	0.1222	16.86	16.94	0.47	0.00	16.94	1.0	0.00	0.00

Mix #	Date	Age	Cycles	Avg %Exp	Avg G/L	Avg Sonic	Percent	Comments
06+08 A,B,C	1/18/07	14	0	0.00	0.00	1862	100	
06+08 A,B,C	1/23/07	19	40	0.009	-0.06	1788	92	
06+08 A,B,C	1/26/07	22	64	0.006	-0.04	1823	96	
06+08 A,B,C	1/30/07	26	93	0.016	-0.04	1826	96	
06+08 A,B,C	2/2/07	29	116	0.033	-0.02	1810	94	
06+08 A,B,C	2/6/07	33	148	0.071	0.02	1724	86	
06+08 A,B,C	2/9/07	36	172	0.123	0.24	1532	68	
06+08 A,B,C	2/13/07	40	204	0.315	0.40	1002	29	A, B, & C Cracking (long. and vert.)
06+08 A,B,C	2/16/07	43	219	0.362	0.40	1327	51	
06+08 A,B,C	2/20/07	47	251	0.597	0.55	1120	36	
06+08 A,B,C	2/23/07	50	275	0.801	0.16	1038	31	Stop test due to cracks and breaking up



NTPEP # RSCP(2006)-08
Mix# 06-8 A,B,C Extended
Mineral Resource Technologies,
ArmorFast Rapid Hardening
(Wrong label was used in photo)

2006 Rapid Setting Patching Materials
Extender Aggregate Test Used For Portland Cement Concrete
Kansas DOT - Testing Results

Gradation AASHTO T27

Sieve	% Retention
37.5	
25.0	
19.0	
12.5	0
9.5	0
4.75	68
2.36	95
1.18	98
600	99
300	99
150	100
75	100

Soundness AASHTO T103A = 0.99

Absorption AASHTO T85 = 1.0 %

Absorption AASHTO T84 = 1.2 %

L. A. Wear AASHTO T96 = 36 C

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-- Rick Smutzer (IN), former NTPEP Chairman

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