ERDC/GSL TR-19-29

Geotechnical and Structures Laboratory

US Army Corps
of Engineers®
Engineer Research and
Development Center

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

Airfield Damage Repair Modernization Program

Evaluation of Concrete Spall Repair Materials

Anthony J. Falls

June 2019

Approved for public release; distribution is unlimited.

The U.S. Army Engineer Research and Development Center (ERDC) solves the nation's toughest engineering and environmental challenges. ERDC develops innovative solutions in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, the Department of Defense, civilian agencies, and our nation's public good. Find out more at www.erdc.usace.army.mil.

To search for other technical reports published by ERDC, visit the ERDC online library at http://acwc.sdp.sirsi.net/client/default.

ERDC/GSL TR-19-29
June 2019

Evaluation of Concrete Spall Repair Materials

Anthony J. Falls

Geotechnical and Structures Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Final report

Approved for public release; distribution is unlimited.

Prepared for Headquarters, Air Force Civil Engineer Center
Tyndall Air Force Base, FL 32403-5319

Under Work Unit LF0B30, Project 449879, "Airfield Damage Repair Modernization Program"

Abstract

Maintenance and repair activities are critical to economically and efficiently sustain airfield operations with existing pavement infrastructure. Repairing spalls in Portland cement concrete (PCC) pavements is a common work activity used to reduce the costs associated with aircraft damage and prolong the service life of the pavement further reducing the life-cycle costs for the pavement structure. Costs decrease dramatically for every additional year of pavement use that does not cause vehicle damage or require repeated patching or full slab replacement.

Traffic performance of fourteen different concrete repair products was evaluated for repairing spalls in PCC airfield pavement. The objective of this study was to identify within these products suitable repair materials for long-term concrete spall deficiency repairs.

Numerous partial-depth repairs were constructed along joints and in the interior of the test slab and backfilled with the repair products following the manufacturer requirements. After the material cured to the minimum required by each manufacturer, the repairs were trafficked with simulated F-15E aircraft traffic to monitor their long-term performance over successive aircraft loadings. The field evaluations of the selected repair products considered how well each product performed under simulated F-15E traffic as well as the ease of mixing, placing, and finishing.

DISCLAIMER: The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. All product names and trademarks cited are the property of their respective owners. The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

DESTROY THIS REPORT WHEN NO LONGER NEEDED. DO NOT RETURN IT TO THE ORIGINATOR.

Contents

Abstract ii

Figures and Tables v

Preface vi

Unit Conversion Factors vii

1 Introduction 1

1.1 Background 1
1.2 Objective 1
1.3 Scope 2

2 Test Site Location 3

3 Materials 5

3.1 Approved materials selected for evaluation 5
3.2 DOTLine 6
3.3 HD-50 Rapid Set 6
3.4 Pavemend 15 6
3.5 Pavepatch 3000 7
3.6 ProSpec Premium Patch 200 7
3.7 Fast Set DOT Mix 7
3.8 Rapid Set Concrete Mix 8
3.9 MasterEmaco T 545HT (Set 45) 8
3.10 Ulti-Pave 3 8
3.11 SikaQuick 2500 9
3.12 Pavemend SLQ 9
3.13 MasterEmaco T 10-60 Repair Mortar 9
3.14 MasterEmaco S 6000 10
3.15 CTS Rapid Set Mortar Mix 10

4 Test Site Preparation and F-15E traffic 11

4.1 Replacing joint seal on the test section 11
4.2 Repair demolition 12
4.2.1 Joint spall cutouts 12
4.2.2 "Popout" spalls 14
4.2.3 Preparations for backfilling 14
4.3 Mixing, placing, and trafficking product repairs 17

5 Test Methods for Evaluation 21

5.1 Simulated F-15E load cart traffic 21
5.1.1 Description of F-15E load cart 21
5.1.2 F-15 load cart traffic 21

5.2 Compressive strength 23

6 Results and Discussion 25

6.1 Compressive strength results 25
6.2 DOT Line 25
6.3 HD-50 Rapid Set 26
6.4 Pavemend 15 26
6.5 Pavepatch 3000 27
6.6 ProSpec Premium Patch 200 27
6.7 Fast Set DOT Mix 27
6.8 CTS Rapid Set Concrete Mix 28
6.9 MasterEmaco T 545HT (Set 45) 28
6.10 Ulti-Pave 3 29
6.11 SikaQuick 2500 29
6.12 Pavemend SLQ 29
6.13 MasterEmaco T 10-60 Repair Mortar 30
6.14 MasterEmaco S 6000 30
6.15 CTS Rapid Set Mortar Mix 31

7 Conclusions and Recommendations 32

7.1 Conclusions 32
7.2 Recommendations 33

References 35

Appendix A: Data sheets for all materials in this study 37

Appendix B: Detailed photos of repairs at various pass intervals 75

Report Documentation Page

Figures and Tables

Figures

Figure 1. Outdoor Pavement Test Facility test section for spall repair field evaluation. 3
Figure 2. Concrete slab layout for spall repair field evaluation. 4
Figure 3. Individual slab layout with spall repair cutout dimensions. 4
Figure 4. Saw cutting existing joints to meet airfield specifications. 11
Figure 5. Completed contraction joint sealant repair. 11
Figure 6. Cutting out joint spall repairs with a wet saw. 12
Figure 7. Concrete wet saw cutouts for joint spall repairs. 13
Figure 8. Removing concrete from joint spall cutouts with a jackhammer. 13
Figure 9. Achieving desired, constant depth of joint spall repairs using a bushing bit. 14
Figure 10. Mini-excavator with jackhammer attachment. 15
Figure 11. Jackhammer attachment (moil point) used to create “popout” spall repairs. 15
Figure 12. Example of final joint spall repair cutout. 16
Figure 13. Example of final spall “popout” repair. 16
Figure 14. Single paddle mixing drill. 17
Figure 15. Dual paddle mixing drill. 18
Figure 16. Applying water as bonding agent (saturated surface dry condition). 18
Figure 17. Scrubbing repair material mortar onto the repair perimeter. 19
Figure 18. F-15E simulation load cart and transport truck. 22
Figure 19. Representation of traffic lane pattern. 23
Figure 20. Preparation of concrete samples during repairs. 24

Tables

Table 1. Approved list of spall repair materials [2, 3]. 5
Table 2. Summary of product placement directions and cure time. 19
Table 3. Average unconfined compressive strengths. 25

Preface

This study was conducted for the U.S. Air Force Civil Engineer Center (AFCEC). Headquarters, Air Force Civil Engineer Center (AFCEC), located at Tyndall Air Force Base, FL, provided funding under Work Unit LF0B30, Project Number 449879 "Airfield Damage Repair Modernization Program" for the research project described in this report. Dr. Craig Rutland, AFCEC, was the technical monitor for the project.

The work was performed by the Airfields and Pavements Branch (GMA) and the Materials Testing Center within the Concrete and Materials Branch (GMC) of the Engineering Systems and Materials Division (GM), U.S. Army Engineer Research and Development Center, Geotechnical and Structures Laboratory (ERDC-GSL). Mr. Jeb S. Tingle (GM) was the ERDC Airfield Damage Repair program manager. At the time of publication, Dr. Timothy W. Rushing was Chief, CEERD-GMA; Mr. Christopher M. Moore was Chief, CEERD-GMC; Dr. G. William McMahon was Chief, CEERD-GM; and Mr. R. Nicholas Boone was the Technical Director for Force Projection and Maneuver Support. The Deputy Director of ERDC-GSL was Mr. Charles W. Ertle II and the Director was Mr. Bartley P. Durst.

COL Ivan P. Beckman was the Commander of ERDC, and Dr. David W. Pittman was the Director.

Unit Conversion Factors

Multiply	By	To Obtain
cubic feet	0.02831685	cubic meters
cubic inches	1.6387064 E-05	cubic meters
cubic yards	0.7645549	cubic meters
degrees Fahrenheit	(F-32)/1.8	degrees Celsius
feet	0.3048	meters
gallons (US liquid)	3.785412 E-03	cubic meters
gallons per minute	6.309019 E-05	cubic meters per second
inches	0.0254	meters
mils	0.0254	millimeters
pounds (force)	4.448222	newtons
pounds (force) per square inch	6.894757	kilopascals
pounds (mass)	0.45359237	kilograms
pounds (mass) per cubic foot	16.01846	kilograms per cubic meter
pounds (mass) per cubic inch	2.757990 E+04	kilograms per cubic meter
pounds (mass) per square foot	4.882428	kilograms per square meter
pounds (mass) per square yard	0.542492	kilograms per square meter
revolutions per minute	0.10471975	radians per second
square feet	0.09290304	square meters
square inches	6.4516 E-04	square meters
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	meters

This page intentionally blank.

1 Introduction

1.1 Background

The U.S. Air Force has tasked the U.S. Army Engineer Research and Development Center (USACE) to conduct long-term aircraft traffic performance testing on concrete spall repair materials. The primary purpose of maintenance and repair of Portland cement concrete (PCC) airfield pavements is to reduce the costs associated with aircraft damage due to foreign object debris (FOD) and tire damage, decrease pavement roughness, and extend the service life of the pavement to reduce the pavement's life-cycle costs. A considerable investment has been made in the construction of concrete surfaces and the vehicles that use these surfaces; therefore, costs decrease dramatically for every additional year of pavement use that does not cause vehicle damage or become structurally insufficient. Routine periodic inspections and rapid repair of pavement problems are essential for reducing life-cycle costs. A properly constructed and maintained pavement can last for many years (Headquarters, Departments of the Army, the Navy, and the Air Force 2001).

This research was conducted by constructing joint center slab "popouts" and saw cut joint spall repairs on an airfield-designed concrete test section using manufacturer requirements for the material used, applying simulated aircraft traffic using an F-15E load cart, and monitoring the performance of the spall repair materials. Spall repair materials were selected from a list of approved products that have been validated through laboratory studies at ERDC.

1.2 Objective

ERDC was tasked by the U.S. Air Force Civil Engineer Center to evaluate various concrete spall repair materials on airfield concrete pavements. A total of fourteen products were tested for performance as well as the ease of mixing, placing, and finishing. The results of the research were used to validate the relationship between actual field performance and evaluation methods currently used in laboratory studies for approving spall repair materials. The objective of this study was to identify within these products suitable repair materials for long-term concrete spall deficiency repairs.

1.3 Scope

The scope of the study is to assess each expeditionary spall repair product on the ease of mixing, placing, and finishing, durability under simulated F-15E load cart passes, and laboratory compressive strength values. The field evaluation consisted of fourteen concrete test pads; each concrete pad was assigned to a spall repair material. After successfully placing all repair materials, the entire test section was trafficked with the F-15E load cart for a total of 3,000 passes and monitored for deterioration over the trafficking period. Chapter 2 of this report contains a detailed description of the test site and schematic of the individual slab layouts designated to each repair product. Chapter 3 discusses all the concrete repair materials involved in this study. Test site preparation, cutting out joint spalls and "popouts" for repair, constructing the repairs, and a description of F-15E simulated aircraft traffic is detailed in Chapter 4. Test methods for evaluating each product and the results/discussions are covered in Chapters 5 and 6, respectively. Chapter 7 contains the conclusions and recommendations gathered from this study.

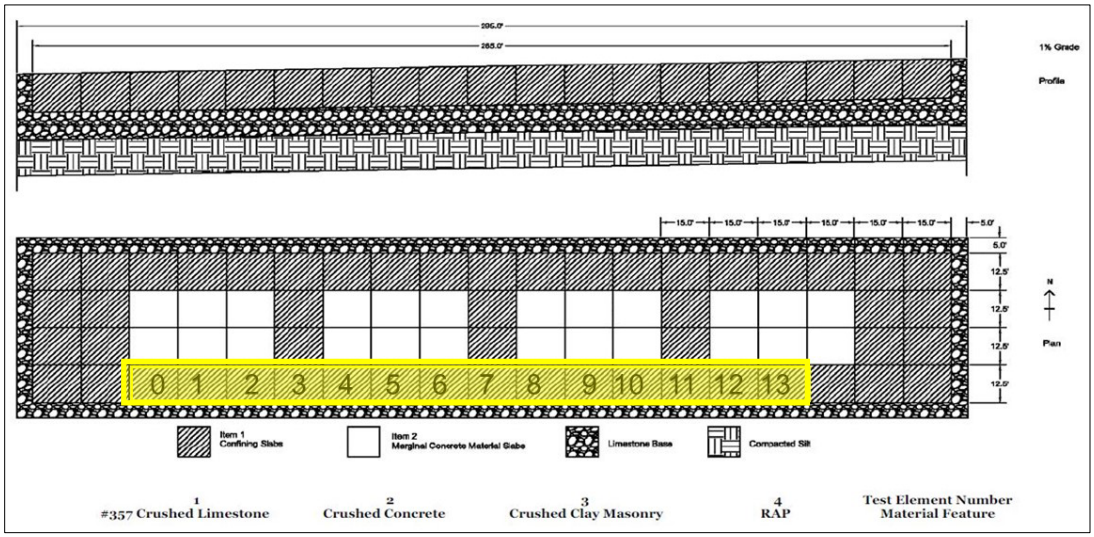
2 Test Site Location

The test site location for the spall repair field testing required a jointed concrete pavement capable of supporting C-17 aircraft traffic with a minimum concrete thickness of 12 inches. The test section required a minimum length of 275 feet and a minimum of 15 longitudinal and 15 transverse joints for placing spall repair materials. Continuous slabs were desired to allow for efficient trafficking of all repairs made with each pass of the load cart.

A PCC test section meeting these criteria was available at the Outdoor Pavement Test Facility located on the east side of the ERDC Vicksburg campus. This test site was 285-feet long and 50-feet wide with 12.5-feet by 15-feet concrete slabs that were 11 and 13 inches thick for the interior and exterior slabs, respectively. This provided 19 longitudinal joints and 18 transverse joints for testing. An aerial view of the test site is shown in Figure 1. The slab layout (test slabs 0 through 13) for the test site is shown in Figure 2. The south outside row of slabs, highlighted yellow in Figure 2 was used for the overall test section.

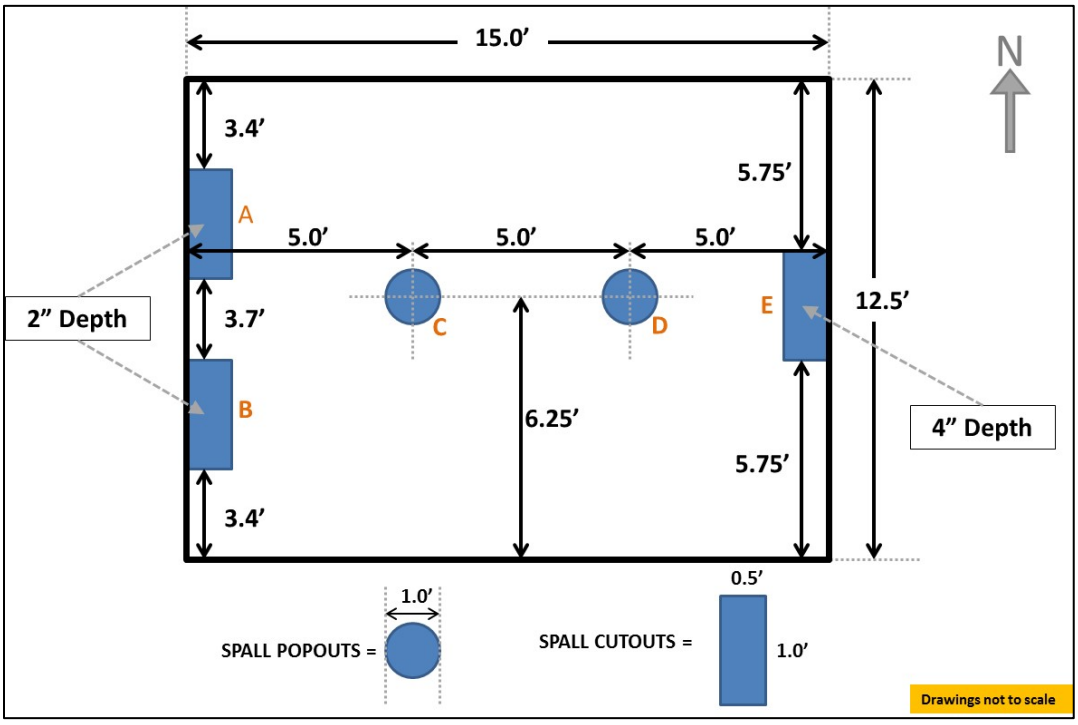
Figure 1. Outdoor Pavement Test Facility test section for spall repair field evaluation.

Figure 2. Concrete slab layout for spall repair field evaluation.



Each product was designated to its own test slab. The numbers within each slab shown in Figure 2 detail the location where each candidate product was installed. Each test slab has a total of two joint spall repairs at a 2-inch depth (Repair A and Repair B), two "popout" repairs (Repair C and Repair D), and one joint spall repair at a 4-inch depth (Repair E). A schematic of a test slab is shown in Figure 3.

Figure 3. Individual slab layout with spall repair cutout dimensions.



3 Materials

3.1 Approved materials selected for evaluation

All repair materials for this study were selected from the Tri-Service Transportation website under the Pavement Repair Material Certification Program (https://transportation.erdc.dren.mil/triservice/research.aspx) from the approved repair material matrix table. All repair materials were required to have a temporary expeditionary repair classification at a minimum; however, many of the materials had a more premium rating from the cementitious laboratory testing protocol. Table 1 shows the list of approved spall repair materials evaluated for this study.

Table 1. Approved list of spall repair materials [2, 3].

Product Name	Manufacturer	Expeditionary
DOTLine	CeraTech, Inc.	Yes
HD-50 Rapid Set	Dayton Superior Corp.	Yes
Pavemend 15	CeraTech, Inc.	Yes
Pavepatch 3000	Dayton Superior Corp.	Yes [1]
ProSpec Premium Patch 200	Bonsal American	Yes
Fast Set DOT Mix	Quikcrete Companies	Yes [1]
Rapid Set Concrete Mix	CTS Cement Corp.	Yes
MasterEmaco T 545HT (SET 45)	BASF	Yes
Ulti-Pave 3	Buzzi Unicem	Yes
SikaQuick 2500	Sika Corp	Yes
Pavemend SLQ	CeraTech, Inc.	Yes
MasterEmaco T 10-60 Repair Mortar	BASF	Yes
MasterEmaco S 6000	BASF	Yes
CTS Rapid Set Mortar Mix[4]	CTS Cement Corp.	Yes

[1] Approved for secondary runways, secondary taxiways, and parking aprons only.

[2] All products are cementitious with the exception of MasterEmaco S 6000 which is a polymeric material.

[3] All product information gathered from https://transportation.erdc.dren.mil/cacsites/TriService/pavement_repair.aspx.

[4] Product was added after all other products were tested for repair. The product was added to the test section on 8 March 2016. A total of 300 passes was placed on this product to even up with the traffic passes previously placed on the other product repairs.

3.2 DOTLine

DOT Line is a fiber reinforced, rapid-setting cementitious-based structural repair concrete. It is a single component powder that is water activated. DOT Line was designed for horizontal applications providing structural repair of roads, bridges, airport runways, and form and pour projects.

The manufacturer states that DOT Line has a 10 to 15 minute working time, can reach compressive strengths of more than 2,500 psi within two hours from mixing, and can be applied in ambient temperature ranges of 40° to 120° F. The manufacturer also states it can be used as a temporary repair for asphalt pavement, but testing of that repair technique was not included in this study. (http://www.pavemend.com/dotline_product_page.html)

3.3 HD-50 Rapid Set

HD-50 is a fast-setting, fiber-reinforced, latex-modified, one component concrete repair material requiring only water to mix and apply. HD-50 is a cement-based compound having similar characteristics to normal PCC mixes.

The manufacturer states that HD 50 is designed for the repair of heavy duty surfaces such as concrete highways, bridge decks, parking structures, airport runways, freezer rooms, industrial and warehouse floors, and loading docks. HD 50 is a flowable material that may be poured into place for horizontal applications or into formed vertical and overhead applications. (http://www.daytonsuperior.com/docs/default-source/tech-data-sheets/hd_50.pdf?sfvrsn=10)

3.4 Pavemend 15

Pavemend 15 is a cementitious, rapid-setting, self-leveling structural repair mortar. It is a single component powder that is water activated. The manufacturer states that Pavemend 15 has 7 to 9 minutes of working time and will reach a compressive strength of 2,500 psi within two hours and more than 6,000 psi at 28 days. The manufacturer also states that it is designed for horizontal and rapid setting form and pour applications. Pavemend 15 can be used in ambient temperature ranges of 30° to 110° F.

Its uses, as claimed by the manufacturer, include an ideal repair material for roads and bridges, airport runways, warehouse or manufacturing facility floors, post-tension cable repairs, and form and pour projects. Although not

tested within this study, the manufacturer claims it can be used as a temporary repair for asphalt pavement. (http://www.pavemend.com/15.0_product_page.html)

3.5 Pavepatch 3000

Pavepatch 3000 is a fast-setting, one component concrete repair material requiring only water to mix and apply. Pave Patch 3000 is a cement based compound having similar characteristics to normal Portland cement concrete mixes.

The manufacturer states that Pavepatch 3000 is designed for the repair of heavy duty surfaces such as concrete highways, bridge decks, parking structures, airport runways, freezer rooms, industrial and warehouse floors, and loading docks. Pavepatch 3000 is a pourable material that may be poured into place for horizontal applications or into formed vertical and overhead applications. (http://www.daytonsuperior.com/docs/default-source/tech-data-sheets/pave_patch_3000.pdf?sfvrsn=9)

3.6 ProSpec Premium Patch 200

ProSpec Premium Patch 200 is a rapid-setting, fiber-reinforced, polymer-modified cement mortar designed for concrete repair and overlay applications requiring high durability.

The manufacturer states that ProSpec Premium Patch 200 is designed to repair heavy-duty surfaces such as highway repairs, bridge decks, parking structures, airport runways, freezer rooms, loading docks, and wastewater treatment facilities. (http://www.prospec.com/uploads/product/document/premium_patch_200_rev_1114.pdf)

3.7 Fast Set DOT Mix

Fast Set DOT Mix is a fiber-reinforced, rapid-setting repair material and meets DOT Region 3 requirements as a patching material for commercial applications at a thickness of 0.5 to 2 in. This product may also be extended with up to 25 lb of gravel per 55-lb bag for repairs to roads and bridges at a minimum thickness of 2 in. Fast Set DOT Mix is available with an integral corrosion inhibitor in cases where maximum corrosion protection is desired. The addition of corrosion inhibitor has no adverse effect on the other physical properties of the product.
(http://www.quikrete.com/PDFs/DATA_SHEET-CGFS%20DOT%20Mix%201244-56%20-58.pdf)

3.8 Rapid Set Concrete Mix

Rapid Set Concrete Mix is a fast-setting, multipurpose concrete repair material. As stated by the manufacturer, Rapid Set Concrete Mix is a blend of Rapid Set hydraulic cement with quality aggregates and mixes with water to produce a workable, quality concrete material that is ideal where fast strength gain, high durability, and low shrinkage are desired. It is non-metallic, and no chlorides are added. The manufacturer claims it sets in 20 minutes and is ready for traffic in approximately one hour.

Rapid Set Concrete Mix is used for general and structure concrete repair, construction of pavements, formed work, footings, setting posts, industrial floors and machine bases. For freeze-thaw durability, in some geographical areas, Rapid Set Concrete Mix contains an air-entraining admixture. (http://www.ctscement.com/rapid-set-concrete-mix/)

3.9 MasterEmaco T 545HT (Set 45)

Master Emaco T 545HT (formerly known as Set 45) is a one-component, magnesium phosphate-based patching and repair mortar. The manufacturer states that this concrete repair and anchoring material sets in approximately 15 minutes and takes rubber tire traffic in 45 minutes. It comes in two formulations, MasterEmaco T 545 regular for ambient temperatures below 85° F and MasterEmaco T 545 HT for ambient temperatures ranging from 85° to 100° F. (https://www.master-builders-solutions.basf.us/en-us/products/masteremaco/1639)

3.10 Ulti-Pave 3

Ulti-Pave 3 Repair Mix is a multipurpose pavement repair material that is fast-setting with rapid strength gains. This repair material is used for the repair and construction of interior and exterior pavements and utilizes a calcium sulfoaluminate cement.

The manufacturer claims that, when mixed with water, Ulti-Pave 3 produces a repair product with approximately 30 minutes workability, a minimum of 3,000 psi in 3 hours, and continues to gain strength over 28 days to approximately 7,500 psi when placed within standard concrete guidelines. Ulti-Pave 3 develops strengths faster than Portland cement. (www.buzziunicemusa.com/)

3.11 SikaQuick 2500

SikaQuick 2500 is a one-component, rapid hardening (as defined by ASTM C-928), early strength gaining, cementitious patching material for concrete.

The manufacturer states that it can be used on highway repairs, structural repair, full depth patching, and horizontal repair of concrete and mortar. When 25-30 lb of 3/8-in. gravel is added to the 50-lb multi-wall bag, the yield is approximately 0.60 cubic foot and is workable for approximately 15 minutes, weather dependent. The shelf life is approximately one year stored at low humidity and 40° to 95° Fahrenheit. The manufacture recommends the material be conditioned at 65° to 75° degrees Fahrenheit before use. (usa.sika.com)

3.12 Pavemend SLQ

As stated by the manufacturer, Pavemend SLQ is a cementitious, very rapid setting (as defined by ASTM C-928), self-leveling structural repair mortar suitable for very rapid concrete repair in all climates, especially in near-freezing and below-freezing applications. It is a single component powder that is water activated and suited for aggregate extension. Pavemend SLQ has 2-4 minutes working time and can reach compressive strengths of more than 3,000 psi within 60 minutes of final set.

It is designed for horizontal and formed applications and can be applied in ambient temperature ranges from -20° to 110° Fahrenheit without special mixing or curing equipment. It is ideal for moderate to cold weather repairs of roads and bridges, airport runways, warehouse or manufacturing facility floors, post-tension cable repairs, and form and pour projects. The manufacturer states it can be used as a temporary repair for asphalt pavement but that was not tested during this study. (www.seratechinc.com)

3.13 MasterEmaco T 10-60 Repair Mortar

Master Emaco T 10-60 Rapid Mortar is a one-component, shrinkage-compensated, rapid-setting, cement-based mortar. The manufacturer states that it is designed for horizontal concrete surfaces where high early strength gain is desired. One 50-lb bag can yield 0.43 cubic foot when mixed with water only. When extended with clean, rounded gravel by 100%, it can yield approximately 0.77 cubic feet.

The manufacturer claims it can be used on highway repairs, structural repair, full-depth patching, and horizontal repair of concrete and mortar. It

has a shelf life of one year when stored in an unopened container at 60° to 80° F in a clean, dry environment. (https://www.master-builders-solutions.basf.us/en-us/products/masteremaco/1623)

3.14 MasterEmaco S 6000

MasterEmaco S 6000 is a solvent-free, reactive methacrylate liquid component, and a specially blended filler component, which includes Master-Top SRS 100HD. The two-part mix single unit can yield 0.33 cubic foot but can be extended up to 100 % with select aggregates for deeper repairs. Typical cure time is one hour at temperatures ranging from 14° to 104° F.

The manufacturer claims it can be used on highway repairs, structural repair, full-depth patching, and horizontal repair of concrete and mortar. The shelf life is two years when stored in an unopened container with a cool, lean, dry environment and a maximum storage temperature of 86° F. (www.master-builders-solutions.basf.us)

3.15 CTS Rapid Set Mortar Mix

CTS Rapid Set Mortar Mix is a high-performance blend of Rapid Set hydraulic cement and quality sand. The manufacturer claims it has rapid strength gain, high durability, low shrinkage, is durable in wet environments, sets in 15 minutes, and is ready for traffic in 1 hour.

It is non-metallic, and no chlorides are added. It is similar in appearance to Portland cement-based mortars and may be applied using similar methods. (http://www.ctscement.com/rapid-set-mortar-mix/)

4 Test Site Preparation and F-15E traffic

4.1 Replacing joint seal on the test section

Prior to cutting out joint spalls for repair material placement, repair of the existing joints of the test section was needed. This included widening the existing joint with a 3/8-in. diamond blade wet saw (Figure 4), cleaning the joints by water blasting, and installing a quality approved joint sealant (Figure 5). All work was completed according to UFC 3-270-03 (Headquarters of the Army Navy, and Air Force, 2001).

Figure 4. Saw cutting existing joints to meet airfield specifications.

Figure 5. Completed contraction joint sealant repair.

4.2 Repair demolition

4.2.1 Joint spall cutouts

After replacing the joint sealant and allowing it to fully cure, the perimeter of the partial-depth repairs for each test slab was made, as shown previously in Figure 3. A walk-behind, wet-cutting concrete saw (Figure 6) was used to make cuts in the test slabs for the partial-depth repairs. Care was taken to minimize the overcut for each side of the joint spall cutout, as shown in Figure 7. A jackhammer with a standard narrow chisel was then used to break the majority of the concrete out for each repair, as shown in Figure 8. In order to achieve the desired constant depth for each repair, the same jackhammer with a standard bushing bit was used, as shown in Figure 9.

Figure 6. Cutting out joint spall repairs with a wet saw.

Figure 7. Concrete wet saw cutouts for joint spall repairs.

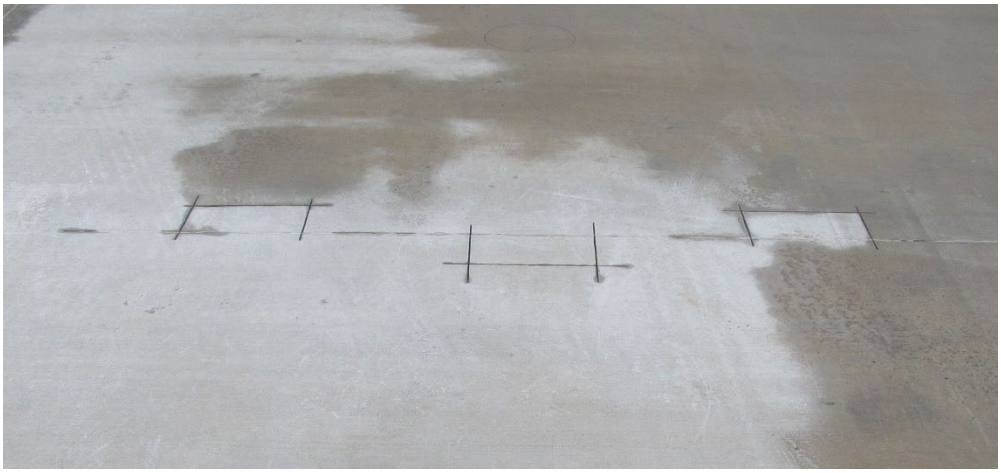


Figure 8. Removing concrete from joint spall cutouts with a jackhammer.

Figure 9. Achieving desired, constant depth of joint spall repairs using a bushing bit.

4.2.2 "Popout" spalls

A slightly different method was used for the "popout" spall repairs in the center of the test slabs. A mini-excavator with a jackhammer and moil point attachment was used to strike the concrete surface to construct the "popouts". It was somewhat difficult to reproduce each "popout" with the same dimensions; however, every effort was used to replicate the dimensions. The equipment used to create the "popout" repairs in each test slab is shown in Figure 10 and Figure 11.

4.2.3 Preparations for backfilling

After the spall cutouts and spall "popouts" were created, the entire test section was brushed and pressure washed to remove all undesirable material and debris. Asphalt-treated fiberboard was placed on the contraction joint wall of each joint spall repair to maintain the contraction joint during repair as well as prevent the repair from bearing on the adjacent slab after placement. The fiberboard was trimmed to the contour of the repair depth surface. Construction adhesive was used to attach the fiber board to the vertical face. Construction caulk was also placed in the crevice between the

fiberboard and the depth of the repairs to mitigate seepage of the repair material into the contraction joint below the pavement surface. Examples of a final joint spall repair cutout and a spall "popout" are shown in Figure 12 and Figure 13, respectively.

Figure 10. Mini-excavator with jackhammer attachment.

Figure 11. Jackhammer attachment (moil point) used to create "popout" spall repairs.

Figure 12. Example of final joint spall repair cutout.

Figure 13. Example of final spall “popout” repair.

4.3 Mixing, placing, and trafficking product repairs

On 22 July 2015, a total of 12 engineering technicians completed all repairs on the test section; four personnel were dedicated to mixing, four personnel were dedicated to applying bond agents and finishing, and four personnel were dedicated to making the concrete cylinders for compressive strength testing. Three civil engineers oversaw the repairs and instructed technicians on correct water ratios, mixing times, mixing techniques, and finishing and also assisted the technicians with work activities as needed. All of the products were mixed with a single paddle mixer or dual paddle mixer, as shown in Figure 14 and Figure 15, respectively. All of the products required some sort of bonding agent that helps the repair material adhere to the perimeter of the repair and increase performance. Two types of bonding agents were used for the cementitious products depending on what was required by the manufacturer for each specific product placed; i.e., using water to produce a saturated surface dry condition repair bond (Figure 16) or scrubbing repair material mortar onto the perimeter of the repair as a bonding aid (Figure 17). Master Emaco S6000 required the application of a proprietary bonding agent.

Figure 14. Single paddle mixing drill.

Figure 15. Dual paddle mixing drill.

Figure 16. Applying water as bonding agent (saturated surface dry condition).

Figure 17. Scrubbing repair material mortar onto the repair perimeter.

The products with longer manufacturer reported set times were placed first in order to begin trafficking on the entire test section at one time. Table 2 is a summary of mixing and placement directions, as well as test slab designation, for each of the products. These specification and directions are detailed for each product in Appendix A: Data sheets for all materials in this study.

Table 2. Summary of product placement directions and cure time.

Product Name	Slab #	Water for mixing	Required Aggregate Extension	Mixing Tool/Time	Work Time	Cure/ Traffic Time	Bonding Agent	Notes
CTS Rapid Set Mortar Mix	0	3-5 quarts per 55-lb bag	NO	Drill with paddle 1-3 mins until lump free	Not Specified	1 hour	Sponge, Saturated Surface Dry	Mix powder to water
MasterEmaco T 10-60 Repair Mortar	1	2.75 quarts	C33 #8 Gravel (25 lbs)	Drill with paddle minimum 3 mins	15 minutes	Not Specified	Sponge, Saturated Surface Dry	Mix powder to water
DOT Line	2	4.00 quarts	NO	Mixer: 2 qts for 1 min, add 2 qts for 6 min	10-15 minutes	2 hour	Sponge, Saturated Surface Dry	Minimum of 2 bags mixed at a time.
Pavemend 15	3	4.00 quarts	NO	Drill with paddle 4 mins until 95°F	8 minutes	2 hour	Sponge, Saturated Surface Dry	Mix product dry then add water to powder

Product Name	Slab #	Water for mixing	Required Aggregate Extension	Mixing Tool/Time	Work Time	Cure/ Traffic Time	Bonding Agent	Notes
Ulti-Pave 3	4	2.25 - 2.5 quarts	NO	See spec in Appendix A: 2-4 mins	30 minutes	2 hour	Sponge, Saturated Surface Dry	Mix powder to water
Fast Set DOT Mix	5	4.00 quarts	NO	Mixer: 3 mins	10 minutes	1.5 hour	Sponge, Saturated Surface Dry	Mix powder to water
MasterEmaco T 545HT (set45)	6	2 quarts	C33 #8 Gravel (30 lbs)	Drill with paddle 1-1.5 mins	10 minutes	1 hour	Sponge, Saturated Surface Dry	Mix powder to water
SikaQuick 2500	7	2.0 - 2.5 quarts	NO	Drill with paddle until homogeneous	15 minutes	1 hour	Fiber brush with product	Mix powder to water
HD-50 Rapid Set	8	3.25 quarts	C33 #8 Gravel (30 lbs)	Drill with paddle 2-3 mins	15 minutes	1 hour	Fiber brush with product	Mix powder to water
Pavepatch 3000	9	3.00 quarts	C33 #8 Gravel (30 lbs)	Drill with paddle 2-3 mins	15 minutes	1 hour	Fiber brush with product	Mix powder to water
MasterEmaco S 6000	10	NA	C33 #8 Gravel (40 lbs)	Drill with blade 30 to 60 seconds	5 minutes	1 hour	Fiber brush with Master Emaco P6001	Part A-0.5 gallon, Part B-Sand, and Part C-Aggregate
ProSpec Premium Patch 200	11	3.25 quarts	NO	Drill with paddle 2-3 mins	15 minutes	1 hour	Fiber brush with product	Light rodding to consolidate repair
Rapid Set Concrete Mix	12	4 +/- 0.50 quarts	NO	Drill with paddle 1-3 mins	20 minutes	1 hour	Sponge, Saturated Surface Dry	Mix powder to water. Apply burlap material for 1 hour during cure.
Pavemend SLQ	13	4.0 quarts	NO	Drill with paddle until 85°F, minimum 2 mins	5 minutes	1 hour	Sponge, Saturated Surface Dry	None

5 Test Methods for Evaluation

5.1 Simulated F-15E load cart traffic

A load cart designed to simulate a maximum gross vehicle weight F−15E aircraft was used for trafficking the spall repairs constructed. The repairs were trafficked with 3,000 total passes before completion of testing. The repairs were monitored over the course of the applied traffic for deterioration, cracking, and spalling.

5.1.1 Description of F-15E load cart

The load cart was equipped with a single 36-in. by 11-in., 30-ply tire inflated to an internal pressure of 325 psi to represent the test tire. The measured contact width of the F-15E tire when fully loaded is 9 in. PCASE reports that an F-15E aircraft loaded to its maximum capacity weighs 81 kips, with the main gears carrying 87% of that load; therefore, the load cart was outfitted with lead weights to produce a main gear load of 35.2 kips. The F-15E load cart was equipped with one outrigger wheel to prevent overturning and was powered by the front half of a U.S. Army 2.5-ton transport truck. The front axle supported a load of approximately 8 kips with a tire pressure of 60 psi. The load at the outrigger wheel was about 3 kips and had a tire pressure of 50 psi. A photograph of the load cart is shown in Figure 18.

5.1.2 F-15 load cart traffic

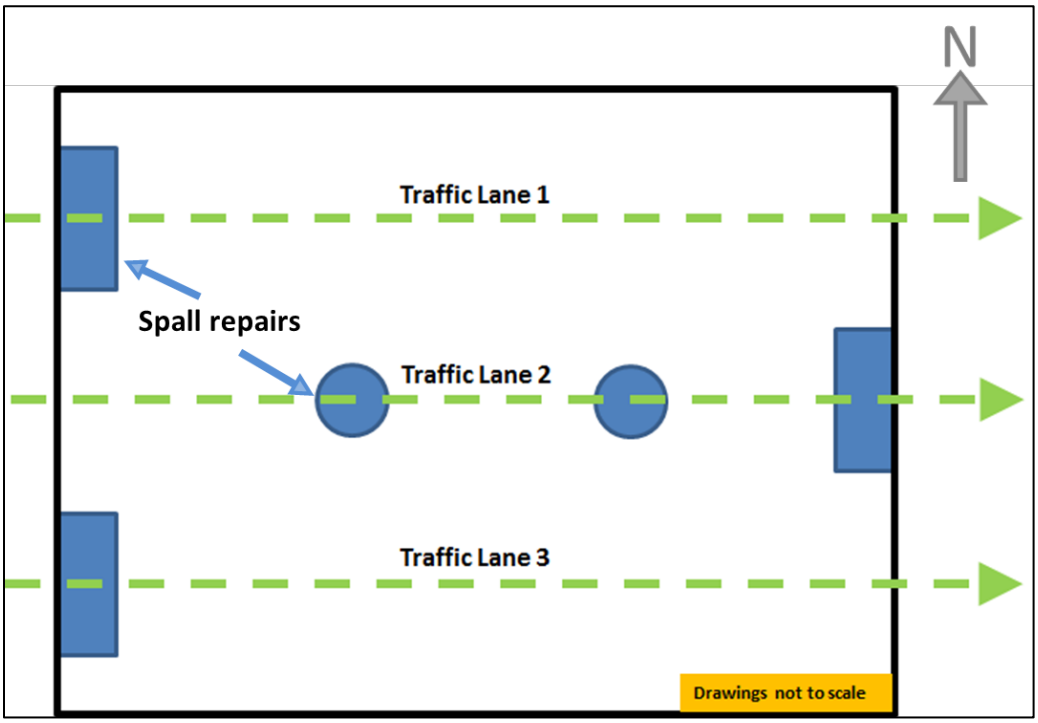
Traffic on each spall repair test slab was applied with three lanes of channelized traffic as shown in Figure 19. The pattern applied is an aggressive traffic scheme to simulate a worst-case scenario, as spall repairs in the field will not likely receive this amount of direct and constant traffic in a short period of time. Traffic guide lanes were placed offset of the actual traffic lanes to assist the load cart operator in successfully trafficking over the approximate center of each spall repair with the test wheel. Traffic was applied by driving the load cart forward (west to east) and then backward (east to west) over the length of the entire test section and then shifting the path of the load cart laterally to the next traffic lane on each forward path. A pass is defined as the crossing of a single point by the test vehicle, either forward or backwards.

A total of 30 traffic passes were placed on the products by the end of the day on 22 July 2015, and a total of 300 passes were placed on all traffic lanes by 9 March 2016 with no major distresses. Traffic continued over the test section until a total of 3,000 passes on all lanes was achieved on 7 July 2016. Depending on undesirable weather and load cart operator experience/availability, on average, approximately 60 passes per day on all three lanes could be achieved (ranging from 20 to 110 passes per day).

As noted in Table 1, CTS Mortar mix was added to the test section on 8 March 2016. Trafficking on all previous products stopped until a total of 300 aircraft passes were placed on this product immediately after its curing. Trafficking resumed to the entire test section after these initial passes to the CTS mortar product were complete to traffic all repairs at once. Detailed photographs of the repairs at various traffic pass intervals are in Appendix B: Detailed photos of repairs at various pass intervals.

Figure 18. F-15E simulation load cart and transport truck.

Figure 19. Representation of traffic lane pattern.



5.2 Compressive strength

Minimum compressive strength criterion is important for ensuring that the spall repair materials will not crush easily under wheel loads or under stresses caused by environmentally induced pavement movements. Compressive strength testing was accomplished in accordance with ASTM C 39 procedures (ASTM 2016) from three specimens cast from each product following ASTM C31 (ASTM 2015). The compressive strength of the concrete repair mixtures was evaluated by testing 3-in. by 6-in. cylinders, as shown in Figure 20.

Typically, larger 4-in. by 8-in. or 6-in. by 12-in. cylinders are used for compression strength testing; however, the smaller volume and area of the cylinders used allows for less material to be used in their casting and allows for faster testing in the laboratory within the short duration tolerance needed for a valid test result. Laboratory approval testing completed by the ERDC on prepackaged, proprietary cementitious repair materials also uses the smaller cylinder size.

Strength specimens were field-cured and received the same curing treatment as constructed repairs required by the manufacturer. The duration of curing varied by each manufacturers' requirement given in the published

technical information, but all products were cured between 1.5 and 3 hours before trafficking began. The curing duration was established as the time elapsed from final finishing to testing of a specimen, not the time elapsed from initial set of the material to the time of testing.

Results were reported as maximum compressive stress (psi), which equals the maximum applied load divided by the specimen's initial, unloaded cross-sectional area.

Figure 20. Preparation of concrete samples during repairs.

6 Results and Discussion

6.1 Compressive strength results

All of the repair products were tested for unconfined compressive strength, with the exception of CTS Rapid Set Mortar Mix (no cylinders cast for this product), at the approximate time of initial traffic. A total of three, 3-in. by 6-in. cylinder specimens were tested for each product, and the average compressive strengths was calculated. The results are shown below in Table 3.

Table 3. Average unconfined compressive strengths.

Product Name	Test Slab	Unconfined Compressive Strength (PSI)
CTS Rapid Set Mortar Mix	0	----1
MasterEmaco T 10-60 Repair Mortar	1	4,180
DOT Line	2	2,100
Pavemend 15	3	580
Ulti-Pave 3	4	4,250
Fast Set DOT Mix	5	4,760
MasterEmaco T 545HT (set45)	6	1,580
SikaQuick 2500	7	3,650
HD-50 Rapid Set	8	2,560
Pavepatch 3000	9	4,170
MasterEmaco S 6000	10	860
ProSpec Premium Patch 200	11	2,940
Rapid Set Concrete Mix	12	2,760
Pavemend SLQ	13	1,000
[1] Product placed on 8 March 2016 after initial testing of other products. No data for compressive strength.		

6.2 DOT Line

DOT Line performed great with no edge cracking, spalling, or surface cracks through the duration of this study (3,000 passes of F-15E simulated traffic). There was minor contraction joint spalling on repairs 2A and 2B starting at the approximate pass interval of 1,500; however, it was not potentially hazardous to aircraft and did not pose a FOD threat through the remainder of this study.

The manufacturer's directions for placement required a saturated surface dry bonding agent that was achieved by wetting a sponge with water and dabbing every surface of the repair prior to pouring the product in the repair. The product was easy to mix, place, and finish; however, the manufacturer required a minimum of two bags to be mixed when used for concrete repair.

6.3 HD-50 Rapid Set

HD-50 Rapid Set performed great with no edge cracking, spalling, or surface cracks through the duration of this study. There was minor edge cracking/raveling on repairs 8A, 8B, and 8E (all joint spall repairs) starting at the approximate pass interval of 1,500; however, it was not potentially hazardous to aircraft and did not pose a FOD threat through the remainder of this study. Both "popout" repairs, 8C and 8D, performed excellently with no visible cracking or raveling through the duration of this study.

The manufacturer's directions for placement required a bonding agent of the product itself. This was achieved by thoroughly mixing the product, applying the product to a stiff-bristle, plastic brush, and scrubbing the product into every surface of the repair prior to placing the product. Even though the manufacture required an aggregate extension (30 lbs per bag of C33 #8 gravel), the product was easy to mix, place, and finish.

6.4 Pavemend 15

Pavemend 15 performed great with the exception of repairs 3B and 3E that developed contraction joint cracking/raveling at the approximate pass interval of 1,500. Also, repair 3E developed a longitudinal crack (approximate pass interval of 1,500) through the center of the repair parallel to the contraction joint; however, it did not seem to penetrate to the bottom of the repair, affect performance, or pose a FOD threat through the remainder of this study.

The manufacturer's directions for placement required a saturated surface dry bonding agent and did not require aggregate extension. The product was easy to mix, place, and finish; however, it did require the product to be mixed thoroughly until it reached a temperature of 95° F which required a temperature gun to be added to the tool set for mixing. At the time of initial traffic, the average compressive strength was only 580 psi. Although

this is maybe considered a fairly weak compressive strength, it did not affect the performance.

6.5 Pavepatch 3000

Pavepatch 3000 performed great with the exception of minor contraction joint cracking/raveling on repair 9A starting at the approximate pass interval of 1,000; however, it was not potentially hazardous to aircraft and did not pose a FOD threat through the remainder of this study. Repairs 9B, 9C, 9D, and 9E performed excellently with no visible cracking or raveling through the duration of this study.

The manufacturer's directions for placement required a bonding agent of the product itself. This was achieved by thoroughly mixing the product, applying the product to a stiff-bristle, plastic brush, and scrubbing the product into every surface of the repair prior to placing the product. Even though the manufacturer required an aggregate extension (30 lbs per bag of C33 #8 gravel), the product was easy to mix, place, and finish.

6.6 ProSpec Premium Patch 200

ProSpec Premium Patch 200 performed excellently with the exception of minor contraction joint cracking/raveling on repairs 11A, 11B, and 11E starting at the approximate pass interval of 1,500; however, it was not potentially hazardous to aircraft and did not pose a FOD threat through the remainder of this study. Both "popout" repairs, 11C and 11D, performed excellently with no visible cracking or raveling through the duration of this study.

The manufacturer's directions for placement required a bonding agent of the product itself and did not require aggregate extension. The product was easy to mix, place, and finish; however, it was recommended to lightly rod the product after pouring in the repair to assist with consolidation.

6.7 Fast Set DOT Mix

The performance of Fast Set DOT Mix was poor with all the repairs, except for repair 5E, developing minor surface cracking, edge cracking, and contraction joint crack/raveling at the approximate pass interval of 500. These deficiencies progressed significantly through the duration of this study; however, it did not pose a significant FOD threat. Repair 5E was the

deeper repair (4 in. depth) of the other two spall repairs, 5A and 5B (2 in. depth), and exhibited great performance. Furthermore, there may need to be a testing or lab specifications to not use this product for repairs shallower than 4 in. until a more thorough study of this product is implemented.

The manufacturer's directions for placement required a saturated surface dry bonding agent and did not require aggregate extension. The product was easy to mix, place, and finish. At the time of initial trafficking, the average compressive strength achieved was 4,760 psi, which could suggest that the product developed early, rapid strength gain causing the repairs to be somewhat brittle. Again, this would need to be proven with a more thorough examination of this product to confirm this assumption.

6.8 CTS Rapid Set Concrete Mix

CTS Rapid Set Concrete Mix performed great with the exception of minor contraction joint cracking/raveling and edge cracking (repairs 12A, 12B, and 12E) after the approximate pass interval of 1,000. These repairs continued to perform for the duration of the study. Both "popout" repairs (12C and 12D) performed excellently with no visible cracks or spalling/raveling through the duration of this study. Repair 12A developed a relatively large spall at the contraction joint after 500 passes; however, it endured the total 3,000 passes with the spall breaking into two smaller pieces. It did not pop out or pose a FOD threat.

The manufacturer's directions for placement required a saturated surface dry bonding agent and did not require aggregate extension. The product was easy to mix, place, and finish.

6.9 MasterEmaco T 545HT (Set 45)

MasterEmaco T 545 HT (formerly Set 45) performed great with the exception of minor contraction joint cracking/raveling on repairs 6A, 6B, and 6E after the approximate pass interval of 1,500. These repairs exhibited great performance for the remainder of this study. Both "popout" repairs (6C and 6D) performed excellently with no visible cracks or spalling/raveling through the duration of this study.

The manufacturer's directions for placement required a saturated surface dry bonding agent. Although the manufacturer required aggregate extension (30 lbs per bag of C33 #8 gravel), the product was easy to mix, place, and finish.

6.10 Ulti-Pave 3

The performance of Ulti-Pave 3 was poor. Repairs 4A and 4B developed corner breaks at the contraction joint at the approximate pass level of 1,500. At approximately 2000 passes, the corner break on repair 4A broke into several pieces, began to ravel, and posed a FOD threat. The "popout" repairs (4C and 4D) exhibited minor to moderate surface cracking/raveling at the approximate pass level of 1,000 to 2,500, respectively.

The manufacturer claims to have an approximate workability time of 30 minutes. This did not prove true while mixing this product, as it became very thick and stiff approximately two minutes into mixing. After thoroughly mixing to a homogenous texture, it was difficult to place in the repair spot and finish. While using this product, it is highly recommended to delay the set up time by using very cold water to mix or some sort of retarding agent in order to assist with mixing, placing, and finishing.

The manufacturer's directions for placement required a saturated surface dry bonding agent and did not require aggregate extension. At the time of traffic, the average compressive strength was 4,250 psi, which may suggest why the product set up so aggressively.

6.11 SikaQuick 2500

SikaQuick 2500 performed excellently with no visible edge cracking, contraction joint spalling, or surface cracks through the duration of this study.

The manufacturer's directions for placement required a bonding agent of the products itself and did not require aggregate extension. The working time was 15 minutes, and the product was very easy to mix, place, and finish.

6.12 Pavemend SLQ

Pavemend SLQ performed excellently with the exception of minor contraction joint spall (less than 0.5-in. wide and approximately 2-in. along the

contraction joint) on repair 13E starting at the approximate pass interval of 1,000; however, it was not potentially hazardous to aircraft and did not pose a FOD threat through the remainder of this study. The other joint spall repairs, 13A and 13B, and both "popout" repairs, 13C and 13D, performed excellently with no visible cracking or raveling through the duration of this study.

The manufacturer's directions for placement required a saturated surface dry bonding agent and did not require an aggregate extension. The working time was 5 minutes, and the product was very easy to mix, place, and finish. At the time of initial trafficking, the average compressive strength was 1,000 psi. This value may seem on the lower or less desired side of the compressive strength spectrum; however, it did not reflect in the overall performance of the product.

6.13 MasterEmaco T 10-60 Repair Mortar

MasterEmaco T 10-60 Repair Mortar performed great with the exception of minor contraction joint cracking/raveling on repair 1B after the approximate pass interval of 500; however, these repairs continued to exhibit great performance for the remainder of the study. Joint spall repairs, 1A and 1E, and both "popout" repairs, 1C and 1D, performed excellently with no visible cracks or spalling/raveling through the duration of this study.

The manufacturer's directions for placement required a saturated surface dry bonding agent. Although the manufacture required an aggregate extension (25 lbs per bag of C33 #8 gravel), the product was easy to mix, place, and finish.

6.14 MasterEmaco S 6000

The performance of MasterEmaco S 6000 was poor. All repairs exhibited moderate to severe surface cracking/raveling and early surface deterioration before the pass interval of 500. Furthermore, this deterioration resulted in exposure of the aggregate and in some cases, dislodging of the aggregate further causing a FOD threat.

The manufacturer's directions for placement required a bonding agent of a separate product manufactured by MasterEmaco (P 6001) that is sprayed on all surfaces of the repair and allowed to cure. There were no specifica-

tions on the product data sheet on allotted cure time for the primer/binding agent. After allowing the primer to cure (no longer shiny or tacky to the touch), the product used for repair was mixed with two separate parts (Part A and Part B) made by the manufacturer. No water is used for mixing. MasterEmaco S 6000 Part A is a reactive binder based on methacrylate monomers used with Part B to form a polymer concrete. MasterEmaco S 6000 Part B is a non-cementitious, water-free composite material in which fine and coarse aggregates are bound together in a dense matrix with a polymer binder (mix ½ gallon of Part A for 37 pound bag of Part B).

The manufacturer claims to have an approximate workability time of five minutes. This did not prove true while mixing this product as it became very thick and stiff approximately two minutes into mixing. It was also recommended by the manufacturer to use aggregate extension (40 lbs of C33 #8 gravel). After thoroughly mixing and staying below the five minute workability time frame, it was difficult to place in the repair area and finish. While using this product, it is highly recommended to delay the set up time by using some sort of retarding agent in order to assist with mixing, placing, and finishing (if allowed by manufacturer). Also, it is suggested not to use an aggregate extension or use a significantly less amount than the 40 lbs recommend by the manufacturer, which could impede the ease of mixing.

At the time of trafficking, the average compressive strength was 860 psi which may suggest why the product set up so aggressively and could be the reason for early deterioration and failure. This would need to be proven with a more thorough examination of this product to confirm this assumption. This product is considered highly undesirable to use under time constraints due the complexity of the primer and mixing the product, as well as early stiffening further made it very difficult to place and finish. In addition to difficulty of using this product, its performance was very poor.

6.15 CTS Rapid Set Mortar Mix

CTS Rapid Set Mortar Mix performed excellently with no visible edge cracking, spalling, or surface cracks through the duration of this study.

The manufacturer's directions for placement did not specify a bonding agent; however, saturated surface dry was used. Also, the product did not require an aggregate extension. The product was very easy to mix, place, and finish.

7 Conclusions and Recommendations

The ERDC evaluated the performance of partial-depth pavement repairs constructed with 14 different concrete pavement repair materials. The repairs cast were trafficked with simulated F-15E aircraft loads for a maximum of 3,000 passes. The deterioration of the repairs was monitored during trafficking. Conclusions pertaining to material production, repair placement and finishing, and traffic performance are detailed below. Recommendations for the future use of these products and additional work are also provided.

7.1 Conclusions

1. CTS Rapid Set Mortar Mix, SikaQuick 2500, ProSpec Premium Patch 200, and Pavemend SLQ exhibited excellent performance with no significant cracks or deterioration through the entire trafficking duration. All products were easy to mix, place, and finish and did not require aggregate extensions. All products endured 3,000 passes of channelized F-15E load cart traffic with no repair deficiencies. These products are recommended for long-term concrete pavement repairs and expedient repairs due to their performance during this study.

2. MasterEmaco T 10-60 Repair Mortar, DOT Line, MasterEmaco T 545HT (formerly Set45), HD-50 Rapid Set, Pavepatch 3000, and Rapid Set Concrete Mix exhibited great performance with minor edge cracking and raveling of contraction joints as pass intervals increased; however, there was no threat of FOD. Some of these products require aggregate extension and/or bonding agents of the product itself for installation; however, all products were easy to mix, place, and finish. These products are recommended for use of long-term repairs and expedient repairs if the products listed in Conclusion 1 above are not available.

3. Pavemend 15 exhibited good performance with minor contraction joint spalling/raveling. Repair 3E developed a longitudinal crack (approximate pass interval of 1,500) through the center of the repair parallel to the contraction joint; however, it did not seem to penetrate to the bottom of the repair, affect performance, or pose a FOD threat through the duration of this study. The product was easy to mix, place, and finish; however, a temperature gun was needed to mix the product until it

reached a temperature of 95° F. Pavemend 15 is recommended for use of long-term repairs and expedient repairs if the products listed in Conclusion 1 above are not available.

4. Ulti-Pave 3, Fast Set DOT Mix, and MasterEmaco S 6000 showed early signs of moderate to severe deterioration early during trafficking and progressively worsened. Ulti-Pave 3 and MasterEmaco S 6000 were very difficult to mix, place, and finish and became very stiff before a homogeneous mixture was achieved. These products have potential to create FOD early after repairs are constructed and are not recommended for use in airfield concrete repair.

5. The performance of the "popout" repairs was equal to or exceeded that of the joint spall repairs made.

6. The difference in joint spall repair depth did not seem to affect the overall product performance with the exception of Fast Set DOT Mix.

7.2 Recommendations

From the data collected and observations made in this study, the following is recommended.

1. When selecting a repair material, always consider the physical environment (temperature, humidity, chance of precipitation, etc.) and the directions for use. As detailed in the results section of this report, some products require special tools or complicated directions that may not be suitable for expedient repair situations.

2. A similar evaluation should be performed where manufacturers' construction requirements and UFC repair guidance are not followed to see which construction task or items are not critical to the repair installation process or performance, for example, make repairs without saw cutting, bonding agents, compressible insert, or special curing requirements, and more specifically, a quick repair for early, aggressive traffic. This would represent a situation where time of repair to back in service is minimal.

3. Conduct a long-term evaluation with the top performing products where the repairs endure not only trafficking performance but environmental conditions as well. Locations that are typically wet and areas with large thermal gradients would be areas of interest to evaluate items tested in

the laboratory protocol. Some products tested in the laboratory by ERDC showed expansion issues when exposed to wet conditions. Also, products with poor adhesion may not deform with the slab and could be stressed more than those with better adhesion. Installation of repairs during cooler times would also be suspect to repair damage as the slabs expand with temperature variances. Testing in different locations will produce different stresses on the repairs that may lead to different construction or material requirements.

4. In most cases, even with some of the top performing products, the contraction joints seemed to be the first signs of repair deficiencies with minor raveling and spalling. A study on best-performing bonding agents and backer board material used for maintaining contraction joints would be beneficial.

References

American Society for Testing and Materials (ASTM). 2016. Standard test method for compressive strength of cylindrical concrete specimens. Designation: C 39-16. West Conshohocken, PA.

———. 2015. Standard Practice for making and Curing Concrete test Specimens in the Field. Designation: C 31-15. West Conshohocken, PA.

———. 2000. Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs Designation: C 928-00. West Conshohocken, PA.

Headquarters, Departments of the Army and the Air Force. 1993. Standard Practice for Sealing Joints and Cracks in Rigid and Flexible Pavements. Technical Manual 5-822-11/AFM 88-6, Chap 7. Washington, D.C.

Headquarters, Departments of the Army, the Navy, and the Air Force. 2001. Concrete Crack and Partial-Depth Spall Repair. Unified Facilities Criteria 3-270-03. Washington, D.C.

———. 2001. Concrete Repair. Unified Facilities Criteria 3-270-04, Washington, D.C.

Uncited

Priddy, L.P., J.S. Tingle, T.J. McCaffrey, and R.S. Rollings. 2007. Laboratory and Field Investigations of Small Crater Repair Technologies. ERDC/GSL TR-07-27. Vicksburg, MS: Engineer Research and Development Center.

Priddy, L.P. 2011. Development of Laboratory Testing Criteria for Evaluating Cementitious, Rapid-Setting Pavement Repair Materials. ERDC/GSL TR-11-13. Vicksburg, MS: Engineer Research and Development Center.

Product Manufacturer Webpage Links

http://www.pavemend.com/dotline_product_page.html

http://www.daytonsuperior.com/docs/default-source/tech-data-sheets/hd_50.pdf?sfvrsn=10

http://www.pavemend.com/15.0_product_page.html

http://www.daytonsuperior.com/docs/default-source/tech-data-sheets/pave_patch_3000.pdf?sfvrsn=9

http://www.prospec.com/uploads/product/document/premium_patch_200_rev_1114.pdf

http://www.quikrete.com/PDFs/DATA_SHEET-CGFS%20DOT%20Mix%201244-56%20-58.pdf

http://www.ctscement.com/rapid-set-concrete-mix/

https://www.master-builders-solutions.basf.us/en-us/products/masteremaco/1639

www.buzziunicemusa.com/

usa.sika.com

www.seratechinc.com

https://www.master-builders-solutions.basf.us/en-us/products/masteremaco/1623

www.master-builders-solutions.basf.us

http://www.ctscement.com/rapid-set-mortar-mix/

Appendix A: Data Sheets for All Materials in This Study

BASF
The Chemical Company

PRODUCT DATA

3 03 01 00 **Maintenance of Concrete**

10-60 RAPID MORTAR

Very rapid-setting cement-based mortar

Description

10-60 Rapid Mortar is a one-component shrinkage-compensated very rapid-setting cement-based mortar. It is designed for horizontal concrete surfaces where high early strength gain is required.

Yield

0.43 ft³ (0.012 m³) per 50 lb (22.7 kg) bag

When extended 50%: 0.57 ft³ (0.016 m³)

When extended 100%: 0.77 ft³ (0.022 m³)

Packaging

50 lb (22.7 kg) bags

3,000 lb (1,360.8 kg) bulk bags

Shelf Life

1 year when properly stored

Storage

Store and transport in unopened containers at 60 to 80° F (16 to 27° C) in clean, dry conditions.

Features	Benefits
• Extra low permeability	Helps prevent chloride intrusion
• Very rapid setting	Structures can be opened to vehicular traffic in 1 hour; epoxy coated in as little as 4 hours
• Excellent resistance to freeze/thaw cycling	Outstanding durability
• Nongypsum based	Volume stability
• Shrinkage compensated	Minimizes cracking from drying shrinkage; reduces stress at the bond line
• Can be extended up to 100% by weight with 3/8" (10 mm) aggregate	Economical; high yields
• Proprietary cement blend	Bonds to carbonated and noncarbonated concrete substrates

Where to Use

APPLICATION

- Applications requiring high early-strength gain
- Structural concrete repairs
- Repairing industrial floors
- Bridges
- Parking decks
- Airport runways

LOCATION

- Horizontal surfaces
- Interior or exterior

SUBSTRATE

- Concrete

How to Apply

Surface Preparation

CONCRETE

1. Concrete must be structurally sound and fully cured (28 days).
2. Saw cut the perimeter of the area being patched into a square with a minimum depth of 1/2" (13 mm).
3. Remove all unsound concrete and roughen the surface to a minimum 1/4" (6 mm) profile amplitude.
4. Remove all laitance, oil, grease, curing compounds, and other contaminants that could prevent adequate bond.
5. The concrete substrate should be saturated surface-dry (SSD), without standing water, before application.

Protection and Repair

Technical Data

Composition

10-60 Rapid Mortar is a blend of cement, graded aggregate, shrinkage-compensating agents, and set-control additives.

Compliances

- ASTM C 928

Test Data

The following results were obtained with a water / powder ratio of 5.5 pints (2.6 L) of water to 50 lbs (22.7 kg) of 10-60 Rapid Mortar at 73° F (23° C).

PROPERTY	RESULTS	TEST METHODS
Fresh wet density, lb/ft³ (kg/m³)	130 (2,082)	ASTM C 138
Set time, min, at 72° F (22° C)		ASTM C 191
Initial	16	
Final	28	
Working time, min	8	
Length change, % (µstrain)		ASTM C 928
Drying shrinkage	-0.05 (-500)	
Wetting expansion	+0.03 (+300)	
Coefficient of thermal expansion, in/in/° F (cm/cm/° C)	7.0 x 10⁻⁶ (12.6 x 10⁻⁶)	CRD C 39
Modulus of elasticity, psi (GPa)	4.4 x 10⁶ (19.5)	ASTM C 469
Rapid chloride permeability, coulombs	< 300	ASTM C 1202
Freeze/thaw resistance, % RDM, at 300 cycles	100	ASTM C 666, (Procedure A)
Scaling resistance, at 25 cycles	0 rating; no scaling	ASTM C 672
Slant shear bond strength, psi (MPa)		ASTM C 882, modified[1]
1 day	2,300 (16)	
28 days	2,600 (18)	
Splitting tensile strength, psi (MPa)		ASTM C 496
1 day	400 (3)	
28 days	450 (3)	
Flexural strength, psi (MPa)		ASTM C 348
1 day	700 (5)	
28 days	850 (6)	
Compressive strength, psi (MPa), 2" cubes		ASTM C 109
1 hr	2,000 (14)	
1 day	4,000 (28)	
28 days	8,000 (55)	
Compressive strength, psi (MPa), 3 by 6" cylinders, at 28 days	7,400 (51)	ASTM C 39

[1]No bonding agent used; mortar scrubbed into substrate.

All application and performance values are typical for the material, but may vary with test methods, conditions, and configurations.

REINFORCING STEEL

1. Remove all oxidation and scale from the exposed reinforcing steel in accordance with ICRI Technical Guideline No. 03730 "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion."

2. For additional protection from future corrosion, coat the prepared reinforcing steel with Zincrich Rebar Primer.

MIXING

1. Add 5-1/2 pints (2.6 L) of clean water to the mixing container for each bag of 10-60 Rapid Mortar. If required, add the correct amount of aggregate to the mixer. Add the powder to the water while continuously mixing with a slow-speed drill and paddle, mortar mixer, or other forced action mixer.

2. Mix for a minimum of 3 minutes until fully homogeneous.

AGGREGATE EXTENSION

1. For repair areas 2 – 4" (51 – 102 mm) in depth, the minimum recommended addition is 15 – 25 lbs (6.8 – 11.4 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb (22.7 kg) bag.

2. For areas greater than 4" (102 mm) in depth, the minimum recommended addition is 25 – 50 lbs (11.4 to 22.7 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb bag.

3. The maximum aggregate extension is 50 lbs (22.7 kg) of pea gravel per bag.

4. The performance of 10-60 Rapid Mortar depends on the type, condition, and amount of aggregate added. Rely on trials, testing, and previous experience to determine aggregate suitability.

Application

1. Apply the mixed material onto the prepared saturated surface-dry (SSD) substrate by gloved hand, trowel, or screed. Ensure proper consolidation of the mortar and compaction around reinforcing steel. Minimum application thickness is 1/2" (13 mm).

2. Finish the completed repair, as required, taking care not to overwork the surface.

3. A maximum of 15 minutes should be allowed to mix, place, and finish 10-60 Rapid Mortar at 70° F (21° C).

Clean Up

Clean tools and equipment with clean water immediately after use. Cured material must be removed mechanically.

Curing

1. Proper curing is extremely important. Cure 10-60 Rapid Mortar immediately after finishing. Use a water-based curing compound that complies with ASTM C 309.

For Best Performance

- Minimum ambient, surface, and material temperature is 40° F (4° C) and rising.
- Do not mix longer than 5 minutes.
- Minimum application thickness is 1/2" (13 mm).
- Consult coating supplier for overcoating requirements.
- Make certain the most current versions of product data sheet and MSDS are being used; call Customer Service (1-800-433-9517) to verify the most current version.
- Proper application is the responsibility of the user. Field visits by BASF personnel are for the purpose of making technical recommendations only and are not for supervising or providing quality control on the jobsite.

Health and Safety

10-60 RAPID MORTAR

WARNING!

10-60 Rapid Mortar contains silica, crystalline quartz; alumina cement; portland cement; anhydrite; fly ash; calcium sulfate; silica, amorphous; iron oxide.

Risks

Product is alkaline on contact with water and may cause injury to skin or eyes. Ingestion or inhalation of dust may cause irritation. Contains small amount of free respirable quartz which has been listed as a suspected human carcinogen by NTP and IARC. Repeated or prolonged overexposure to free respirable quartz may cause silicosis or other serious and delayed lung injury.

Precautions

Avoid contact with skin, eyes and clothing. Prevent inhalation of dust. Wash thoroughly after handling. Keep container closed when not in use. DO NOT take internally. Use only with adequate ventilation. Use impervious gloves, eye protection and if the TLV is exceeded or used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with applicable Federal, state and local regulations.

First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs or if swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Refer to Material Safety Data Sheet (MSDS) for further information.

Proposition 65

This product contains material listed by the State of California as known to cause cancer, birth defects or other reproductive harm.

VOC Content

0 g/L or 0 lbs/gal less water and exempt solvents.

For medical emergencies only, call ChemTrec (1-800-424-9300).

MBT PROTECTION & REPAIR PRODUCT DATA
10-60 RAPID MORTAR

BASF Corporation
Building Systems
889 Valley Park Drive
Shakopee, MN, 55379

www.BuildingSystems.BASF.com

Customer Service 800-433-9517
Technical Service 800-243-6739

LIMITED WARRANTY NOTICE: Every reasonable effort is made to apply BASF exacting standards both in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our election, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products, but also upon many factors beyond our control. Therefore, except for such replacement or refund, BASF MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and BASF shall have no other liability with respect thereto. Any claim regarding product defect must be received in writing within one (1) year from the date of shipment. No claim will be considered without such written notice or after the specified time interval. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the BASF Technical Manager.

This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights. In particular, BASF disclaims all CONDITIONS AND WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. BASF SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL, INDIRECT OR INCIDENTAL DAMAGES (INCLUDING LOSS OF PROFITS) OF ANY KIND. BASF reserves the right to make any changes according to technological progress or further developments. It is the customer's responsibility and obligation to carefully inspect and test any incoming goods. Performance of the product(s) described herein should be verified by testing and carried out only by qualified experts. It is the sole responsibility of the customer to carry out and arrange for any such testing. Reference to trade names used by other companies is neither a recommendation, nor an endorsement of any product and does not imply that similar products could not be used.

For professional use only. Not for sale to or use by the general public.

Form No. 1018978 07/11
Printed on recycled paper including 10% post-consumer fiber.

© 2011 BASF
Printed in U.S.A.

CTS Cement | Professional Cement Products
Rapid Set® Mortar Mix Data Sheet

Rapid Set

MORTAR MIX

High-Strength Structural Repair Mortar

Highlights:

- ***FAST***
  Sets in 20 minutes
  Rock solid in 1 hour
- ***DURABLE***
  Formulated for long life in critical applications
- ***STRUCTURAL***
  For repair and new construction
- ***MULTI-PURPOSE***
  Use for concrete repairs, wall repairs, stucco repairs, one-coat exterior plaster, underlayments, floors, formed work and more

CONFORMS TO:
ASTM: C928 and C387
State and Local Approvals

MANUFACTURER:
CTS Cement Manufacturing Corp.
11065 Knott Ave., Suite A
Cypress, CA 90630
Tel: 800-929-3030
Fax: 714-379-8270
Web: www.CTScement.com
E-mail: info@CTScement.com

PRODUCT NAME:
Rapid Set® MORTAR MIX

DESCRIPTION: Rapid Set MORTAR MIX is a high-performance, fast-setting, multipurpose repair material. Durable in wet environments, MORTAR MIX is a blend of Rapid Set hydraulic cement and quality aggregates. Rapid Set is non-metallic and no chlorides are added. Mix MORTAR MIX with water to produce a workable, high quality mortar material that is ideal where fast strength gain, high durability and low shrinkage are desired. MORTAR MIX sets in 20 minutes and achieves structural strength in 1 hour.

USES: Use MORTAR MIX for general and structural concrete repair, construction of pavements, stucco and plaster repair, one-coat exterior plaster, underlayments and formed work. MORTAR MIX is a versatile product that is suitable for vertical and overhead applications. For freeze thaw durability, in some geographical areas, MORTAR MIX contains an air-entraining admixture.

ENVIRONMENTAL ADVANTAGES: Use MORTAR MIX to reduce your carbon footprint and lower your environmental impact. Production of Rapid Set cement emits far less CO_2 than portland cement. Contact your representative for LEED values and environmental information.

APPLICATION: Apply MORTAR MIX in thicknesses from 1/2" to 6" (1.2 cm to 15.2 cm). For thicker applications, use Rapid Set® Concrete Mix. Not intended for high heat applications above 300°F (149°C). For overlay applications, a minimum of one test section should be prepared to evaluate the suitability of the materials and procedures.

SURFACE PREPARATION: For repairs, application surface shall be clean, sound and free from any materials that may inhibit bond, such as oil, asphalt, curing compound, acid, dirt and loose debris. Roughen surface and remove all unsound material. Apply MORTAR MIX to a thoroughly saturated surface with no standing water.

MIXING: The use of a power-driven mechanical mixer, such as a mortar mixer or a drill-mounted mixer, is recommended. Organize work so that all personnel and equipment are in place before mixing. Use clean potable water. **MORTAR MIX may be mixed using 3 to 5 quarts (2.8 L to 4.7 L) of water per 55-lb (25-kg) bag. Use less water to achieve higher strengths. Do not exceed 5 quarts (4.7 L) of water per bag.** For increased fluidity and workability, use Rapid Set® FLOW Control® plasticizing admixture from the Rapid Set® Concrete Pharmacy®. Place the desired quantity of mix water into the mixing container. While the mixer is running, add MORTAR MIX. Mix for the minimum amount of time required to achieve a lump-free, uniform consistency (usually 1 to 3 minutes). Do not retemper.

Rapid Set®

MORTAR MIX™

High-Strength Structural Repair Mortar

PLACEMENT: Rapid Set® MORTAR MIX may be placed using traditional construction methods. Organize work so that all personnel and equipment are ready before placement. Place, consolidate and screed quickly to allow for maximum finishing time. Use a method of consolidation that eliminates air voids. Do not wait for bleed water; apply final finish as soon as possible. MORTAR MIX may be troweled, floated or broom finished. On flat work, do not install in layers. Install full-depth sections and progress horizontally. To extend working time, use Rapid Set® SET Control® retarding admixture from the Rapid Set® Concrete Pharmacy® or cold mix water. Do not install on frozen surfaces. MORTAR MIX may be applied in temperatures ranging from 45°F to 90°F (7°C to 32°C).

CURING: Water cure all MORTAR MIX installations by keeping exposed surfaces wet for a minimum of 1 hour. Begin curing as soon as the surface starts to lose its moist sheen. When experiencing extended setting time due to cold temperature or the use of retarder, longer curing times may be required. The objective of water curing shall be to maintain a continuously wet surface until the product has achieved sufficient strength.

COLD WEATHER: Environmental and material temperatures below 70°F (21°C) may delay setting time and reduce the rate of strength gain. Lower temperatures will have a more pronounced effect. Thinner sections will be more significantly affected. To compensate for cold temperatures, keep material warm, use heated mix water and follow ACI 306 Procedures for Cold Weather Concreting.

WARM WEATHER: Environmental and material temperatures above 70°F (21°C) may speed setting time and increase the rate of strength gain. Higher temperatures will have a more pronounced effect. To compensate for warm temperatures, keep material cool, use chilled mix water and follow ACI 305 Procedures for Hot Weather Concreting. The use of SET Control retarding admixture from the Concrete Pharmacy will help offset the effects of high temperatures.

YIELD & PACKAGING: MORTAR MIX is available in 55-lb and 25-lb (25-kg and 11.3-kg) sizes. One 55-lb (25-kg) bag of MORTAR MIX will yield approximately 0.5 ft^3.

SHELF LIFE: When stored in a dry location, in an undamaged package, MORTAR MIX has a shelf life of 12 months.

USER RESPONSIBILITY: Before using CTS products, read current technical data sheets, bulletins, product labels and safety data sheets. It is the user's responsibility to review instructions and warnings for any CTS products prior to use.

WARNING: DO NOT BREATHE DUST. AVOID CONTACT WITH SKIN AND EYES. Use material in well-ventilated areas only. Exposure to cement dust may irritate eyes, nose, throat, and the upper respiratory system/lungs. Silica exposure by inhalation may result in the development of lung injuries and pulmonary diseases, including silicosis and lung cancer. Seek medical treatment if you experience difficulty breathing while using this product. The use of a NIOSH/MSHA-approved respirator (P-, N- or R-95) is recommended to minimize inhalation of cement dust. Eat and drink only in dust-free areas to avoid ingesting cement dust. Skin contact with dry material or wet mixtures may result in bodily injury ranging from moderate irritation and thickening/cracking of skin to severe skin damage from chemical burns. If irritation or burning occurs, seek medical treatment. Protect eyes with goggles or safety glasses with side shields. Cover skin with protective clothing. Use chemical resistant gloves and waterproof boots. In case of skin contact with cement dust, immediately wash off dust with soap and water to avoid skin damage. In case of skin contact with wet concrete, wash exposed skin areas with cold running water as soon as possible. In case of eye contact with cement dust, flush immediately and repeatedly with clean water and consult a physician.

PHYSICAL DATA

Set Time, ASTM C 191 Mod.**	
Initial set	20 minutes
Final set	35 minutes
Compressive Strength, ASTM C109 Mod.**	
1 hour*	2500 psi (17.2 MPa)
3 hours	4000 psi (27.6 MPa)
24 hours	5000 psi (34.5 MPa)
7 days	5500 psi (37.9 MPa)
28 days	6500 psi (44.8 MPa)
Slant Shear Bond Strength, ASTM C882 Mod.**	
24 hours	1200 psi (8.27 MPa)
28 days	2200 psi (15.2 MPa)
Splitting Tensile, ASTM C496 Mod.**	
7 days	450 psi (3.10 MPa)
28 days	550 psi (3.79 MPa)
Flexural Strength, ASTM C78 Mod**	
7 days	500 psi (3.45 MPa)
28 days	550 psi (3.79 MPa)
Length Change, ASTM C157 Mod. (max)**	
28 days in air	-0.04
28 days in water	0.02

*After final set
**Data obtained at flow consistency 103 by ASTM C1437 Mod. at 70°F (21°C)

If wet concrete splashes into eyes, rinse eyes with clean water for at least 15 minutes and go to the hospital for further treatment.

PROPOSITION 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

PIPlease refer to the SDS and www.CTScement.com for additional safety information regarding this material.

LIMITED WARRANTY: CTS CEMENT MANUFACTURING CORP. (CTS) warrants its materials to be of good quality and, at its option, will replace or refund the purchase price of any material proven to be defective within one (1) year from date of purchase. The above remedies shall be the limit of CTS's responsibility. Except for the foregoing, all warranties expressed or implied, including merchantability and fitness for a particular purpose, are excluded. CTS shall not be liable for any consequential, incidental, or special damages arising directly or indirectly from the use of the materials.

USGBC and related logo is a trademark owned by the U.S. Green Building Council and is used by permission.
© 2015 CTS Cement Mfg. Corp. DS_003_EN-052615D
30% post consumer waste recycled fiber

D.O.T.LINE™ RAPID REPAIR CONCRETE

Pre-Extended (3/8"), Fiber Reinforced
RAPID REPAIR CONCRETE

Product Data Sheet

pavemend

Updated 8.19.14

1 General Characteristics

D.O.T.Line™ is fiber reinforced, rapid setting cementitious based structural repair concrete. It is a single component powder that is water activated. **D.O.T.Line**™ has 10 - 15 minutes of working time and will reach compressive strengths of more than 2500 psi within 2 hours from mixing. **D.O.T.Line**™ can be applied in ambient temperature ranges of 40° to 120° F.

D.O.T.Line™ finishes like traditional Portland based concrete and cleans up easily with water. **D.O.T.Line**™ rapid repair concrete offers high performance and ease of use in a cost effective, turn-key, pre-extended package.

RECOMMENDED USES: D.O.T.Line™ has been designed for horizontal applications providing for cost effective structural repair of roads, bridges, airport runways, and form & pour projects. Can be used as a temporary repair for asphalt pavement.

2 Additional Physical Properties

UNIT WEIGHT (with water, sand & aggregate)
152 lb/ft³ (2434 kg/m³)

SETTING TIME
Set Times at 72°F/22°C at 2" (5 cm) material depth
Initial set: 20 - 25 minutes
Final set: 30 - 40 minutes

VOLUME YIELD (#8 - 3/8" fractured stone- included)
0.40ft³ (0.011 m³)

3 Material Specifications

Results provided by licensed engineering test laboratory and represent typical results from production materials. Actual results may vary from third party testing results; however, CERATECH's materials *meet and/or exceed* **ASTM C928**, and *exceed* established internal quality control standards, (available upon request). All samples were air cured.

Property	As Packaged 4 in. x 8 in. cylinders	Test Method
Compressive Strengths, **psi** (MPa)		
2 hours	> 2,500	ASTM C 39
1 day - 24 hours	> 5,000	ASTM C 39
7 days	> 7,000	ASTM C 39
28 days	> 9,000	ASTM C 39
Flexural Strength, **psi** (MPa)		
1 day - 24 hours	> 600	ASTM C 78
7 days	> 900	ASTM C 78
28 days	> 1,200	ASTM C 78
Splitting Tensile Strength, **psi** (MPa)		
28 days	> 500	ASTM C 496
Bond Strength, **psi** (MPa)		
1 day- 24 hours	> 1,500	ASTM C 882
7 days	> 2,000	ASTM C 882
Rapid Freeze Thaw Resistance (Durability Factor - Retained percentage of Dynamic Modulus)		
300 cycles	100%	ASTM C 666A
Scaling Resistance, **lbs/ft²** (kg/m²)		
50 cycles	0	ASTM C 672
Modulus of Elasticity, **psi**		
28 days	5.41×10^6	ASTM C 469
Coefficient of Thermal Expansion, **in/in/°F**		
28 days	$1.327EE^{-5}$	TxDOT-TEX-428-A
Length Change, **% of total length**		
28 days soak / 28 days dry	< .02 / < .045	ASTM C 157

CERATECH

PFT Planet Friendly Technology!

D.O.T.LINE™ RAPID REPAIR CONCRETE

Pre-Extended (3/8"),
Fiber Reinforced
RAPID REPAIR CONCRETE

Product Data Sheet

pavemend

Updated 8.19.14

4 Site Preparation

Surfaces should be prepared in accordance with ICRI 03730, "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion" and / or ACI 546R-96 "Concrete Repair Guide". Concrete surfaces should be prepared by appropriate mechanical methods to obtain an exposed aggregate surface with a minimum surface profile of +/- 1/16" (1.5 mm) in accordance with ICRI 03732. Pre-existing coatings or surface treatments should be completely removed. Dry, clean, stable surfaces are required. Remove all standing water. Reinforcing steel should have no loose scale. **Surfaces of host concrete must be damp.**

5 Mixing Instructions

Standard Mixing Procedures (Rotating Drum Concrete Mixer)

- Pre-wet cement mixer with water then drain all water from mixer (away from repair area).
- Start mixer - **D.O.T.Line™** requires a total of 2 quarts of water per 53.5 lb. unit. Initially, add only 1 quart of water to concrete mixer per 53.5 lb unit of **D.O.T.Line™** to be used.
- Add pre-determined units of **D.O.T.Line™**, mix for 1 minute.
- Add in remaining quart of water per unit of **D.O.T.Line™**.
- Mix for 6 additional minutes or 7 minutes total.
- Pour all contents into repair area.
- Clean mixer or repeat process for next batch.

! D.O.T.Line™ is a water to binder sensitive cement. NEVER use less than 2 quarts of water nor MORE THAN 2 1/8 quarts of water per 53.5 lb. unit of **D.O.T.Line™**).

NOTES:

1. In ambient temperatures, < 50°F / 10°C, use warm water (70°F/22°C to 90°F/32°C).
2. In ambient temperatures > 85°F/ 29°C, use cooler water (50°F/ 10°C to 60°F/16°C).
3. Working times will vary when mix water temperature's are outside of these recommendations.
4. Minimum recommended batch size is 2 units (Use 4 quarts of water for 2 bag batches).

6 Packaging & Shelf Life

PACKAGING
53.5lb (24.3 kg) Bag
GSA P/N: C100

SHELF LIFE
1 year

STORAGE
Bags must be kept dry and out of direct sunlight.

7 Limitations

- Not recommended for surface temperatures above **120°F**/49°C or below **40°F**/10°C. (Contact CERATECH Tech support for temperatures below 50°F).

8 Application & Finish

- **Surfaces of host concrete must be damp with no standing water.**
- Working times based on ambient temperature, types of aggregate and total amount of water. Working times are influenced by surface temperature and repair profile. **Working time can be extended by adding CERATECH's Set Retarder Admixture to mix water. (See Set Retardant product data sheet for more information).**
- Minimum profile thickness is **1.25"** (3.2 cm). There are no restrictions to the depth of the repair profile.
- For best results, CERATECH recommends monolithic placement of repair materials. Maintain a minimum thickness of 1" if repair material must be layered. Material must also be layered before final set has been reached.
- Upon initial set, a broom finish can be applied. Upon final set, the material can be saw-cut, drilled, sanded and/or polished.
- Do not re-temper. The addition of water to the surface of the repair will negatively affect the materials final properties.
- **General loading in 2 hours for wheeled traffic and 1 hour for foot traffic after addition of water. ! Add 30 minutes for every 10°F drop in temperature.** Contact CERATECH **Field Engineering for Cold Weather Applications** (50°F / 10°C and below).
- **All previously existing joints must be re-established within 2-3 hours of final set.**
- Self-curing, (Protect with blankets or equivalent in ambient temperatures below freezing (32°F / 0°F), water curing not required or recommended.
- Clean all tools and equipment with water prior to the material reaching final set.

CERATECH

PFT
Planet Friendly Technology!

DOTLINE™ RAPID REPAIR CONCRETE

Pre-Extended (3/8"),
Fiber Reinforced
RAPID REPAIR CONCRETE

Product Data Sheet

pavemend

Updated 8.19.14

9 Safety

- See **Material Safety Data Sheet (MSDS)**.
- This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.
- Dispose of water and materials in accordance with Federal, State and Local regulations.
- The use of a dust mask, safety goggles and gloves is recommended.
- Keep out of the reach of children.

WARRANTY:
CERATECH, Inc. ("CERATECH") warrants that its products are free from defects in materials and workmanship. If any CERATECH product fails to conform to this warranty, CERATECH will replace the product at no cost to the buyer or refund the purchase price, at CERATECH's election. Any warranty claim must be made within one (1) year from the date of the shipment of the product to the buyer. In no event shall CERATECH be liable to the buyer for any consequential or incidental damages of any nature. CERATECH MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL AS TO THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF ITS PRODUCTS AND EXCLUDES THE SAME. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

CERATECH

PFT Planet Friendly Technology!

COMMERCIAL GRADE FASTSET™ DOT MIX

PRODUCT NO. 1244-56, -81

DIVISION 32

Rigid Paving Repair
32 01 29

PRODUCT DESCRIPTION

QUIKRETE® Commercial Grade FastSet™ DOT Mix is a fiber reinforced, rapid-setting repair material specifically designed to meet ASTM C928 Category R3 specifications for a high-performance repair material.

PRODUCT USE

QUIKRETE® FastSet™ DOT Mix meets DOT Region 3 requirements as a patching material for commercial applications at a thickness of 1/2" - 2" (12.7 - 51 mm). This product may also be extended with up to 25 lb (11.3 kg) of gravel per 55 lb (25 kg) bag for repairs to roads and bridges at a minimum thickness of 2" (51 mm). FastSet™ DOT Mix Extended is identical to FastSet™ DOT Mix except that it already contains the recommended amount of coarse aggregate. QUIKRETE® FastSet™ DOT Mix is available with an integral corrosion inhibitor in cases where maximum corrosion protection is desired. The addition of corrosion inhibitor has no adverse effect on the other physical properties of the product.

SIZES

- QUIKRETE® FastSet™ DOT Mix - 55 lb (25 kg) bags
- QUIKRETE® FastSet™ DOT Mix Extended - 80 lb (36.3 kg) bags

YIELD

- A 55 lb (25 kg) bag of FastSet™ DOT Mix will yield 0.44 cu ft (12.5 L) at a mortar consistency
- An 80 lb (36.3 kg) bag of FastSet™ DOT Mix Extended (1244-81) or a 55 lb (25 kg) bag of FastSet™ DOT Mix (1244-56) extended with 25 lb (11.3 kg) of high-quality ASTM C33 size number 8 aggregate 100%- 1/2" (12.7 mm)) will yield approximately 0.57 cu ft (16.1 L)

TECHNICAL DATA

APPLICABLE STANDARDS

ASTM International

- ASTM C33 Standard Specification for Concrete Aggregates
- ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- ASTM C157/C157M Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete
- ASTM C191 Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
- ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- ASTM C672 Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
- ASTM C928 Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
- ASTM C1090 Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout

Department of Transportation (DOT) Region III Test Method IV

PHYSICAL/CHEMICAL

QUIKRETE® FastSet™ DOT Mix is a blend of rapid hardening cement, sand and special additives. Typical results obtained on FastSet™ DOT Mix, when tested in accordance with the applicable ASTM test methods, are shown in Table 1. Similar results are obtained with FastSet™ DOT Mix Extended (1244-81) or with the addition of up to 25 lb (11.3 kg) of high quality ASTM C33 size number 8 aggregate (100%-1/2" (12.7 mm)) to a bag of FastSet™ DOT Mix (1244-56).

INSTALLATION

SURFACE PREPARATION

All surfaces should be clean and free of foreign substances that would cause bond failure. Remove all spalled areas and areas of unsound concrete. The hole should have a vertical edge of 1/2" (12.7 mm) or more, formed by use of a pneumatic jackhammer or by sawing. In some cases, it may be necessary to roughen smooth surfaces or etch old ones with acid. After the chipping process is completed, the repair area must be cleaned via water blasting or another suitable method. Dampen holes with clean water before patching. No puddles of water should be left in the hole.

MIXING

WEAR IMPERVIOUS GLOVES, such as nitrile when handling product. Mechanically mix FastSet™ DOT Mix or FastSet™ DOT Mix Extended for a minimum of 3 minutes using a standard concrete or mortar mixer. Use approximately 1 gal (3.8 L) of clean potable water per 55 lb (25 kg) bag of FastSet™ DOT Mix or 80 lb (36.3 kg) bag of FastSet™ DOT Mix Extended. Adjust water as needed to achieve a

place-able consistency. The recommended slump is 3" - 7" (76-178 mm). Do not exceed recommended slump range.

TABLE 1 TYPICAL PHYSICAL PROPERTIES			
Compressive strength, ASTM C109 (Modified) / C39			
Age	ASTM C928 Spec	Typical Values	
		Neat	Extended
	psi (MPa)	psi (MPa)	psi (MPa)
1.5 hours	-	3000 (20.7)	3000 (20.7)
3 hours	3000 (20.7)	4500 (31.0)	4500 (31.0)
24 hours	5000 (34.5)	6500 (44.8)	5500 (37.9)
7 days	5000 (34.5)	8000 (55.2)	6500 (44.8)
28 days	-	9000 (62.1)	8000 (55.2)
Setting time, ASTM C191			
Initial			10 - 20 minutes
Final			20 - 45 minutes
Length change, ASTM C157			
Condition	ASTM C928 Specification		Typical Values
28 days, air	> -0.15%		-0.052%
56 days, air	-		-0.057%
84 days, air	-		-0.062%
28 days, water	< +0.15%		+0.020%
56 days, water	-		+0.024%
84 days, water	-		+0.027%
Cylindrical height change, ASTM C1090			
24 hours			+0.02%
Slant shear bond strength			
Age	ASTM C928 Specification		Typical Values
24 hours	1000 psi (6.9 MPa)		1200 psi (8.3 MPa)
7 days	1500 psi (10.3 MPa)		1620 psi (11.2 MPa)
Scaling resistance testing			
Test method	Specification		Typical Values
ASTM C666	> 60% modulus		78%
ASTM C672	(Visual)		< 2.5
ASTM C672 (Mass Loss)	1 lb/ft2 (5 kg/m2)		0
Region 3 TM4 @ 25 cycles	< 8.0% loss		-0.28%
Region 3 TM4 @ 50 cycles	< 8.0% loss		+0.38%

APPLICATION

WEAR IMPERVIOUS GLOVES, such as nitrile when handling product. Place the repair material quickly and continuously, using light rodding to eliminate bubbles. Mechanical vibration should be avoided in areas that will be exposed to de-icing salts.

After FastSet™ DOT Mix has been compacted and spread to completely fill the forms without air pockets, strike off and float immediately. To strike off, use a straight board (screed), moving the edge back and forth with a sawing motion to smooth the surface. Use a darby or bull float to float the surface; this levels any ridges and fills voids left by the straight edge.

Cut the FastSet™ DOT Mix away from the forms by running an edging tool or trowel along the forms to compact the slab edges. Note - For best results, do not overwork the material.

CURING

Proper curing increases the strength and durability of concrete repair materials. QUIKRETE® Acrylic Concrete Cure and Seal (#8730) provides the easiest and most convenient method of curing. Apply by spray, brush or roller, when the surface is hard, following the final finishing operation. The surface may be damp, but not wet, when applying the curing compound.

PRECAUTIONS

- During extremely hot or dry conditions, cold water should be used to maintain mix at a moderate placement temperature. Use hot water when mixing in severely cold weather.
- Mix no more than can be used in 10 minutes.

WARRANTY

NOTICE OF LIMITED WARRANTY: The QUIKRETE® Companies, Inc. warrant this product to be of merchantable quality when used or applied in accordance with the instructions hereon. This product is not warranted as suitable for any purpose or use other than the general purpose for which it is intended. Liability under this warranty is LIMITED to the replacement of its product (as purchased) if found to be defective, or at the shipping companies' option, to refund the purchase price. In the event of a claim under this warranty, notice must be given to The QUIKRETE® Companies, Inc. in writing at: One Securities Centre, 3490 Piedmont Road, Suite 1300, Atlanta, GA 30305. **THIS WARRANTY IS ISSUED AND ACCEPTED IN LIEU OF ALL OTHER EXPRESS WARRANTIES AND EXPRESSLY EXCLUDES LIABILITY FOR CONSEQUENTIAL DAMAGES.**

** Refer to www.quikrete.com for the most current technical data, SDS, and guide specifications*

DAYTON SUPERIOR

HD 50

Horizontal Repair Mortar

TECHNICAL DATA SHEET

DESCRIPTION

HD 50 is a fast setting, fiber reinforced, latex-modified, shrinkage compensated,heavy duty, one component concrete repair material requiring only water to mix and apply. HD 50 is a cement based compound having similar characteristics to normal portland cement mixes and is compatible with portland cement concrete.

USE

HD 50 is designed for the repair of heavy duty surfaces such as concrete highways, bridge decks, parking structures, airport runways, freezer rooms, industrial and warehouse floors, and loading docks. HD 50 is a flowable material that may be poured into place for horizontal applications or into formed vertical and overhead applications.

FEATURES

- Can be opened to use or traffic within 60 minutes
- High compressive strength quickly – over 2,000 psi in one hour
- Resists salt penetration and damage from freeze/thaw cycles
- Contains no chlorides or magnesium phosphate
- Meets ASTM C-928; Specification for Very Rapid Hardening Cementitious Repair Materials
- Non Corrosive
- Compatible with portland cement concrete
- Aggregate extension – Up to 60% on repairs greater than 2 inches (5cm) deep
- Can be coated with epoxy in as little as 4 hours

PROPERTIES

Meets ASTM C-928: As a Type R-3 mortar

Compressive Strength – ASTM C-109 At 73°F (22.8°C)
1 Hour 2000 psi (13.8 MPa)
3 Hours 3500 psi (24.1 MPa)
1 Day 5200 psi (35.9 MPa)
7 Days 6500 psi (44.8 MPa)
28 Days 8100 psi (55.8 MPa)

Slant Shear Bond Strength ASTM C-882 (*modified per ASTM C 928)
1 day 2,000 psi (13.8 MPa)
7 days 2,750 psi (18.9 MPa)

Length Change of Hardened Cement Mortar and Concrete ASTM C 157 (*modified per ASTM C 928)
Length Change @ 28 days
Air Cure -0.11%
Water Cure 0.04%

Scaling Resistance (Freeze/Thaw) - ASTM C-672
Average of 3 specimens
25 cycles 0 (no scaling)
Scaling of oven-dry mass @ 25 cycles 0.0 lbs/ft²

Rapid Freeze/Thaw Test: ASTM C-666
At 300 Cycles - No loss

Initial Set
15-20 minutes
Final Set: 25-30 minutes

Moisture content: <4% in 4hrs when tested in laboratory conditions. (always test in field placements prior to coating as ambient conditions may vary)

Note:
The data shown is typical for controlled laboratory conditions. Reasonable variation from these results can be expected due to interlaboratory precision and bias. When testing the field mixed material, other factors such as variations in mixing, water content, temperature and curing conditions should be considered.

Estimating Guide

Yield: 0.42 cu. ft./50 lb. (0.012 cu m /22.7 kg)
0.60 cu. ft./50 lb. (0.017 cu. m/22.7 kg) bag with 60% extension, 30 lbs. (13.61 kg) with 3/8 in. (1 cm) pea gravel.

Packaging

PRODUCT CODE	PACKAGE	SIZE	
		lbs.	kg
67460	Bag	50	22.67

STORAGE

Shelf life of unopened bags, when stored in a dry facility, is 12 months. Excessive temperature differential and/or high humidity can shorten the shelf life expectancy. Store in a cool, dry area free of direct sunlight.

APPLICATION

Surface Preparation:

The concrete must be sound and free of all foreign material, including oil, grease, dust, laitance, or other surface contaminants. Surface preparation in accord with ICRI Guidelines is recommended. The edges of the patches should be saw-cut perpendicular to the surface to no more than a depth of 1/2 in. (13 mm) to avoid feather edging the repair material. Best results will be obtained by abrasive blasting the area to be repaired, providing uniform depth, a high surface profile and a firm bonding area. All surfaces to be repaired should be in a saturated-surface-dry (SSD) condition with no standing water on the surface.

Water Requirements:

Use 6½ pints (3.07 L) of water /50 lb. (22.7 kg) of powder.

Mixing:

Mix with a low speed drill or, for larger projects a mortar mixer with rubber tipped blades, by adding the water first and then the powder. Mixing time should be two to three minutes and placing should not exceed fifteen minutes. Adequate placing and finishing equipment and material should be available for continuous placement of the material.

DAYTON SUPERIOR

HD 50

Horizontal Repair Mortar

TECHNICAL DATA SHEET

Placement:
Using freshly mixed material, scrub a thin layer onto the SSD substrate with a stiff fiber brush and place the repair mortar before the scrub coat dries. Trowel the repair material onto the surface to a minimum thickness of 1/2 in. (1.3 cm) and a maximum thickness of 2 in. (5.1 cm).

For repairs over 2 in. (5 cm) deep, the material should be extended 60% by weight with clean, SSD, pea gravel with an approximate size of 3/8 in (9.5 mm) and conforming to the requirements of ASTM C 33.

CLEAN UP
Clean tools and equipment immediately with water. Hardened material will require mechanical removal.

CURING
Water cure for a minimum of 1 hour or apply a Dayton Superior ASTM C309 water-based curing compound to the repaired area immediately after placement.

LIMITATIONS

FOR PROFESSIONAL USE ONLY
Prior to coating, moisture content must be measured and comply with the coating manufacture's requirements. Any and all curing material must be removed from the HD50 prior to coating.
When testing the field mixed material, other factors such as variations in mixing, water content, temperature and curing conditions should be considered.
When using less than one bag always drymix the full bag prior to each use. DO NOT apply at temperatures below 40°F (5°C) without following the cold weather concreting procedures outlined in ACI 306. For application in temperatures below 45°F (4°C), best results will be obtained by warming the material and mix water as well as the substrate. Colder temperatures will extend the setting time and warmer temperatures will reduce the setting time. DO NOT featheredge. Do not re-temper the mixed material or use admixtures. Do not use for resurfacing or topping large floor areas. Mixing equipment should be cleaned with water frequently and prior to material hardening.

PRECAUTIONS

READ SDS PRIOR TO USING PRODUCT
- Product contains Crystalline Silica and Portland Cement – Avoid breathing dust – Silica may cause serious lung problems
- Use with adequate ventilation
- Wear protective clothing, gloves and eye protection (goggles, safety glasses and/or face shield)
- Keep out of the reach of children
- Do not take internally
- In case of ingestion, seek medical help immediately
- May cause skin irritation upon contact, especially prolonged or repeated. If skin contact occurs, wash immediately with soap and water and seek medical help as needed.
- If eye contact occurs, flush immediately with clean water and seek medical help as needed
- Dispose of waste material in accordance with federal, state and local requirements

MANUFACTURER
Dayton Superior Corporation
1125 Byers Road
Miamisburg, OH 45342
Customer Service: 888-977-9600
Technical Services: 877-266-7732
Website: www.daytonsuperior.com

WARRANTY
Dayton Superior Corporation ("Dayton") warrants for 12 months from the date of manufacture or for the duration of the published product shelf life, whichever is less, that at the time of shipment by Dayton, the product is free of manufacturing defects and conforms to Dayton's product properties in force on the date of acceptance by Dayton of the order. Dayton shall only be liable under this warranty if the product has been applied, used, and stored in accordance with Dayton's instructions, especially surface preparation and installation, in force on the date of acceptance by Dayton of the order. The purchaser must examine the product when received and promptly notify Dayton in writing of any non-conformity before the product is used and no later than 30 days after such non-conformity is first discovered. If Dayton, in its sole discretion, determines that the product breached the above warranty, it will, in its sole discretion, replace the non-conforming product, refund the purchase price or issue a credit in the amount of the purchase price. This is the sole and exclusive remedy for breach of this warranty. Only a Dayton officer is authorized to modify this warranty. The information in this data sheet supersedes all other sales information received by the customer during the sales process. THE FOREGOING WARRANTY SHALL BE EXCLUSIVE AND IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER WARRANTIES OTHERWISE ARISING BY OPERATION OF LAW, COURSE OF DEALING, CUSTOM, TRADE OR OTHERWISE.

Dayton shall not be liable in contract or in tort (including, without limitation, negligence, strict liability or otherwise) for loss of sales, revenues or profits; cost of capital or funds; business interruption or cost of downtime, loss of use, damage to or loss of use of other property (real or personal); failure to realize expected savings; frustration of economic or business expectations; claims by third parties (other than for bodily injury), or economic losses of any kind; or for any special, incidental, indirect, consequential, punitive or exemplary damages arising in any way out of the performance of, or failure to perform, its obligations under any contract for sale of product, even if Dayton could foresee or has been advised of the possibility of such damages. The Parties expressly agree that these limitations on damages are allocations of risk constituting, in part, the consideration for this contract, and also that such limitations shall survive the determination of any court of competent jurisdiction that any remedy provided in these terms or available at law fails of its essential purpose.

BASF
The Chemical Company

Technical Data Guide

3 03 01 00
Maintenance of Concrete

MasterEmaco® S 6000

Rapid setting methacrylate repair material

FORMERLY DEGADECK® POLYMER CONCRETE

PACKAGING
PART A: 4.5 gal (17 kg) pail or
54 gal (190 kg) drum
PART B: 37 lb (16.7 kg) bags

YIELD
0.33 ft³ per unit

MASTEREMACO S 6000 UNIT:
PART A: 0.5 gal (1.9 L)
PART B: One 37 lb (16.7 kg) bag

See Mixing Section for aggregate extensions

STORAGE
Store in unopened containers in cool, clean, dry conditions out of direct sunlight. Maximum storage temperature is 86° F (30° C).

SHELF LIFE
2 years when properly stored

VOC CONTENT
0 g/L less water and exempt solvents

DESCRIPTION
MasterEmaco S 6000 is a solvent free, 100% reactive methacrylate liquid component and a specially blended filler component, which includes MasterTop SRS 100HD. MasterEmaco S 6000 can be extended up to 100% with select aggregates for deeper repairs. Typical cure time is one hour at temperatures ranging from 14 to 104° F (–10 to 40° C).

PRODUCT HIGHLIGHTS
- Fast curing allows fast return of traffic flow on highway and bridge projects
- Can be applied at a large range of temperatures, 14 to 104° F (–10 to 40° C), for extended application season
- Extendable with aggregate for variable depth placement consistencies
- Two-component for ease of installation
- High strength and excellent bonding capabilities to a variety of concrete substrates
- Durable to withstand freeze-thaw damage
- UV resistance protects product performance from sun exposure

SUBSTRATES
- Concrete

APPLICATIONS
- Exterior
- Horizontal & formed vertical
- Bridge decks
- Parking structures
- Runways
- Civil engineering applications
- Anchor bolts
- Potholes
- Joint nosing repairs
- Bearing pads
- Spalled concrete repairs

HOW TO APPLY

SURFACE PREPARATION

1. The substrate must be clean, dry and structurally sound. Completely remove all substances detrimental to bonding, such as dirt, oils, fats, waxes, chemical contaminants, and weak, loose, or unsound concrete.
2. Use routine methods like sandblasting, chipping, and wire brushing; do not acid etch. Obtain a minimum CSP 5 as described by the International Concrete Repair Institute. Do not use a method of surface preparation that will fracture the concrete. Verify the absence of microcracking or bruising in accordance with ICRI Guideline No. 310.2.

Technical Data Guide
MasterEmaco® S 6000

Technical Data

Composition

MasterEmaco S 6000 Part B is a non-cementitious, water-free composite material in which fine and coarse aggregates are bound together in a dense matrix with a polymer binder.
MasterEmaco S 6000 Part A is a reactive binder based on Methacrylate monomers used with Part B to form a polymer concrete.

Compliances

- MasterEmaco S 6000 is classified under DOT regulations as Resin Solution, UN 1866, Class 3, PG II.
- Master Builders Solutions resins are manufactured to ISO 9001 standards.

Typical Properties

COMPONENT	RESULTS PART A	PART B
Appearance	Liquid	Grey powder
Specific gravity, g/cm³	0.93	—
Bulk density, approx, lb/ft³ (kg/m³)	—	78.5 (1.26)
Viscosity, cP (MPa-sec)	1	—
Flash point, ° F (° C)	48 (9)	—

Test Data

PROPERTY	RESULTS	TEST METHOD
Compressive strength, psi (MPa)	7,000 (48.2)	ASTM C 579
Tensile strength, psi (MPa)	1,150 (7.9)	ASTM C 307
Flexural strength, psi (MPa)	5,900 (40.7)	ASTM C 580
Compressive modulus of elasticity, psi (MPa)	0.6×10^6 (4.1×10^3)	ASTM C 469
Coefficient of thermal expansion, /° F (/° C)	38×10^{-6} (68×10^{-6})	ASTM C 531
Linear shrinkage, %	0.08	ASTM C 531
Water absorption, % / 24 hrs	0.09	ASTM D 570

Aggregate Extension

REPAIR THICKNESS IN (MM)	EXTENSION % BY WEIGHT	AGGREGATE GRAIN SIZE	LBS OF AGGREGATE	SQUARE FEET	CUBIC FEET
⅛ (3.2)	—	—	—	29.3	0.30
¼ (6.4)	—	—	—	14.6	0.30
½ (12.7)	10	1/16" to ⅛"	4	7.9	0.33
¾ (19)	25	1/16" to ⅛"	10	5.9	0.37
1 (25.4)	50	3/16" to ⅜"	20	5.4	0.45
1½ (38)	75	3/16" to ⅜"	30	4.2	0.52
2 (50.8)	100	¼" to ¾"	40	3.5	0.59

Master Builders Solutions by BASF
www.master-builders-solutions.basf.us

3. The concrete surface must be dry with a maximum 5% moisture content. Damp and wet surfaces may be dried with artificial heat if the concrete will remain dry when the heat source is removed (i.e., the concrete must not be saturated with moisture).
4. Conduct adhesion tests with the polymer system to ensure proper preparation and good bond strength. Adhesion tests should exhibit failure in the concrete, not at the interface. Concrete failure must be greater than 200 psi (1.4 MPa).
5. Patch perimeter must be sawcut to ¼" as materials cannot be feather-edged.
6. MasterEmaco S 6000 requires the use of MasterEmaco P 6001.

PRIMING

Prime all surfaces with MasterEmaco P 6001 at 100 ft²/gal. Mix 1 gallon of MasterEmaco P 6001 with appropriate amount of MasterTop SRS 100HD (see MasterEmaco P 6001 data sheet for Mixing instructions) and apply immediately. Allow to fully cure prior to placing MasterEmaco S 6000.

MIXING

1. Mix MasterEmaco S 6000 in 5 gallon pails with a mixing blade or in concrete drum mixers. Measure out no more than ½ gallon of Part A per 37 lb bag of Part B.
2. Add Part A to container followed by Part B and mix thoroughly for 30–60 seconds to obtain a mortar consistency. When extending, add aggregate as required (contact BASF Technical Service for proper aggregate extension technique).
3. MasterEmaco S 6000 can be used in any thickness over ½" (12.7 mm) when extended with selected washed and dried aggregate. Aggregate is added after Part A and Part B are blended.

APPLICATION

1. Finish the patch or repair using standard concrete finishing methods. For larger, deeper and vertical repairs, polyethylene or plastic laminate-lined forms may be required.
2. For small, shallow repairs, use a trowel to spread and smooth the MasterEmaco S 6000. Keep the trowel flat and do NOT overwork the mortar, as improper surface cure will result. The product completely cures and is traffic ready within one hour.
3. The minimum application thickness for MasterEmaco S 6000 is ⅛" (3.18 mm). Applications over ½" (12.7 mm) thick must be extended. Washed and dried pea gravel or coarse aggregate is used to extend the mortar mix. The largest aggregate size should not exceed ⅓ the depth of the patch (contact BASF Technical Service for proper aggregate extension technique). Never use any extender aggregate less than 1/16" (1.6 mm) with MasterEmaco S 6000.

ANCHOR BOLTS

Holes must be primed prior to addition of polymer mortar. Bolts must be rust-free and preferably galvanized. Other types of metal plating should be tested for compatibility with MasterEmaco P 6001 and MasterEmaco S 6000 prior to use.

JOINT HEADERS

MasterEmaco S 6000 is well-suited for header repairs to armored joints, strip joint systems and other similar applications. For retrofit of existing headers, remove all existing header material and any damaged and spalled concrete. Edges should be sawcut to ¼" (6.4 mm). All surfaces must be properly primed and allowed to cure prior to accepting the polymer concrete. For new construction, the concrete should be cut back 4–8" from the joint and 2–4" depth depending on design requirements.

CLEAN UP

Clean tools as needed with inhibited MMA, acetone, ethyl acetate or similar solvents.

FOR BEST PERFORMANCE

- MasterEmaco S 6000: Non-cementitious, water-free composite material in which fine and coarse aggregates are bound together in a dense matrix with a polymer binder. Polymer concretes are used for repairing spalled, eroded and deteriorated concrete surfaces. They are specified in environments that demand rapid cure, low maintenance and high functional performance.
- Do not recoat while material is still hot to touch.
- Do not "slick off" material with straight MMA or solvents. This will interfere with the curing process.
- Material must be re-primed prior to over-coating with other MasterEmaco S 6000
- MasterEmaco S 6000 is not intended for use over bituminous-based substrates.
- Do not overwork the product. It will interfere with the curing process.
- Elevated temperatures will accelerate cure time.
- MasterTop SRS 100HD is already pre-blended into MasterEmaco S 6000 Part B.
- MasterEmaco S 6000 resins cure via an addition polymerization mechanism using the MasterTop SRS 100HD. Free radicals are formed and used to convert the liquid resin into a three-dimensional polymer network. This reaction proceeds easily below 50° F (10° C). Also, during the reaction, all hardener is consumed and the polymer is fully formed within a one-hour period. There is no potential for an excess of unreacted components or extended cure that is typical of other systems. When used correctly, cure is thorough and consistent.
- For professional use only; not for sale to or use by the general public.
- Make certain the most current versions of product data sheet and SDS are being used; visit master-builders-solutions.basf.us to verify the most current version.
- Proper application is the responsibility of the user. Field visits by BASF personnel are for the purpose of making technical recommendations only and are not for supervising or providing quality control on the jobsite.

HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Safety Data Sheets and product label information for this product prior to use. The SDS can be obtained by visiting www.master-builders-solutions.basf.us, e-mailing your request to basfbscst@basf.com or calling 1(800)433-9517. Use only as directed.

For medical emergencies only, call ChemTrec® 1(800) 424-9300.

LIMITED WARRANTY NOTICE

BASF warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. BASF MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is the replacement of product or refund of the purchase price, at the sole option of BASF. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. BASF WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. BASF reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.

BASF Corporation
Construction Systems

889 Valley Park Drive, Shakopee, MN 55379
www.master-builders-solutions.basf.us

Customer Service 1(800)433.9517
Technical Service 1(800)243.6739

© 2014 BASF Corporation Form No.1031121 rev 01/14

DAYTON SUPERIOR®

Pave Patch 3000

Horizontal Repair Mortar

TECHNICAL DATA SHEET

DESCRIPTION

Pave Patch 3000 is a fast setting, heavy duty, one component concrete repair material requiring only water to mix and apply. Pave Patch 3000 is a cement based compound having similar characteristics to normal portland cement mixes and is compatible with portland cement concrete.

USE

Pave Patch 3000 is designed for the repair of heavy duty surfaces such as concrete highways, bridge decks, parking structures, airport runways, freezer rooms, industrial and warehouse floors, and loading docks. Pave Patch 3000 is a pourable material that may be poured into place for horizontal applications or into formed vertical and overhead applications.

FEATURES

- Resists freeze-thaw cycles to extend the life of the patch
- Is shrinkage compensated, helping to assure a tight contact with the surround concrete
- Fast setting in 15-25 minutes; normal traffic in one to three hours
- High compressive strength; up to 4500 psi (31 MPa) in 3 hours after setting
- Ready-to-use, just add water
- Meets ASTM C-928

PROPERTIES

Flow (ASTM-928): 100% min.

Working Time (72°F)(22.2°C): 7-10 min.

Length change in water (ASTM C-157): 0.09%

Length change in air (ASTM C-157): 0.037%

Compressive Strength (ASTM C-109)* (50 lbs. Pave Patch 3000 and 6 pints of water (6.25 lbs., 2.84 kg):

1 hour*: 3000 psi (20.7 MPa)

3 hours: 4700 psi (31 MPa)

1 day: 5500 psi (38.0 MPa)

7 days: 6600 psi (44.8 MPa)

28 days: 9500 psi (65.5 MPa)

*1 hour strength tested after set

Slant Shear Bond Strength (ASTM C-882)- modified per ASTM C928:

24 hours: 1700 psi (10.3 MPa).

7 days: 2000 psi (13.8 MPa)

28 days: 2500 psi min.

Flexural Strength (ASTM C-78): 800 psi (5.5 MPa)

Freeze-Thaw Resistance:

200 cycles in 10% NaCl (Durability factor): 100%

Scaling (ASTM C-672) 25 cycles Visual Ratings:

0 at 70°F (21.1°C)

Initial Set: 15-20 minutes

Final Set: 25-30 minutes

Note:
The data shown is typical for controlled laboratory conditions. Reasonable variation from these results can be expected due to interlaboratory precision and bias. When testing the field mixed material, other factors such as variations in mixing, water content, temperature and curing conditions should be considered.

Estimating Guide

Yield: 0.41 cu. ft./50 lb. (0.011 cu. M/22.7 kg)
0.59 cu. ft./50 lb. (0.016 cu. M/22.7 kg) bag with 60% extension 30 lbs. (13.6 kg) with 3/8 in. (1 cm) pea gravel.

Packaging

PRODUCT CODE	PACKAGE	SIZE	
		lbs.	kg
143333	Bag	50	22.67

STORAGE

Shelf life of unopened bags, when stored in a dry facility, is 12 months. Excessive temperature differential and/or high humidity can shorten the shelf life expectancy. Store in a cool, dry area free of direct sunlight.

APPLICATION

Surface Preparation:

The concrete must be sound and free of all foreign material, including oil, grease, dust, laitance, or other surface contaminants. Surface preparation in accord with ICRI Guidelines is recommended. The edges of the patches should be saw-cut perpendicular to the surface to no more than a depth of 1/2 in. (13 mm) to avoid feather edging the repair material. Best results will be obtained by abrasive blasting the area to be repaired, providing uniform depth, a high surface profile and a firm bonding area. All surfaces to be repaired should be in a saturated-surface-dry (SSD) condition with no standing water on the surface.

Water Requirements:

Use 6 pints (2.82 L) of water /50 lb. (22.67 kg) of powder.

Mixing:

Mix with a low speed drill or, for larger projects a mortar mixer with rubber tipped blades, by adding the water first and then the powder. Mixing time should be two to three minutes and placing should not exceed fifteen minutes. Adequate placing and finishing equipment and material should be available for continuous placement of the material.

Placement:

Using freshly mixed material, scrub a thin layer onto the SSD substrate with a stiff fiber brush and place the repair mortar before the scrub coat dries. Trowel the repair material onto the surface to a minimum thickness of 1/2 in. (1.3 cm) and a maximum thickness of 2 in. (5.1 cm).

DAYTON SUPERIOR

Pave Patch 3000

Horizontal Repair Mortar

TECHNICAL DATA SHEET

For repairs over 2 in. (5.1 cm) deep, the material should be extended 60% by weight with clean, SSD, pea gravel with an approximate size of 3/8 in (9.5 mm) and conforming to the requirements of ASTM C 33.

CLEAN UP

Clean tools and equipment immediately with water. Hardened material will require mechanical removal.

CURING

Water cure for a minimum of 1 hour or apply a Dayton Superior ASTM C-309 water-based curing compound to the repaired area immediately after placement.

LIMITATIONS

FOR PROFESSIONAL USE ONLY

When using less than one bag, always dry mix the full bag prior to each use.
DO NOT apply at temperatures below 40°F (5°C) without following the cold weather concreting procedures outlined in ACI 306.
For application in temperatures below 45°F (4°C), best results will be obtained by warming the material and mix water as well as the substrate.
Colder temperatures will extend the setting time and warmer temperatures will reduce the setting time.
DO NOT featheredge.
Do not re-temper the mixed material or use admixtures.
Do not use for resurfacing or topping large floor areas.
Mixing equipment should be cleaned with water frequently and prior to material hardening.

Sec 14 Concrete Repair

PRECAUTIONS

READ SDS PRIOR TO USING PRODUCT

- Product contains Crystalline Silica and Portland Cement – Avoid breathing dust – Silica may cause serious lung problems
- Use with adequate ventilation
- Wear protective clothing, gloves and eye protection (goggles, safety glasses and/or face shield)
- Keep out of the reach of children
- Do not take internally
- In case of ingestion, seek medical help immediately
- May cause skin irritation upon contact, especially prolonged or repeated. If skin contact occurs, wash immediately with soap and water and seek medical help as needed.
- If eye contact occurs, flush immediately with clean water and seek medical help as needed
- Dispose of waste material in accordance with federal, state and local requirements

MANUFACTURER

Dayton Superior Corporation
1125 Byers Road
Miamisburg, OH 45342
Customer Service: 888-977-9600
Technical Services: 877-266-7732
Website: www.daytonsuperior.com

WARRANTY

Dayton Superior Corporation ("Dayton") warrants for 12 months from the date of manufacture or for the duration of the published product shelf life, whichever is less, that at the time of shipment by Dayton, the product is free of manufacturing defects and conforms to Dayton's product properties in force on the date of acceptance by Dayton of the order. Dayton shall only be liable under this warranty if the product has been applied, used, and stored in accordance with Dayton's instructions, especially surface preparation and installation, in force on the date of acceptance by Dayton of the order. The purchaser must examine the product when received and promptly notify Dayton in writing of any non-conformity before the product is used and no later than 30 days after such non-conformity is first discovered. If Dayton, in its sole discretion, determines that the product breached the above warranty, it will, in its sole discretion, replace the non-conforming product, refund the purchase price or issue a credit in the amount of the purchase price. This is the sole and exclusive remedy for breach of this warranty. Only a Dayton officer is authorized to modify this warranty. The information in this data sheet supersedes all other sales information received by the customer during the sales process. THE FOREGOING WARRANTY SHALL BE EXCLUSIVE AND IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER WARRANTIES OTHERWISE ARISING BY OPERATION OF LAW, COURSE OF DEALING, CUSTOM, TRADE OR OTHERWISE.

Dayton shall not be liable in contract or in tort (including, without limitation, negligence, strict liability or otherwise) for loss of sales, revenues or profits; cost of capital or funds; business interruption or cost of downtime, loss of use, damage to or loss of use of other property (real or personal); failure to realize expected savings; frustration of economic or business expectations; claims by third parties (other than for bodily injury), or economic losses of any kind; or for any special, incidental, indirect, consequential, punitive or exemplary damages arising in any way out of the performance of, or failure to perform, its obligations under any contract for sale of product, even if Dayton could foresee or has been advised of the possibility of such damages. The Parties expressly agree that these limitations on damages are allocations of risk constituting, in part, the consideration for this contract, and also that such limitations shall survive the determination of any court of competent jurisdiction that any remedy provided in these terms or available at law fails of its essential purpose.

pavemend 15.0® Self Leveling RAPID REPAIR MORTAR

Product Data Sheet

pavemend

Updated 2.4.14

1 General Characteristics

Pavemend 15.0™ is a cementitious, rapid setting, ***self-leveling*** structural repair mortar. It is a single component powder that is water activated. **Pavemend 15.0**™ has 7 - 9 minutes of working time and will reach compressive strengths of >2500 psi within two hours and more than 6000 psi at 28 days. Designed for horizontal and rapid setting form and pour applications, **Pavemend 15.0**™ can be used in ambient temperature ranges of 30° - 110° F. Rapid strength development and low initial viscosity make **Pavemend 15.0**™ ideal for most ***pre-cast grouting applications.***

RECOMMENDED USES: Pavemend 15.0™ is an ideal repair material for roads and bridges, airport runways, warehouse or manufacturing facility floors, post-tension cable repairs and form and pour projects. Can be used as a temporary repair for asphalt pavement.

2 Additional Physical Properties

UNIT WEIGHT (NEAT)
115 lb/ft³ (1842 kg/m³)

SETTING TIME
Set Times at 72°F/22°C at 1" (2.54 cm) material depth
Initial set: 5 - 7 minutes
Final set: 7 - 12 minutes

VOLUME YIELD
0.42 ft³ (0.012 m³) per 45 lb. (20.4 kg) unit

3 Material Specifications

Results provided by licensed engineering test laboratory and represent typical results from production materials. Actual results may vary from third party testing results; however, CERATECH's materials *meet and/or exceed* **ASTM C928**, and *exceed* established internal quality control standards, (available upon request). All samples were air cured.

Property	Results 2" Cubes	Test Method
Compressive Strengths, **psi**		
2 hours	> 2,500	ASTM C 109
3 hours	> 3,500	ASTM C 109
1 day - 24 hours	> 4,000	ASTM C 109
7 days	> 5,000	ASTM C 109
28 days	> 6,000	ASTM C 109
Flexural Strength, **psi**		
7 days	> 600	ASTM C 78
28 days	> 850	ASTM C 78
Splitting Tensile Strength, **psi**		
7 days	> 200	ASTM C 496
28 days	> 300	ASTM C 496
Bond Strength, **psi**		
1 day - 24 hours	> 1,000	ASTM C 882
7 days	> 1,500	ASTM C 882
Scaling Resistance, **lbs/ft²**		
25 cycles	0	ASTM C 672
Modulus of Elasticity, **msi**		
28 days	3.3	ASTM C 469
Coefficient of Thermal Expansion, (millionsth) **in/in/° F**		
28 days	2.82	AASHTO TP 60
Length Change, **% of total length**		
28 days soak / 28 days dry	-0.0085 /-0.0595	ASTM C 157

1500 N. Beauregard St. Suite 320 Alexandria, VA 22311 • 800-581-8397 • sales@pavemend.com
Fax: 703-894-1068 • Technical Support: 888-341-2600

PFT Planet Friendly Technology!

pavemend 15.0® Self Leveling RAPID REPAIR MORTAR

Product Data Sheet

pavemend®

Updated 2.4.14

4 Site Preparation

Surfaces should be prepared in accordance with ICRI 03730, "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion" and / or ACI 546R-96 "Concrete Repair Guide". Concrete surfaces should be prepared by appropriate mechanical methods to obtain an exposed aggregate surface with a minimum surface profile of +/- 1/16" (1.5 mm) in accordance with ICRI 03732. Pre-existing coatings or surface treatments should be completely removed. Dry, clean, stable surfaces are required. Remove all standing water. Reinforcing steel should have no loose scale. **Surfaces of host concrete must be damp.**

5 Mixing Instructions

Standard NEAT Procedures (Bucket Mixing with Drill & Paddle)
Pavemend 15.0™ cannot be extended

- Loosen material by tumbling bucket & dry mixing ***before*** adding water.
- To ensure product performance, **DO NOT divide or separate individual units into smaller portions. MIX ENTIRE CONTENTS AT ONE TIME.**
- A drill (6 amp minimum) with a mixer blade turning at least 500 to 800 rpm is required. Drills with speeds greater than 800 RPMs may entrain air in the mix.
- **DO NOT HAND MIX.**
- To begin the mixing process, add the proper amount of water:

For Each	Add
45 lb (20.4 kg) 5 gallon (18.9 L) bucket or	1 U.S. gallon (3.8 of water)

- Ideal water temperature is between 65°F/18°C and 75°F/24°C.
- ***After adding the water, it is very important to rapidly incorporate all of the dry Pavemend 15.0™ powders into water to achieve a uniform wet mixture within the first 30 seconds of mixing.***
- In ambient temperatures under 72°F/22°C, CERATECH highly recommends the use of a thermal gun or temperature probe to verify that a **Critical Mix Temperature of 95˚F/35˚C has been reached.** Place material into repair area when this temperature has been achieved.
- In ambient temperatures over 72°F/22°C and without using a thermal measuring gun or temperature probe, mix material for 6 minutes in ambient temperatures of 72°F /22°C to 80°F/27°C, mix for 4 1/2 minutes in ambient temperatures of 80°F/27°C to 90°F/32°C, mix for 4 minutes in ambient temperatures above 90°F/32°C and place.

MIXING NOTES:
Pavemend 15.0™ undergoes an exothermic chemical reaction during blending. Heat, the by-product of the reaction, is the best indication that the reaction is complete and that the product is ready to be poured. **Pavemend 15.0™ has a Critical Mix Temperature of 95˚F/35˚C which MUST BE REACHED before pouring to obtain optimum performance.** *(In cold weather, it may be impossible to reach the Critical Mix Temperature, therefore a 40°F/22°C rise in material temperature is mandatory to ensure that the necessary chemical reactions have taken place to deliver the desired performance characteristics);* Mixing time to reach the **Critical Mix Temperature** will vary with ambient air and mix water temperatures, however, **never mix Pavemend 15.0™ for less than 4 minutes** It is recommended that a thermal gun or temperature probe be used to ensure that the **Critical Mix Temperature** has been achieved.

6 Packaging & Shelf Life

PACKAGING
45 lb (20.4 kg) 5 gallon (18.9 L) bucket - GSA P/N: C500

SHELF LIFE
Buckets - 3 years (when stored in original unopened bucket)

STORAGE
Buckets are environmentally sealed and require no special storage requirements

7 Limitations

- Not recommended for surface temperatures above **120˚F**/49°C or below **30°F**/-1°C.
- Will not bond to polymers.
- Cannot be pumped.
- Can be mixed with drill and paddle or in a grout mixer (care should be taken to wash out grout mixer before material hardens (7-10 minutes). **DO NOT MIX IN A ROTATING DRUM CONCRETE MIXER.**

1500 N. Beauregard St. Suite 320 Alexandria, VA 22311 • 800-581-8397 • sales@pavemend.com
Fax: 703-894-1068 • Technical Support: 888-341-2600

PFT Planet Friendly Technology!

pavemend 15.0® Self Leveling RAPID REPAIR MORTAR

Product Data Sheet

pavemend®

Updated 2.4.14

8 Application & Finish

- Minimum NEAT profile thickness is 0.06" (1.5mm). There are no restrictions to the depth of the repair profile.
- For best results, CERATECH recommends monolithic placement of repair materials. Maintain a minimum thickness of 1.00 inch if repair material must be layered.
- Upon initial set, a broom finish can be applied. Upon final set, the material can be saw-cut, drilled, sanded and/or polished.
- Do not re-temper. The addition of water to the surface of the repair will negatively affect the materials final properties.
- **General loading in 2.0 hours for wheeled traffic and 60 minutes for foot traffic.** For applications 0.5" thick and greater, in ambient and/or surface temperatures below 50°F/10°C, extend the loading time by 30 minutes for each 10° below 50°F/10°C. For applications 1.00" thick and greater, in ambient and/or surface temperatures below 40°F/4°C extend the loading time by 30 minutes for each 10° below 40°F/4°C.
- **All previously existing joints must be re-established within 1-3 hours of final set.**
- **Self-curing.**
- Clean all tools and equipment with water prior to the material reaching final set.

9 Safety

- See **Material Safety Data Sheet (MSDS)**.
- This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.
- Dispose of water and materials in accordance with Federal, State and Local regulations.
- The use of a dust mask, safety goggles and gloves is recommended.
- Keep out of the reach of children.

WARRANTY:
CERATECH, Inc. ("CERATECH") warrants that its products are free from defects in materials and workmanship. If any CERATECH product fails to conform to this warranty, CERATECH will replace the product at no cost to the buyer or refund the purchase price, at CERATECH's election. Any warranty claim must be made within one (1) year from the date of the shipment of the product to the buyer. In no event shall CERATECH be liable to the buyer for any consequential or incidental damages of any nature. CERATECH MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL AS TO THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF ITS PRODUCTS AND EXCLUDES THE SAME. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

CERATECH

www.ceratechinc.com

1500 N. Beauregard St. Suite 320 Alexandria, VA 22311 • 800-581-8397 • sales@pavemend.com
Fax: 703-894-1068 • Technical Support: 888-341-2600

PFT

Planet Friendly Technology!

pavemend SLQ®

Self Leveling, Extendable
VERY RAPID
REPAIR MORTAR

Product Data Sheet

pavemend

Updated 2.4.14

1 General Characteristics

Pavemend SLQ™ is a cementitious, very rapid setting, ***self-leveling*** structural repair mortar suitable for very rapid concrete repair in all climates, especially in near freezing and below freezing applications. It is a single component powder that is water activated, and is suited for aggregate extension. **Pavemend SLQ™** has 2-4 minutes working time and will reach compressive strengths of more than 3000 psi within 60 minutes of final set. Designed for horizontal and formed applications. **Pavemend SLQ™** can be applied in ambient temperature ranges from -20°F to 110°F without special mixing or curing equipment. **Pavemend SLQ™** ***is the premier choice for critical infrastructure repairs where cold conditions prevail and/or a one hour return to service is desired.***

RECOMMENDED USES: Pavemend SLQ™ is ideal for moderate to cold weather repairs of roads and bridges, airport runways, warehouse or manufacturing facility floors, post-tension cable repairs and form and pour projects. Can be used as a temporary repair for asphalt pavement.

2 Additional Physical Properties

UNIT WEIGHT (NEAT)
115 lb/ft³ (1842 kg/m³)

SETTING TIME
Set Times at 72°F/22°C at 1" (2.54 cm) material depth
Initial set: 2 - 4 minutes
Final set: 4 - 6 minutes

VOLUME YIELD
NEAT:
0.42 ft³ (0.012 m³) per 46 lb. (20.9 kg) unit
0.12 ft³ (0.003 m³) per 11 lb (4.99 kg) unit

Extended 50% w 3/8" or 1/2" fractured aggregate:
0.60 ft³ (0.017 m³) per 46 lb. (20.9 kg) unit
0.15 ft³ (0.004 m³) per 11 lb (4.99 kg) unit

Extended 75% w 3/8" or 1/2" fractured aggregate:
0.72 ft³ (0.02 m³) per 46 lb. (20.9 kg) unit
0.18 ft³ (0.005 m³) per 11 lb (4.99 kg) unit

3 Material Specifications

Results provided by licensed engineering test laboratory and represent typical results from production materials. Actual results may vary from third party testing results; however, CERATECH's materials *meet and/or exceed* **ASTM C928**, and *exceed* established internal quality control standards, (available upon request). All samples were air cured.

Property	NEAT 2" Cubes	Extended 3/8" pea gravel 4" Dia. x 8" Cylinders	Test Method
Compressive Strengths, **psi**			
1 hour	> 3,000	> 3,000	ASTM C 109 / ASTM C 39
3 hours	> 4,000	> 4,000	ASTM C 109 / ASTM C 39
24 hours	> 4,500	> 4,500	ASTM C 109 / ASTM C 39
7 days	> 5,000	> 5,000	ASTM C 109 / ASTM C 39
28 days	> 6,000	> 6,000	ASTM C 109 / ASTM C 39
Flexural Strength, **psi**			
7 days	> 500	*TBD	ASTM C 78
28 days	> 600	*TBD	ASTM C 78
Splitting Tensile Strength, **psi**			
7 days	> 150	*TBD	ASTM C 496
28 days	> 250	*TBD	ASTM C 496
Bond Strength, **psi**			
24 hours	> 1,200	*TBD	ASTM C 882
7 days	> 1,375	*TBD	ASTM C 882
Rapid Freeze Thaw Resistance (Durability Factor - Retained percentage of Dynamic Modulus)			
300 cycles	99.6%	*NTBT	ASTM C 666A
Scaling Resistance, **lbs/ft²**			
50 cycles	0	*NTBT	ASTM C 672
Modulus of Elasticity, **psi**			
28 days	1.93 EE⁶	*TBD	ASTM C 469
Coefficient of Thermal Expansion, **in/in/°F**			
28 days	2.95	*NTBT	AASHTO TP 60
Length Change, **% of total length**			
28 days soak / 28 days dry	< 0.020 / < 0.030	*NTBT	ASTM C 157

1 3rd party test results
2 Internal test results
* NTBT - Not to be tested
* To be determined

1500 N. Beauregard St. Suite 320 Alexandria, VA 22311 • 800-581-8397 • sales@pavemend.com
Fax: 703-894-1068 • Technical Support: 888-341-2600

PFT
Planet Friendly Technology!

pavemend SLQ® Self Leveling, Extendable VERY RAPID REPAIR MORTAR

Product Data Sheet

pavemend

Updated 2.4.14

4 Site Preparation

Surfaces should be prepared in accordance with ICRI 03730, "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion" and / or ACI 546R-96 "Concrete Repair Guide". Concrete surfaces should be prepared by appropriate mechanical methods to obtain an exposed aggregate surface with a minimum surface profile of +/- 1/16" (1.5 mm) in accordance with ICRI 03732. Pre-existing coatings or surface treatments should be completely removed. Dry, clean, stable surfaces are required. Remove all standing water. Reinforcing steel should have no loose scale. **Surfaces of host concrete must be damp.**

5 Mixing Instructions

Standard NEAT Procedures (Bucket Mixing with Drill & Paddle)

- Loosen material by tumbling bucket & dry mixing ***before*** adding water.
- To ensure product performance, **DO NOT divide or separate individual units into smaller portions. MIX ENTIRE CONTENTS AT ONE TIME.**
- A drill (6 amp minimum) with a mixer blade turning at least 500 to 800 rpm is required. Drills with speeds greater than 800 RPMs may entrain air in the mix.
- **DO NOT HAND MIX**
- To begin the mixing process, add the proper amount of water:

For Each:	Add:
46 lb (20.9 kg) 5 gallon (18.9 L) bucket	1 U.S. gallon (3.8 L) of water
11lb (4.99 kg) 2 gallon (7.6 L) bucket	1 U.S. quart (.95 L) of water

- In extremely warm conditions, add up to 1 cup of additional water to 5 gallon units, add 1/2 cup to 2 gallon units.
- Ideal water temperature is between 65°F/18°C and 75°F/24°C.
- ***After adding the water, it is very important to rapidly incorporate all of the dry Pavemend SLQ™ powders into water to achieve a uniform wet mixture within the first 30 seconds of mixing.***
- If ambient temperatures are above **85˚F**/29˚C, ***mix material for 2 minutes and use cold water at approximately 55˚F/***13˚C. If temperatures are below 72˚F/22˚C mix until ***Critical Mix Temperature of 85˚F/29˚C*** is reached, **but not less than 2 minutes.** It is recommended that a thermal gun or temperature probe be used to ensure that the **Critical Mix Temperature** has been achieved. Place material into repair area and spread with a trowel, straightedge or squeegee, filling voids and edges.

For Aggregate Extension: (Bucket Mixing with Drill & Paddle)

- Use only 3/8" (1 cm) or 1/2" (1.3cm) #7 clean washed fracured stone up to 100% maximum by weight. (For best finishing characteristics, extend by no more than 75%).
- ***Add aggregate to material and water slurry after mixing for 30 seconds.***
- See mixing times for NEAT application above.

MIXING NOTES:

1. **Pavemend SLQ™** undergoes an exothermic chemical reaction during blending. Heat, the by-product of the reaction, is the best indication that the reaction is complete and that the product is ready to be poured. **Pavemend SLQ™ has a Critical Mix Temperature of 85˚F/29˚C which MUST BE REACHED before placing to obtain optimum performance.**

   (In cold weather, it may be impossible to reach the Critical Mix Temperature, therefore a 40˚F/22˚C rise in material temperature is mandatory to ensure that the necessary chemical reactions have taken place to deliver the desired performance characteristics); Mixing time to reach the **Critical Mix Temperature** will vary with ambient air and mix water temperatures, however, **never mix Pavemend SLQ™ for less than 2 minutes regardless of ambient temperatures.** It is recommended that a thermal gun or temperature probe be used to ensure that the **Critical Mix Temperature** has been achieved.

6 Packaging & Shelf Life

PACKAGING
46 lb (20.9 kg) 5 gallon (18.9 L) bucket - GSA P/N: C300
11lb (4.99 kg) 2 gallon (7.6 L) bucket - GSA P/N: C350

SHELF LIFE
Buckets - 3 years (when stored in original unopened bucket)

STORAGE
Buckets are environmentally sealed and require no special storage requirements

7 Limitations

- Not recommended for surface temperatures above **110˚F**/43˚C or below **-20°F**/-28°C.
- Will not bond to polymers.
- Cannot be pumped.
- Must be mixed with drill and paddle - **Pavemend SLQ™** cannot be mixed in grout mixer or rotating drum concrete mixers due to rapid set times.

1500 N. Beauregard St. Suite 320 Alexandria, VA 22311 • 800-581-8397 • sales@pavemend.com
Fax: 703-894-1068 • Technical Support: 888-341-2600

PFT Planet Friendly Technology!

pavemend SLQ® Self Leveling, Extendable VERY RAPID REPAIR MORTAR

Product Data Sheet

pavemend

Updated 2.4.14

8 Application & Finish

- Minimum NEAT profile thickness is 0.06" (1.5mm). There are no restrictions to the depth of the repair profile.
- For best results, CERATECH recommends monolithic placement of repair materials. Maintain a minimum thickness of 1.00 inch if repair material must be layered.
- Upon initial set, a broom finish can be applied. Upon final set, the material can be saw-cut, drilled, sanded and/or polished.
- Do not re-temper. The addition of water to the surface of the repair will negatively affect the materials final properties.
- **General loading in 1.0 hour for wheeled traffic and 20 minutes for foot traffic.** For applications 0.5" thick and greater, in ambient and/or surface temperatures below 50°F/10°C, extend the loading time by 30 minutes for each 10° below 50°F/10°C. For applications 1.00" thick and greater, in ambient and/or surface temperatures below 40°F/4°C extend the loading time by 30 minutes for each 10° below 40°F/4°C.
- **All previously existing joints must be re-established within 1-3 hours of final set.**
- **Self-curing.**
- Clean all tools and equipment with water prior to the material reaching final set.

9 Safety

- See **Material Safety Data Sheet (MSDS)**.
- This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.
- Dispose of water and materials in accordance with Federal, State and Local regulations.
- The use of a dust mask, safety goggles and gloves is recommended.
- Keep out of the reach of children.

WARRANTY:
CERATECH, Inc. ("CERATECH") warrants that its products are free from defects in materials and workmanship. If any CERATECH product fails to conform to this warranty, CERATECH will replace the product at no cost to the buyer or refund the purchase price, at CERATECH's election. Any warranty claim must be made within one (1) year from the date of the shipment of the product to the buyer. In no event shall CERATECH be liable to the buyer for any consequential or incidental damages of any nature. CERATECH MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL AS TO THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF ITS PRODUCTS AND EXCLUDES THE SAME. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

CERATECH

www.ceratechinc.com

1500 N. Beauregard St. Suite 320 Alexandria, VA 22311 • 800-581-8397 • sales@pavemend.com
Fax: 703-894-1068 • Technical Support: 888-341-2600

PFT Planet Friendly Technology!

PROSPEC®
Floor Preparation • Concrete Repair • Tile Setting

Premium Patch 200

1. PRODUCT NAME
ProSpec® Premium Patch 200

2. MANUFACTURER
H.B. Fuller Construction Products Inc.
1105 South Frontenac Street
Aurora, IL 60504-6451 U.S.A.

1-800-552-6225 Office
1-800-952-2368 Fax
prospec.com

3. PRODUCT DESCRIPTION
ProSpec® Premium Patch 200 is a rapid-setting, fiber reinforced, high strength, polymer-modified cement mortar designed for concrete repair and overlay applications requiring high durability.

Features and Benefits
- Polymer-modified for increased flexural strength
- Excellent bond – no bonding agent needed
- Interior/exterior
- High early strength – over 2000 psi (14 MPa) in one hour allows repairs to be opened to traffic within 60 minutes
- Wide temperature range – from 20ºF to 100ºF (-6ºC to 38ºC)
- Apply 1/2" (12 mm) to 2" (51 mm)
- Can be extended up to 60% by weight for repairs greater than 2" (51 mm) deep
- High performance cement technology and alkali resistant fibers help improve impact, flexural and tensile strengths
- Contains corrosion inhibitor
- Contains no chlorides or magnesium phosphates
- Compatible with portland cement formulated concrete
- Suitable for DOT horizontal concrete repairs*
- Cement based, non-corrosive – not a chemical concrete
- Meets ASTM C 928, Standard Specification for Packaged, Dry, Very Rapid, Hardening Cementitious Materials for Concrete Repair

* Call for ProSpec® Technical Services for state DOT approvals

Uses
Concrete repair mortar designed to repair heavy duty surfaces such as:
- Highway repairs and overlays
- Bridge decks and parking structures
- Airport runways
- Freezer rooms
- Heavy industrial and warehouse repairs
- Loading docks and wastewater treatment facilities

SAFETY
READ THE SAFETY DATA SHEET (SDS) BEFORE USING THIS PRODUCT. SDS Sheets are available on our website prospec.com or contact Medical Emergency Phone Number (24 Hours): 1-888-853-1758, Transport Emergency Phone Number (CHEMTREC): 1-800-424-9300 or contact ProSpec® Technical Services at 800-832-9023 (7:00AM to 5:00PM M-F, Central US Time).

CAUTIONS
Read complete cautionary information printed on product container prior to use. For medical emergency information, call 1-888-853-1758.

This Product Data Sheet has been prepared in good faith on the basis of information available at the time of publication. It is intended to provide users with information about and guidelines for the proper use and application of the covered ProSpec® brand product(s) under normal environmental and working conditions. Because each project is different, H.B. Fuller Construction Products Inc. cannot be responsible for the consequences of variations in such conditions, or for unforeseen conditions.

4. TECHNICAL DATA

Working Time @ 70ºF (21ºC)	15 minutes
Set Time ASTM C 191 @ 70ºF (21ºC)	
Initial Set	Approx. 18 minutes
Final Set	Approx. 20 minutes
Compressive Strength ASTM C 109 @ 75°F (24°C)	
1 hour	2,650 psi (18.3 MPa)
3 hours	3,800 psi (24.1 MPa)
1 day	5,400 psi (41.3 MPa)
7 days	7,500 psi (55.1 MPa)
28 days	9,100 psi (69.0 MPa)
Compressive Strength ASTM C 109 @ 40°F (4°C)	
1 hour	N/A
3 hours	3,000 psi (17.2 MPa)
1 day	5,000 psi (27.6 MPa)
7 days	8,000 psi (55.1 MPa)
28 days	10,000 psi (69.0 MPa)
Compressive Strength ASTM C 109 @ 100°F (38°C)	
1 hour	3,000 psi (24.1 MPa)
3 hours	5,500 psi (34.5 MPa)
1 day	5,600 psi (41.3 MPa)
7 days	7,800 psi (55.1 MPa)
28 days	9,100 psi (69.0 MPa)
Flexural Strength ASTM C 348	
7 days	>1,100 psi (4.8 MPa)
28 days	>1,200 psi (5.4 MPa)
Bond Strength ASTM C 882	
1 day	1,500 psi (9.6 MPa)
7 days	3,000 psi (13.8 MPa)

Greater than: > Greater than or equal to: ≥ Less than: < Less than or equal to: ≤

Data Sheets are subject to change without notice. For the latest revision, check our website at prospec.com

TECHNICAL DATA (cont.)

Test Length Change of Hardened Cement Mortar and Concrete ASTM C 928			
Change	Water storage	Air storage	Differential
28 days	+0.038%	-0.094%	0.132%
ASTM C 928 requirement	Max. to 0.15%	Max. to -0.15%	Max. to 0.20%

Scaling Resistance (Freeze/Thaw) ASTM C 672 Average of 3 specimens		
No. of Cycles	Rating	Condition of surface
5	0	No scaling visible
10	0	No scaling visible
15	0	No scaling visible
20	0	No scaling visible
25	0	No scaling visible

Test results obtained under controlled laboratory conditions.

Reasonable variations can occur due to atmospheric and job site conditions. Water Used: 3.25qt (3.1 L) clean potable water per 50 lb (22.7 kg) bag.

LEED® Eligibility[1]
- Regional Materials (MR-c5)

Product Enhancement
Rapid Cure Technology (RCT®) – Improves the strength, controls shrinkage and prevents efflorescence of our products without sacrificing workability or working time.

Expansion Stabilization Technology (EST™) – Special additive designed to reduce the potential for cracking and shrinkage.

Packaging
Gray: 50 lb (22.7 kg) bag - Product #65510323

Shelf Life
12 months from the date of manufacture when stored in the original, unopened container, away from moisture, under cool, dry conditions and out of direct sunlight.

5. INSTALLATION
Preparation
All materials should be stored at 40°F (4°C) to 80°F (27°C) 24 hours prior to installation.
- Surfaces must be solid, clean, free of all bond breakers such as oil, grease, dirt etc. Weak concrete surfaces must be cleaned down to solid sound concrete by mechanical means.
- The base concrete should be roughened to enhance mechanical bond and repair areas should be in a saturated surface dry (SSD) condition with all standing water removed. Using a stiff broom or brush apply a bond scrub coat of thinly mixed Premium Patch 200 to the adjacent surfaces.
- Do not let this bond coat dry, before covering it with Premium Patch 200. A minimum patch repair depth of 1/2" (13 mm) is required. This is best accomplished by saw cutting the patch area perimeter to the minimum 1/2" (13 mm) depth.

Note: It is the responsibility of the installer/applicator to ensure the suitability of the product for its intended use.

Application
Idea application conditions are when air, material and substrate temperature are between 40°F (4°C) and 80°F (27°C). For applications outside this range of temperatures, contact ProSpec® Technical Services.

Hot and Cold Weather Applications
Ideal mixed product temperature at placement is 65° - 70°F (21°C), where the initial setting time is 15 - 20 minutes. Hot temperatures will shorten setting time, while cold temperatures will extend setting time.

Hot Weather 80°F to 100°F (27°C to 38°C):
Keep Premium Patch 200 cool. Pre-soak and then remove standing water from the repair area, resulting in a saturated surface dry (SSD) surface. Mix Premium Patch 200 using ice water to extend working time. The repair must be protected from rapid dry out with wet burlap or a water based curing compound.

Cold Weather 20°F to 40°F (-7°C to 4°C):
Do not use antifreeze or accelerators and keep Premium Patch 200 warm. Heat the surrounding concrete until warm. Combine the warmed repair material with warm mixing water. After placing use a construction insulating blanket for at least 2 - 3 hours and keep material from freezing.

Refer to:

ACI 305 Standard on Hot Weather Concreting

ACI 306 Standard on Cold Weather Concreting

Job Mockups
The manufacturer requires that when its ProSpec® products are used in any application or as part of any system that includes other manufacturers' products, the contractor and/or design professional shall test all the system components collectively for compatibility, performance and long-term intended use in accordance with pertinent and accepted industry standards prior to any construction. Written documentation of the tests performed shall be satisfactory to the design professional and contractor. Test results must include the means and methods of application, products used, project-specific conditions being addressed, and standardized tests performed for each proposed system or variation.

Mixing
- Mix as close to the area being repaired as possible. Premium Patch 200 requires only the addition of water. Use 3.25 qt (3.0 L) per 50 lb (22.7 kg). Place the potable water into the mixing container and then while mixing add the repair material.
- Premium Patch 200 can be mixed in a mortar mixer or by using a paddle attached to a heavy duty 1/2" drill (650 rpm). Mix for 2 - 3 minutes to a lump free consistency. Do not retemper or overwater. Place immediately after mixing, working Premium Patch 200 firmly into the sides and bottom eliminating air pockets and ensuring bond. This is best done working from one side of the cavity to the other and then screeding toward the adjoining concrete.
- For repairs deeper than 2" (5 cm), Premium Patch 200 can be extended 60% by weight using clean 3/8" (10 mm) dry pea gravel. Mix the Premium Patch 200 as outlined and then during the last minute of mixing (after 2 minutes) add the pea gravel, blend for 1 additional minute and place.

Curing
Premium Patch 200 should be moist cured for 1 hour after final set (approximately 20 minutes) or the application of a water-based curing compound is acceptable. Prolonged wet curing minimizes the chances of cracking and improves physical properties.

Cleaning
Use water to clean all tools immediately after use.

Limitations
Do not use for applications less than 1/2" (12 mm) thick.
Do not retemper after mixing.
Do not overwater or add other cements or additives.
Protect from premature drying.

Coverage
50 lb (22.7 kg) yields approximately 0.4 ft^3 (0.01 m^3).
50 lb (22.7 kg) extended with 30 lb (13.6 kg) of 3/8" (10 mm) pea gravel yields approximately 0.61 ft^3 (0.02 m^3).

6. AVAILABILITY
To locate ProSpec® products in your area, please contact:
Phone: 800-832-9002
Website: prospec.com

7. WARRANTY
For warranty details, see your sales associate or prospec.com

8. MAINTENANCE
Not applicable

9. TECHNICAL SERVICES
Technical Assistance
Information is available by calling the Technical Support Hotline.
Toll Free: 800-832-9023
Fax: 630-952-1235

Technical and safety literature
To acquire technical and safety literature, please visit our website at prospec.com

10. FILING SYSTEM
Division 3

[1] ProSpec® products can contribute to LEED® credits within the Material Resource, (Recycled Content & Regional Materials) and Indoor Environmental Quality (Low Emitting Materials).

©Copyright 2014
H.B. Fuller Construction Products Inc.

ProSpec® RGT® and EST™ are trademarks of H.B. Fuller Construction Products Inc.

LEED® is a registered trademark of U.S. Green Building Council.

Data Sheets are subject to change without notice. For the latest revision, check our website at prospec.com

H.B. Fuller CONSTRUCTION PRODUCTS
H.B. Fuller Construction Products Inc.
1105 South Frontenac Street
Aurora, IL 60504-6451 U.S.A.
prospec.com

CTS Cement | Professional Cement Products
Rapid Set® Concrete Mix Datasheet

Rapid Set®

CONCRETE MIX

VERY RAPID HARDENING CONCRETE
High Strength & Superior Durability

Highlights:

- ***FAST***
  Sets in 20 minutes; ready for traffic in 1 hour
- ***DURABLE***
  Formulated for long life in critical applications
- ***STRUCTURAL***
  For repair and new construction
- ***MULTI-PURPOSE***
  Use for concrete repair, formed work, setting posts, footings, floors, machine bases, and more

MANUFACTURER:
CTS Cement Manufacturing Corp.
11065 Knott Ave.
Cypress, CA 90630
Tel: 800-929-3030
Fax: 714-379-8270
Web: www.ctscement.com
E-mail: info@ctscement.com

PRODUCT NAME:
Rapid Set© CONCRETE MIX
Very Rapid Hardening Concrete

DESCRIPTION:
CONCRETE MIX is a high-performance, fast-setting, multipurpose concrete repair material. Durable in wet environments, CONCRETE MIX is a blend of Rapid Set© hydraulic cement and quality aggregates. CONCRETE MIX is non-metallic and no chlorides are added. Mix CONCRETE MIX with water to produce a workable, quality concrete material that is ideal where fast strength gain, high durability and low shrinkage are desired. CONCRETE MIX sets in 20 minutes and is ready for traffic in 1 hour.

APPLICATIONS:
Use CONCRETE MIX for general and structure concrete repair, construction of pavements, formed work, footings, setting posts, industrial floors and machine bases. For freeze thaw durability, in some geographical areas, CONCRETE MIX contains an air-entraining admixture.

ENVIRONMENTAL ADVANTAGES:
Use CONCRETE MIX to reduce your carbon footprint and lower your environmental impact. Production of Rapid Set cement emits far less CO_2 than portland cement. Contact your representative for LEED values and environmental information.

RECOMMENDED USE:
Apply CONCRETE MIX in thicknesses from 2" to 24" (5 to 61 cm). For thinner sections, use Rapid Set© Cement All© or Rapid Set© Mortar Mix. Not intended for high heat applications above 300°F. For bonding applications, a minimum one test section should be prepared to evaluate the suitability of the materials and procedures.

SURFACE PREPARATION:
For repairs, application surface shall be clean, sound and free from any materials that may inhibit bond, such as oil, asphalt, curing compound, acid, dirt and loose debris. Mechanically abrade surface and remove all unsound material. Apply CONCRETE MIX to a thoroughly saturated surface with no standing water.

Rapid Set®

CONCRETE MIX

VERY RAPID HARDENING CONCRETE
High Strength & Superior Durability

MIXING:
The use of a power-driven mechanical mixer, such as a mortar mixer or a drill-mounted mixer, is recommended. Organize work so that all personnel and equipment are in place before mixing. Use clean potable water. **Rapid Set® CONCRETE MIX may be mixed using 3.5 to 4.5 quarts (3.3 to 4.2 L) of water per 60-lb (27-kg) bag. Use less water to achieve higher strengths. Do not exceed 4.5 quarts (4.2 L) of water per bag.** For increased fluidity and workability use Rapid Set® FLOW Control® plasticizing admixture from the Rapid Set® Concrete Pharmacy®. Place the desired quantity of mix water into the mixing container. While the mixer is running, add CONCRETE MIX. Mix for the minimum amount of time required to achieve a lump-free, uniform consistency (usually 1 to 3 minutes). Do not retemper.

PLACEMENT:
CONCRETE MIX may be placed using traditional construction methods. Organize work so that all personnel and equipment are ready before placement. Place, consolidate and screed quickly to allow for maximum finishing time. Use a method of consolidation that eliminates air voids. Do not wait for bleed water; apply final finish as soon as possible. CONCRETE MIX may be troweled, floated or broom finished. On flatwork, do not install in layers. Install full-depth sections and progress horizontally. To extend working time, use Rapid Set® SET Control® set retarding admixture or cold mix water. Do not install on frozen surfaces. CONCRETE MIX may be applied in temperatures ranging from 45°F to 90°F (7°C to 32°C).

CURING:
Water cure all CONCRETE MIX installations by keeping exposed surfaces wet for a minimum of 1 hour. Begin curing as soon as the surface starts to lose its moist sheen. When experiencing extended setting time due to cold temperature or the use of retarder, longer curing times may be required. The objective of water curing shall be to maintain a continuously wet surface until the product has achieved sufficient strength.

YIELD & PACKAGING:
CONCRETE MIX is available in 60-lb (27-kg) bags. One 60-lb (27-kg) bag of CONCRETE MIX will yield approximately 0.5 cubic feet.

SHELF LIFE:
One year when stored in cool, dry conditions, out of direct sunlight.

USER RESPONSIBILITY:
Before using Rapid Set products, read current technical data sheet, bulletins, product label and material safety data sheet at www.ctscement.com. It is the user's responsibility to review instructions and warnings for any Rapid Set product in current technical data sheet, bulletins, product label and material safety data sheet prior to use.

WARNING: DO NOT BREATHE DUST. AVOID CONTACT WITH SKIN AND EYES.
Use material in well-ventilated areas only. Exposure to cement dust may irritate eyes, nose, throat, and the upper respiratory system/lungs. Silica exposure by inhalation may result in the development of lung injuries and pulmonary diseases, including silicosis and lung cancer. Seek medical treatment if you experience difficulty breathing while using this product. The use of a NIOSH/MSHA-approved respirator (P-, N- or R-95) is recommended to minimize inhalation of cement dust. Eat and drink only in dust-free areas to avoid ingesting cement dust. Skin contact with dry material or wet mixtures may result in moderate irritation to thickening/cracking of skin to severe skin damage from chemical burns. If irritation or burning occurs, seek medical treatment. Protect eyes with goggles or safety glasses with side shields. Cover skin with protective clothing. Use chemical resistant gloves and waterproof boots. In case of skin contact with cement dust, immediately wash off dust with soap and water to avoid skin damage. Wash skin areas exposed to wet concrete with cold, running water as soon as possible. In case of eye contact with cement dust, flush immediately and repeatedly with clean water and consult a physician. If wet concrete splashes into eyes, rinse eyes with clean water for at least 15 minutes and go to the hospital for further treatment.

PROPOSITION 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Please refer to the MSDS and www.ctscement.com for additional safety information regarding this material.

LIMITED WARRANTY:
CTS CEMENT MANUFACTURING CORP. (CTS) warrants its materials to be of good quality and at its option, within one year from date of sale, will replace material proven defective or refund purchase price thereof, and such replacement or refund shall be the limit of CTS's responsibility. Except for the foregoing, all warranties expressed or implied, including merchantability and fitness for a particular purpose, are excluded. CTS shall not be liable for any consequential, incidental, or special damages arising directly or indirectly from the use of the materials.

PHYSICAL DATA

Set Time, ASTM C-191 Mod.**	
Initial set	20 minutes
Final set	35 minutes
Compressive Strength, ASTM C39 Mod.**	
1 hour*	3000 psi
3 hours	3600 psi
1 day	4500 psi
7 days	5500 psi
28 days	6000 psi
Slant Shear Bond Strength, ASTM C882 Mod.**	
1 day	1200 psi
28 days	2200 psi
Splitting Tensile, ASTM C496 Mod.**	
7 days	600 psi
28 days	700 psi
Flexural Strength, ASTM C78 Mod.**	
7 days	500 psi
28 days	550 psi
Length Change, ASTM C157 Mod. (max)**	
28 days in air	-0.04
28 days in water	0.02

*After final set
**Data obtained at 4" slump by ASTM C143 at 70°F (21°C)

© 2013 CTS Cement Mfg. Corp. DS111413USB L364-EN-1306
USGBC and related logo is a trademark owned by the U.S. Green Building Council and is used by permission.

www.ctscement.com

BASF
The Chemical Company

PRODUCT DATA

3 03 01 00 **Maintenance of Concrete**

SET® 45 AND SET® 45 HW

Chemical-action repair mortar

Description

Set® 45 is a one-component magnesium phosphate-based patching and repair mortar. This concrete repair and anchoring material sets in approximately 15 minutes and takes rubber-tire traffic in 45 minutes. It comes in two formulations: Set® 45 Regular for ambient temperatures below 85° F (29° C) and Set® 45 Hot Weather for ambient temperatures ranging from 85 to 100° F (29 to 38° C).

Yield

A 50 lb (22.7 kg) bag of mixed with the required amount of water produces a volume of approximately 0.39 ft³ (0.011 m³); 60% extension using 1/2" (13 mm) rounded, sound aggregate produces approximately 0.58 ft³ (0.016 m³).

Packaging

50 lb (22.7 kg) multi-wall bags

Color

Dries to a natural gray color

Shelf Life

1 year when properly stored

Storage

Store in unopened containers in a clean, dry area between 45 and 90° F (7 and 32° C).

Features	Benefits
• Single component	Just add water and mix
• Reaches 2,000 psi compressive strength in 1 hour	Rapidly returns repairs to service
• Wide temperature use range	From below freezing to hot weather exposures
• Superior bonding	Bonds to concrete and masonry without a bonding agent
• Very low drying shrinkage	Improved bond to surrounding concrete
• Resistant to freeze/thaw cycles and deicing chemicals	Usable in most environments
• Only air curing required	Fast, simple curing process
• Thermal expansion and contraction similar to Portland cement concrete	More permanent repairs
• Sulfate resistant	Stable where conventional mortars degrade

Where to Use

APPLICATION

- Heavy industrial repairs
- Dowel bar replacement
- Concrete pavement joint repairs
- Full-depth structural repairs
- Setting of expansion device nosings
- Bridge deck and highway overlays
- Anchoring iron or steel bridge and balcony railings
- Commercial freezer rooms
- Truck docks
- Parking decks and ramps
- Airport runway-light installations

LOCATION

- Horizontal and formed vertical or overhead surfaces
- Indoor and outdoor applications

How to Apply

Surface Preparation

1. A sound substrate is essential for good repairs. Flush the area with clean water to remove all dust.
2. Any surface carbonation in the repair area will inhibit chemical bonding. Apply a pH indicator to the prepared surface to test for carbonation. If carbonation is present, abrade surface to a depth that is not carbonated.
3. Refer to International Concrete Repair Institute publication #s 03730 and 03732 for further surface preparation suggestions.

Technical Data

Composition

Set® 45 is a magnesium-phosphate patching and repair mortar.

Test Data

PROPERTY	RESULTS			TEST METHODS
Typical Compressive Strengths*, psi (MPa)				ASTM C 109, modified
	Plain Concrete 72° F (22° C)	**Set® 45 Regular 72° F (22° C)**	**Set® 45 Regular 36° F (2° C)**	**Set® 45 HW 95° F (35° C)**
1 hour	—	2,000 (13.8)	—	—
3 hour	—	5,000 (34.5)	—	3,000 (20.7)
6 hour	—	5,000 (34.5)	1,200 (8.3)	5,000 (34.5)
1 day	500 (3.5)	6,000 (41.4)	5,000 (34.5)	6,000 (41.4)
3 day	1,900 (13.1)	7,000 (48.3)	7,000 (48.3)	7,000 (48.3)
28 day	4,000 (27.6)	8,500 (58.6)	8,500 (58.6)	8,500 (55.2)
NOTE: Only Set® 45 Regular formula, tested at 72° F (22° C), obtains 2,000 psi (13.8 MPa) compressive strength in 1 hour.				
Modulus of Elasticity, psi (MPa)				ASTM C 469
		7 days	**28 days**	
Set® 45 Regular		4.18×10^6 (2.88×10^4)	4.55×10^6 (3.14×10^4)	
Set® 45 Hot Weather		4.90×10^6 (3.38×10^4)	5.25×10^6 (3.62×10^4)	
Freeze/thaw durability test, % RDM, 300 cycles, for Set® 45 and Set 45® HW			80	ASTM C 666, Procedure A (modified**)
Scaling resistance to deicing chemicals, Set® 45 and Set 45® HW				ASTM C 672
5 cycles			0	
25 cycles			0	
50 cycles			1.5 (slight scaling)	
Sulfate resistance				ASTM C 1012
Set® 45 length change after 52 weeks, %			0.09	
Type V cement mortar after 52 weeks, %			0.20	
Typical setting times, min, for Set® 45 at 72° F (22° C), and Set® 45 Hot Weather at 95° F (35° C)				Gilmore ASTM C 266, modified
Initial set			9 – 15	
Final set			10 – 20	
Coefficient of thermal expansion,*** both Set® 45 Regular and Set® 45 Hot Weather coefficients			7.15 x 10⁻⁶/° F (12.8 x 10⁻⁶/° C)	CRD-C 39
Flexural Strength, psi (MPa), 3 by 4 by 16" (75 by 100 by 406 mm) prisms, 1 day strength,				ASTM C 78, modified
Set® 45 mortar			550 (3.8)	
Set® 45 mortar with 3/8" (9 mm) pea gravel			600 (4.2)	
Set® 45 mortar with 3/8" (9 mm) crushed angular noncalcareous hard aggregate			650 (4.5)	

* All tests were performed with neat material (no aggregate)

**Method discontinues test when 300 cycles or an RDM of 60% is reached.

***Determined using 1 by 1 by 11" (25 mm by 25 mm by 279 mm) bars. Test was run with neat mixes (no aggregate). Extended mixes (with aggregate) produce lower coefficients of thermal expansion.

Test results are averages obtained under laboratory conditions. Expect reasonable variations.

Mixing

1. Set® 45 must be mixed, placed, and finished within 10 minutes in normal temperatures (72° F [22° C]). Only mix quantities that can be placed in 10 minutes or less.

2. Do not deviate from the following sequence; it is important for reducing mixing time and producing a consistent mix. Use a minimum 1/2" slow-speed drill and mixing paddle or an appropriately sized mortar mixer. Do not mix by hand.

3. Pour clean (potable) water into mixer. Water content is critical. Use a maximum of 4 pts (1.9 L) of water per 50 lb (22.7 kg) bag of Set® 45. Do not deviate from the recommended water content.

4. Add the powder to the water and mix for approximately 1 – 1-1/2 minutes.

5. Use neat material for patches from 1/2 – 2" (6 – 51 mm) in depth or width. For deeper patches, extend a 50 lb (22.7 kg) bag of Set® 45 HW by adding up to 30 lbs (13.6 kg) of properly graded, dust-free, hard, rounded aggregate or noncalcareous crushed angular aggregate, not exceeding 1/2" (13 mm) in accordance with ASTM C 33, #8. If aggregate is damp, reduce water content accordingly. Special procedures must be followed when angular aggregate is used. Contact your local BASF representative for more information. (Do not use calcareous aggregate made from soft limestone. Test aggregate for fizzing with 10% HCL).

Application

1. Immediately place the mixture onto the properly prepared substrate. Work the material firmly into the bottom and sides of the patch to ensure good bond.

2. Level the Set® 45 and screed to the elevation of the existing concrete. Minimal finishing is required. Match the existing concrete texture.

Curing

No curing is required, but protect from rain immediately after placing. Liquid-membrane curing compounds or plastic sheeting may be used to protect the early surface from precipitation, but never wet cure Set® 45.

For Best Performance

- Color variations are not indicators of abnormal product performance.
- Regular Set® 45 will not freeze at temperatures above -20° F (-29° C) when appropriate precautions are taken.
- Do not add sand, fine aggregate, or Portland cement to Set® 45.
- Do not use Set® 45 for patches less than 1/2" (13 mm) deep. For deep patches, use Set® 45 Hot Weather formula extended with aggregate, regardless of the temperature. Consult your BASF representative for further instructions.
- Do not use limestone aggregate.
- Water content is critical. Do not deviate from the recommended water content printed on the bag.
- Precondition these materials to approximately 70° F (21° C) for 24 hours before using.
- Protect repairs from direct sunlight, wind, and other conditions that could cause rapid drying of material.
- When mixing or placing Set® 45 in a closed area, provide adequate ventilation.
- Do not use Set® 45 as a precision machinery grout.
- Never featheredge Set® 45; for best results, always sawcut the edges of a patch.
- Prevent any moisture loss during the first 3 hours after placement. Protect Set® 45 with plastic sheeting or a curing compound in rapid-evaporation conditions.
- Do not wet cure.
- Do not place Set® 45 on a hot (90° F [32° C]), dry substrate.
- When using Set® 45 in contact with galvanized steel or aluminum, consult your local BASF sales representative.
- Make certain the most current versions of product data sheet and MSDS are being used; call Customer Service (1-800-433-9517) to verify the most current versions.
- Proper application is the responsibility of the user. Field visits by BASF personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

Health and Safety

SET® 45

WARNING!

Contains silica, crystalline quartz, fly ash, magnesium oxide, phosphoric acid, monoammonium salt, iron oxide, silica, amphorous, aluminum oxide, sulfur trioxide.

Risks

Product is alkaline on contact with water and may cause injury to skin or eyes. Ingestion or inhalation of dust may cause irritation. Contains small amount of free respirable quartz which has been listed as a suspected human carcinogen by NTP and IARC. Repeated or prolonged overexposure to free respirable quartz may cause silicosis or other serious and delayed lung injury.

Precautions

Avoid contact with skin, eyes and clothing. Prevent inhalation of dust. Wash thoroughly after handling. Keep container closed when not in use. DO NOT take internally. Use only with adequate ventilation. Use impervious gloves, eye protection and if the TLV is exceeded or used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with applicable Federal, state and local regulations.

First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs or if swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Waste Disposal Method

This product when discarded or disposed of is not listed as a hazardous waste in federal regulations. Dispose of in a landfill in accordance with local regulations.

For additional information on personal protective equipment, first aid, and emergency procedures, refer to the product Material Safety Data Sheet (MSDS) on the job site or contact the company at the address or phone numbers given below.

Proposition 65

This product contains material listed by the State of California as known to cause cancer, birth defects or other reproductive harm.

VOC Content

0 g/L or 0 lbs/gal less water and exempt solvents.

For medical emergencies only, call ChemTrec (1-800-424-9300).

BASF Construction Chemicals, LLC – Building Systems
889 Valley Park Drive
Shakopee, MN, 55379
www.BuildingSystems.BASF.com
Customer Service 800-433-9517
Technical Service 800-243-6739

LIMITED WARRANTY NOTICE: Every reasonable effort is made to apply BASF warranty standards from in the manufacture of our products and in the information which we issue concerning these products and their use. We warrant our products to be of good quality and will replace or, at our discretion, refund the purchase price for any products proved defective. Satisfactory results depend not only upon quality products, but also upon many factors beyond our control. Therefore, except for such replacement or refund, BASF MAKES NO WARRANTY OF FITNESS (FOR A PARTICULAR PURPOSE OR GENERALLY), AND NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, SHALL APPLY. BASF shall not be liable for any loss or damage, direct or consequential, arising from the use of or inability to use the product. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risks and liability in connection therewith. Any statement or recommendation not contained herein shall have no force or effect unless in a written agreement signed by an officer of BASF or its authorized representative.

This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information or advice including the extent to which such information or advice may relate to existing third party intellectual property rights, especially patent rights. In particular, BASF disclaims all CONDITIONS AND WARRANTIES WHETHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR INFORMATION BY BASF SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL, INDIRECT OR INCIDENTAL DAMAGES (INCLUDING LOSS OF PROFITS) OF ANY KIND. BASF reserves the right to make any changes according to technological progress or further developments. It is the customer's responsibility to check whether any of our products are suitable for the intended uses and purposes mentioned above. Performance of the products described herein should be verified by testing and carried out by qualified experts. It is the sole responsibility of the customer to carry out and manage the warranty inspection and to give notice of claims. Reference to trade names used by other companies is neither a recommendation nor an endorsement of any product and does not imply that similar products could not be used.

For professional use only. Not for sale to or use by the general public.

Form No. 1CM0356 10/11
Printed on recycled paper including 10% post consumer fiber

© 2011 BASF
Printed in U.S.A.

Construction

Product Data Sheet
Edition 7.22.2014
SikaQuick® 2500

SikaQuick® 2500

Very rapid hardening, repair mortar

Description	SikaQuick® 2500 is a 1-component, very rapid hardening, early strength gaining, cementitious, patching material for concrete.
Where to Use	■ Use on grade, above, and below grade on concrete. ■ Highway overlays and repairs. ■ Structural repair material for concrete roadways, parking structures, bridges, dams and ramps. ■ Full depth patching repairs. ■ Economical patching material for horizontal repairs of concrete and mortar.
Advantages	■ Very rapid hardening as defined by ASTM C-928. ■ Epoxy coatings can be applied as early as 4 hrs. On site testing is recommended for verification. Please consult coatings manufacturer for recommendations. ■ Freeze/thaw resistant. ■ Easy to use, labor-saving material. ■ Not gypsum-based. ■ High early strength. ■ Fast-setting. ■ Open to foot traffic in 45 minutes; to vehicle traffic in 1 hour (at 73°F). ■ Easily applied to clean, sound substrate. ■ Not a vapor barrier.
Coverage	Approximately 0.43 cu. ft. When extended with 25-30 lbs. of 3/8 in. gravel yield is approximately 0.60 cu. ft.
Packaging	50-lb. multi-wall bag.

Typical Data *(Material and curing conditions @ 73°F (23°C) and 50% R.H.) (Water/powder = 0.12)*

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

Shelf Life	1 year in original, unopened bag.
Storage Conditions	Store dry at 40°-95°F (4°-35°C). For best results, condition material to 65°-75°F before using.
Color	Concrete gray.
Mixing Ratio	Approximately 5 - 5.5 pints of liquid per 50 lb. bag.
Application Life	Approximately 15 minutes after adding powder to the water.

Compressive Strength, psi	**Mortar - ASTM C-109**
1 hour	**2,500 psi (17.2 MPa)
2 hours	**4,000 psi (27.6 MPa)
1 day	**5,700 psi (39.3 MPa)
7 days	7,500 psi (51.7 MPa)
28 days	**8,500 psi (58.6 MPa)

Flexural Strength, psi (ASTM C-78)	
1 day	800 psi (5.5 MPa)
7 days	1,000 psi (6.9 MPa)
28 days	**1,100 psi (7.6 MPa)

Splitting Tensile Strength, psi (ASTM C-496)	
1 day	300 psi (2.0 MPa)
7 days	500 psi (3.4 MPa)
28 days	600 psi (4.1 MPa)

Bond Strength, psi (ASTM C-882) modified	
1 day	**1,800 psi (12.4 MPa)
7 days	2,500 psi (17.2 MPa)
28 days	**2,700 psi (21.4 MPa)

Direct Tensile Bond, psi (ACI 503)	**28 days**	300 psi (substrate failure)
Drying Shrinkage, % (ASTM C-596)	**28 days**	**0.06
Modulus of Elasticity, psi (ASTM C-469)	**28 days**	4.6×10^6
Chloride Permeability, Coulombs (ASTM C-1202)	**28 days**	< 500
Freeze/Thaw Resistance, % (ASTM C-666)	**28 days**	**98%
Scaling Resistance, lb./ft² (ASTM C-672)	**50 cycles**	0.080
Initial Set, minutes (ASTM C-266)	12-24	
Final Set, minutes (ASTM C-266)	20-40	
Abrasion Resistance, inches of wear at 1 hr. (ASTM C-779)	**28 days**	0.026

*Independent certificates available upon request.

D80

Construction

How to Use

Surface Preparation

Surface must be clean and sound. Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired. Be sure repair area is not less than 1/4 in. deep. Preparation work should be done by appropriate means. Obtain an exposed aggregate surface with a minimum surface profile of ± 1/8 in. (CSP-6) on clean, sound concrete. To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a pull-off test. Saw cutting of edges is recommended. Saturate surface to be repaired with clean water. Substrate should be saturated surface dry (SSD) prior to application.

Priming

For priming of reinforcing steel use Sika® Armatec® 110 EpoCem (consult Technical Data Sheet). Concrete Substrate: Prime the prepared substrate with a scrub coat of SikaQuick 2500 prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.

Mixing

Mechanically mix in an appropriately sized mortar mixer. Wet down all tools and mixer to be used.

With water: Start with 5 pints of water added to the mixing vessel. Add 1 bag of SikaQuick® 2500 while continuing to mix. Add up to another 1/2 pint of water to achieve desired consistency. Do not over water.

With Latex R: Pour 5 pints of SikaLatex® R into the mixing container. Slowly add powder, mix and adjust as above.

With diluted Latex R: SikaLatex® R may be diluted up to 5:1 (water: SikaLatex® R) for projects requiring minimal polymer modification. Pour 5 pints of the mixture into the mixing container. Slowly add powder, mix and adjust as above. For applications greater than 1 in. in depth, add 3/8 in. coarse aggregate. The aggregate must be non-reactive (reference ASTM C-1260, C-227 and C-289), clean, well graded, saturated surface dry, have low absorption and high density, and comply with ASTM C-33 size number 8 per Table 2.

Note: Variances in aggregate may result in different strengths. The addition rate is 25-30 lbs. of aggregate per bag of SikaQuick® 2500. (25-30 lbs. of 3/8 in. aggregate is approximately 2.0 - 2.4 gallons by loose volume of aggregate). Do not exceed a slump of 7 in. This may cause excessive bleeding and retardation and will reduce the strength and performance of the material.

Application

The prepared mortar must be scrubbed into substrate. Be sure to fill all pores and voids. Force material against edge of repair, working toward center. After filling repair, screed off excess. Allow concrete to set to desired stiffness, then finish. If a smoother finish is desired, a magnesium float should be used. Mixing, placing, and finishing should not exceed 15 minutes maximum.

To control setting times, cold water should be used in hot weather and hot water used in cold weather.

Tooling & Finishing

As per ACI recommendations for portland cement concrete, curing is required. Moist cure with wet burlap and polyethylene, a fine mist of water or a curing compound meeting ASTM C-309. Moist cure should commence immediately after finishing. If necessary, protect newly applied material from rain. To prevent from freezing, cover with insulating material.

Limitations

- Minimum ambient and surface temperatures 45°F and rising.
- Minimum application thickness 1/4 in. as a mortar and 1 in. extended with aggregate.
- Maximum application thickness 1 in. as a mortar and 6 in. extended with aggregate.
- Do not feather edge.
- Do not exceed 7 in. slump when extended.
- Use only potable water.
- Variations in aggregates may produce differences in strengths from the typical values stated in Sika's Technical Data.
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur® Hi-Mod 32.
- Do not use Sika® Armatec® 110 EpoCem as a bonding agent with SikaQuick® 2500.
- When extended : Minimum application is 1 inches, Max application 6 inches.

PRIOR TO EACH USE OF ANY SIKA PRODUCT, THE USER MUST ALWAYS READ AND FOLLOW THE WARNINGS AND INSTRUCTIONS ON THE PRODUCT'S MOST CURRENT PRODUCT DATA SHEET, PRODUCT LABEL AND SAFETY DATA SHEET WHICH ARE AVAILABLE ONLINE AT HTTP://USA.SIKA.COM/ OR BY CALLING SIKA'S TECHNICAL SERVICE DEPARTMENT AT 800.933.7452 NOTHING CONTAINED IN ANY SIKA MATERIALS RELIEVES THE USER OF THE OBLIGATION TO READ AND FOLLOW THE WARNINGS AND INSTRUCTIONS FOR EACH SIKA PRODUCT AS SET FORTH IN THE CURRENT PRODUCT DATA SHEET, PRODUCT LABEL AND SAFETY DATA SHEET PRIOR TO PRODUCT USE.

KEEP CONTAINER TIGHTLY CLOSED. KEEP OUT OF REACH OF CHILDREN. NOT FOR INTERNAL CONSUMPTION. FOR INDUSTRIAL USE ONLY. FOR PROFESSIONAL USE ONLY.

For further information and advice regarding transportation, handling, storage and disposal of chemical products, users should refer to the actual Safety Data Sheets containing physical, ecological, toxicological and other safety related data. Read the current actual Safety Data Sheet before using the product. In case of emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

Prior to each use of any Sika product, the user must always read and follow the warnings and instructions on the product's most current Product Data Sheet, product label and Safety Data Sheet which are available online at http://usa.sika.com/ or by calling Sika's Technical Service Department at 800-933-7452. Nothing contained in any Sika materials relieves the user of the obligation to read and follow the warnings and instruction for each Sika product as set forth in the current Product Data Sheet, product label and Safety Data Sheet prior to product use.

SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor. NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKA SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS. SALE OF SIKA PRODUCTS ARE SUBJECT SIKA'S TERMS AND CONDITIONS OF SALE AVAILABLE AT HTTP://USA.SIKA.COM/ OR BY CALLING 201-933-8800.

Visit our website at usa.sika.com **1-800-933-SIKA NATIONWIDE**

Regional Information and Sales Centers. For the location of your nearest Sika sales office, contact your regional center.

Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
Phone: 800-933-7452
Fax: 201-933-6225

Sika Canada Inc.
601 Delmar Avenue
Pointe Claire
Quebec H9R 4A9
Phone: 514-697-2610
Fax: 514-694-2792

Sika Mexicana S.A. de C.V.
Carretera Libre Celaya Km. 8.5
Fracc. Industrial Balvanera
Corregidora, Queretaro
C.P. 76920
Phone: 52 442 2385800
Fax: 52 442 2250537

Sika and SikaQuick are registered trademarks.
Printed in Canada.

Buzzi Unicem USA

Ulti-Pave3®

Concrete/Asphalt Pavement Repair Mix

A One-Component, Rapid-Hardening, Cementitious Patching Material, Formulated to Meet ASTM C 928 R3

Engineered for Quality – Outstanding Results

Buzzi Unicem USA

Ulti-Pave3®

Description

Ulti-Pave3® Repair Mix is a multi-purpose pavement repair material that's fast-setting with rapid strength gains. This repair material is used for the repair and construction of interior and exterior pavements. When mixed with water, **Ulti-Pave3®** produces a quality repair product with approximately 30 minutes workability, a minimum of 3,000 psi in 3 hours, and continues to gain strength over 28 days to approximately 7,500 psi when placed within standard concrete guidelines. This repair material utilizes a calcium sulfoaluminate cement. **Ulti-Pave3®** develops strengths faster than Portland cement.

Product Data

Color: Gray
Form: Powder
Delivery: Available in 50-pound bags.
Storage: Store as dry cement.
Material Safety Data Sheets: Available upon request.
Precautions: Hydraulic cement, when dry, is non-hazardous. When in contact with moisture (such as eyes or on skin) or when mixed with water to make cementitious product, it becomes highly caustic and will burn the eyes or skin. Inhalation of dry Portland cement can irritate the upper respiratory system.

Specifications

Ulti-Pave3® is tested under the following ASTM methods:

ASTM C 109-01 Standard Test for Compressive Strength of Hydraulic Cement Mortars.
ASTM C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C 157 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
ASTM C 882 Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

Ulti-Pave3® meets:
ASTM C 928–R3 Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repair.

Buzzi Unicem USA Inc.
100 Brodhead Road, Suite 230
Bethlehem, PA 18017
Contact: William Krupa, Sales Manager Specialty Products
Office: 610-882-5013 Cell: 484-264-2141
Fax: 610-868-8795
Email: william.krupa@buzziunicemusa.com

Mixing

For optimum results, **Ulti-Pave3®** Pavement Repair Mix should be mixed in a pre-wet and appropriately-sized mortar mixer. Minimum application thickness is 2" (51mm). Maximum mixing water per bag is 5 pints per bag. Add approximately 4 pints of mixing water per bag to the mixer and slowly add contents of the bag. Add remaining water as necessary to achieve desired consistency, mixing to a uniform, homogenous mixture for approximately 2 to 4 minutes. Exceeding this amount of water will increase your water cement/cement ratio and may cause segregation and strength loss. For optimum results, maintain a mix temperature of 65-70˚F by using either hot or cold water when mixing. Do not mix more material than can be placed in 20 minutes and no re-tempering.

Surface Prep

Remove all deteriorated concrete and make sure surface is free from dirt, oil, grease and bond-inhibiting materials. Repair area should be prepared to obtain an aggregate fractured surface. Substrate should be conditioned to a saturated surface (SSD) with no standing water and free of frost and ice. Surface temperatures should be between 35 and 90˚ F at time of placement.

Typical Physical Properties

Strength	2 hour 3 hour 1 day 28 days	2,000 avg/psi. 3,000 avg/psi 5,500 avg/psi 7,500 avg/psi
Plasticity	30 minutes	
Shrinkage	28 days - .08%	

Limitations

- Do not exceed maximum amount of mixing water stated above.
- Minimum application thickness is 2" (51mm).
- Repaired surface area needs to be protected from freezing.
- Surface should be damp, but free from standing water, ice and frost.
- Do not use partial bags, as material may separate in handling and transportation.
- Physical properties results were under laboratory conditions.

Disclaimer
The information contained herein is for illustrative purposes only and, to the best of our knowledge, is accurate and reliable. Buzzi Unicem USA cannot, however, under any circumstances make any guarantee of results or assume any obligation or liability in connection with the use of this information. As Buzzi Unicem USA has no control over the use to which others may put its product, it is recommended that the product be tested to determine if suitable for a specific application and/or our information is valid in a particular circumstance. Responsibility remains with the architect or engineer, contractor and owner for the design, application and proper installation of the product. User shall determine the suitability of product for specific application and assume all responsibilities in connection therewith.

Appendix B: Detailed Photos of Repairs at Various Pass Intervals

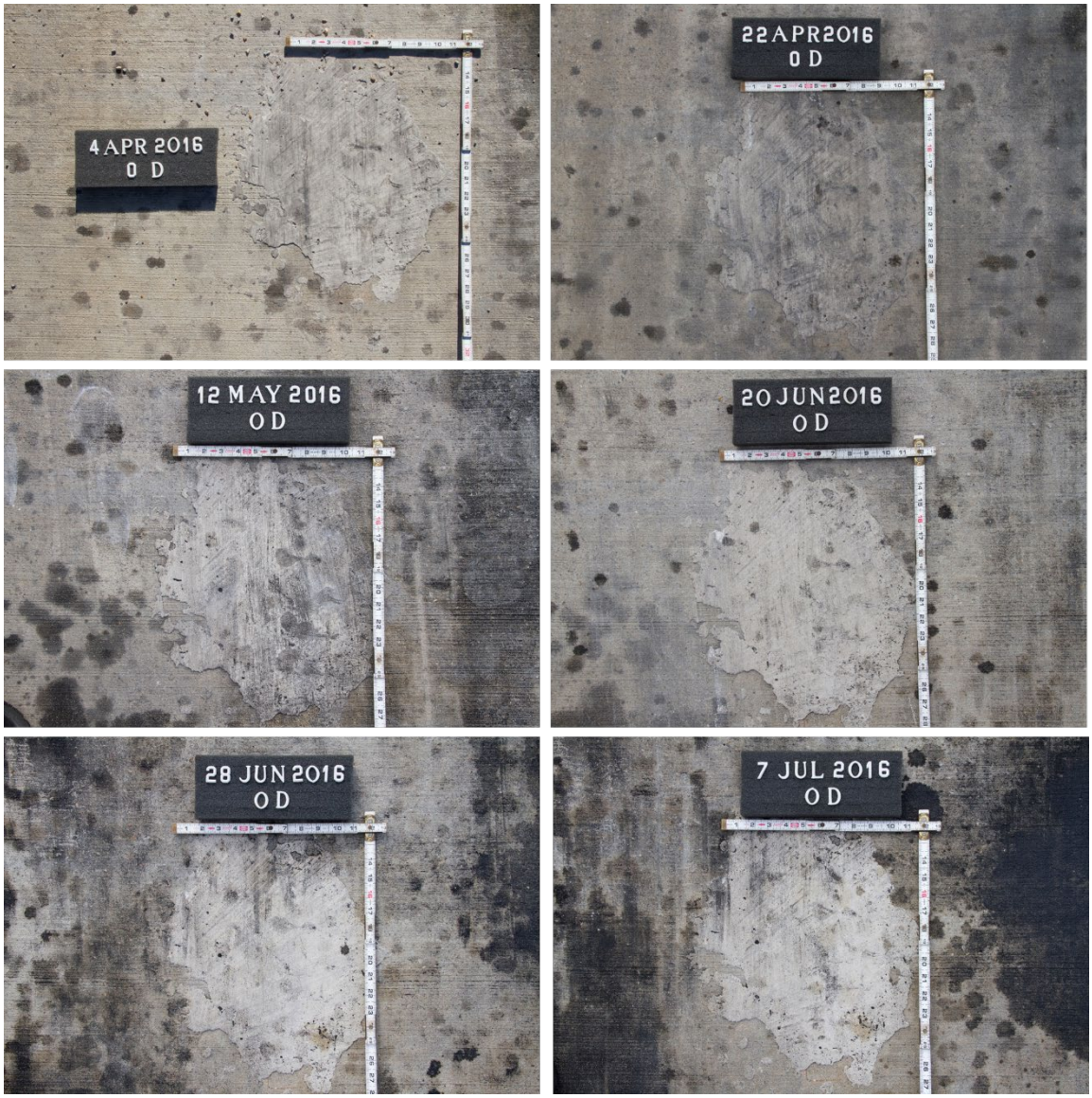
The following images are time-lapse photos of all the repairs made during this evaluation at various traffic pass intervals. Each image contains a total of six photos at 500 passes, 1,000 passes, 1,500 passes, 2,000 passes, 2,500 passes, and 3,000 passes from photo at the top left to bottom right.

Each product was designated to its own test slab for a total of 14 products/test slabs labeled test slab 0-13. Each test slab has a total of two joint spall repairs at a 2-inch depth (Repair A and Repair B), two pop out repairs (Repair C and Repair D), and one joint spall repair at a 4-inch depth (Repair E). For example, Repair 7B would be test slab 7 (SikaQuick 2500), Repair B (joint spall repair, 2-inch depth on the southeast portion of the test slab). A schematic of a test slab is shown in Figure 3.

CTS Rapid Set Mortar Mix – Test Slab 0

4 APR 2016
O B
22 APR 2016
O B
12 MAY 2016
O B
20 JUN 2016
O B
28 JUN 2016
O B
7 JUL 2016
O B

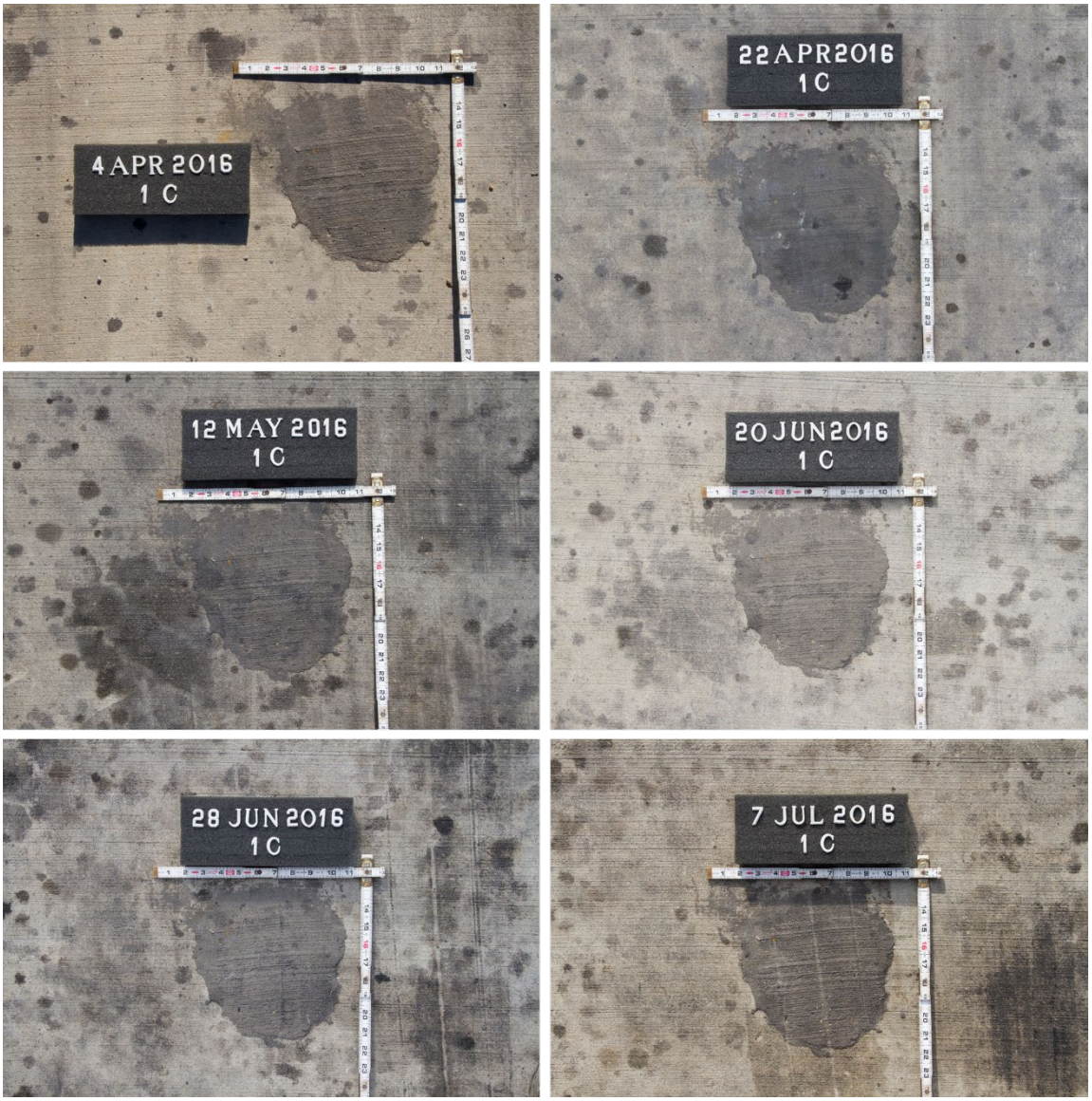
4 APR 2016
0 C
22 APR 2016
0 C
12 MAY 2016
0 C
20 JUN 2016
0 C
28 JUN 2016
0 C
7 JUL 2016
0 C

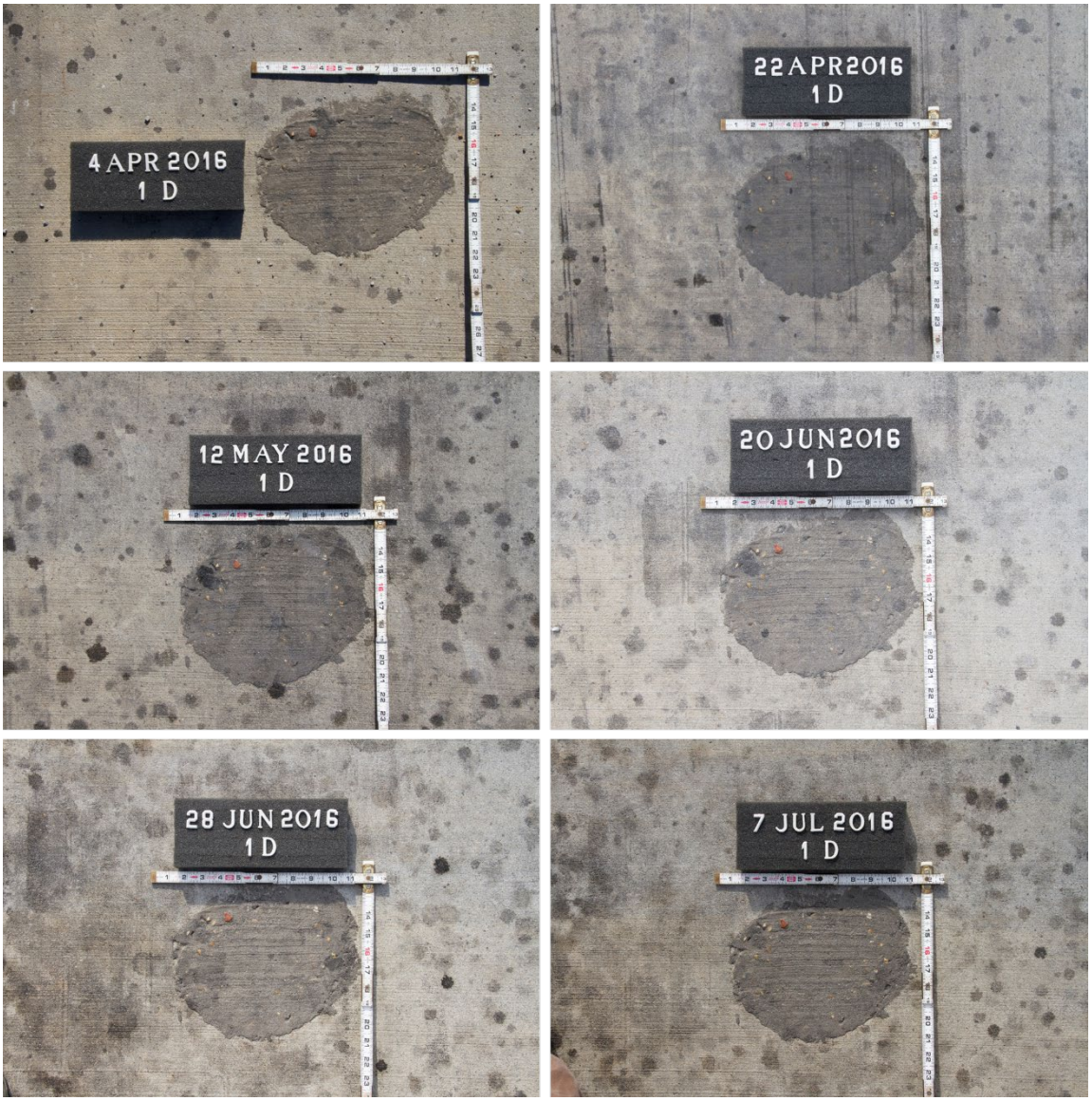

4 APR 2016
O D
22 APR 2016
O D
12 MAY 2016
O D
20 JUN 2016
O D
28 JUN 2016
O D
7 JUL 2016
O D

4 APR 2016
0 E
22 APR 2016
0 E
12 MAY 2016
0 E
20 JUN 2016
0 E
28 JUN 2016
0 E
7 JUL 2016
0 E

MasterEmaco T 10-60 Repair Mortar – Test Slab 1

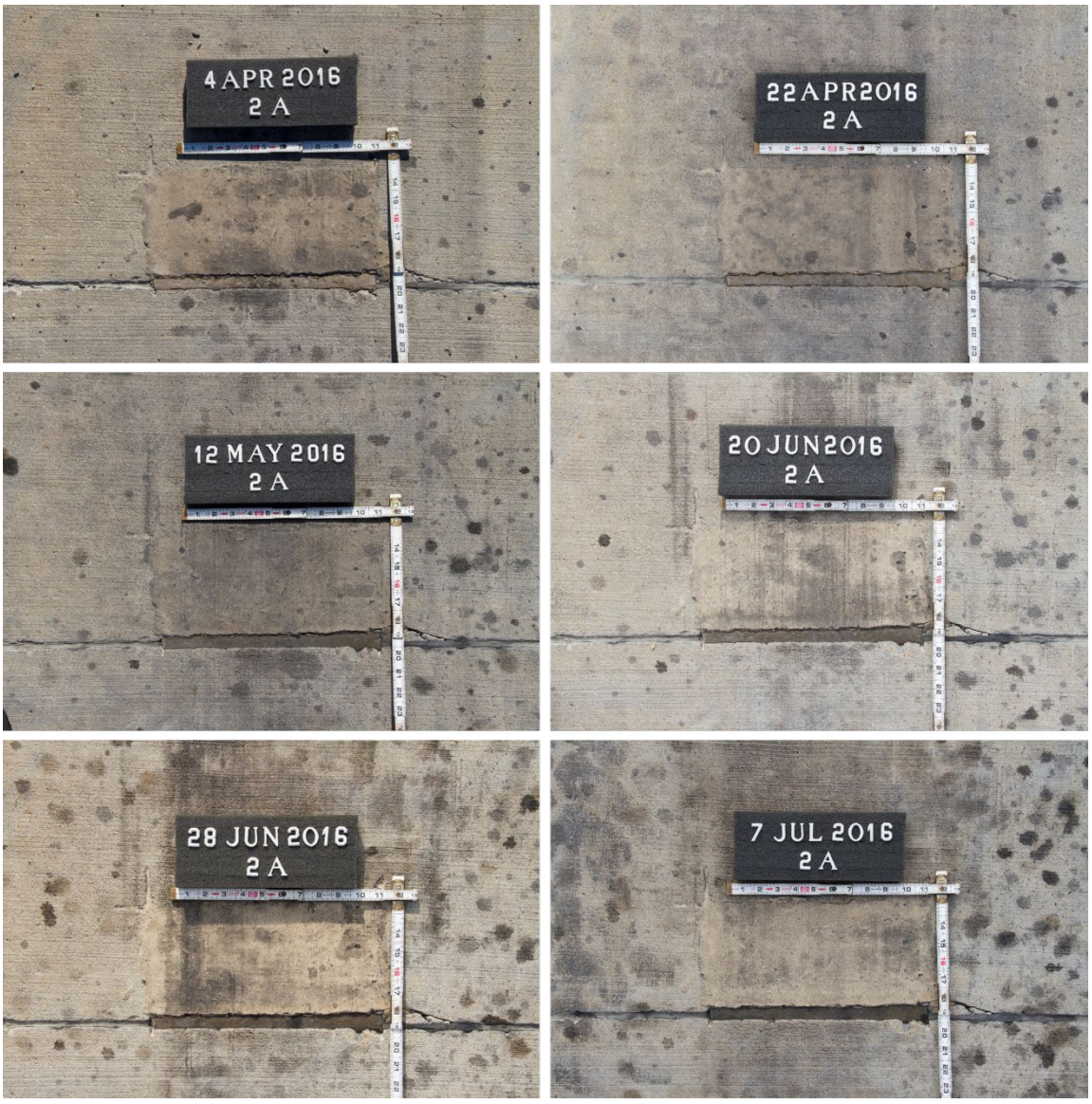
4 APR 2016
1 B
22 APR 2016
1 B
12 MAY 2016
1 B
20 JUN 2016
1 B
28 JUN 2016
1 B
7 JUL 2016
1 B

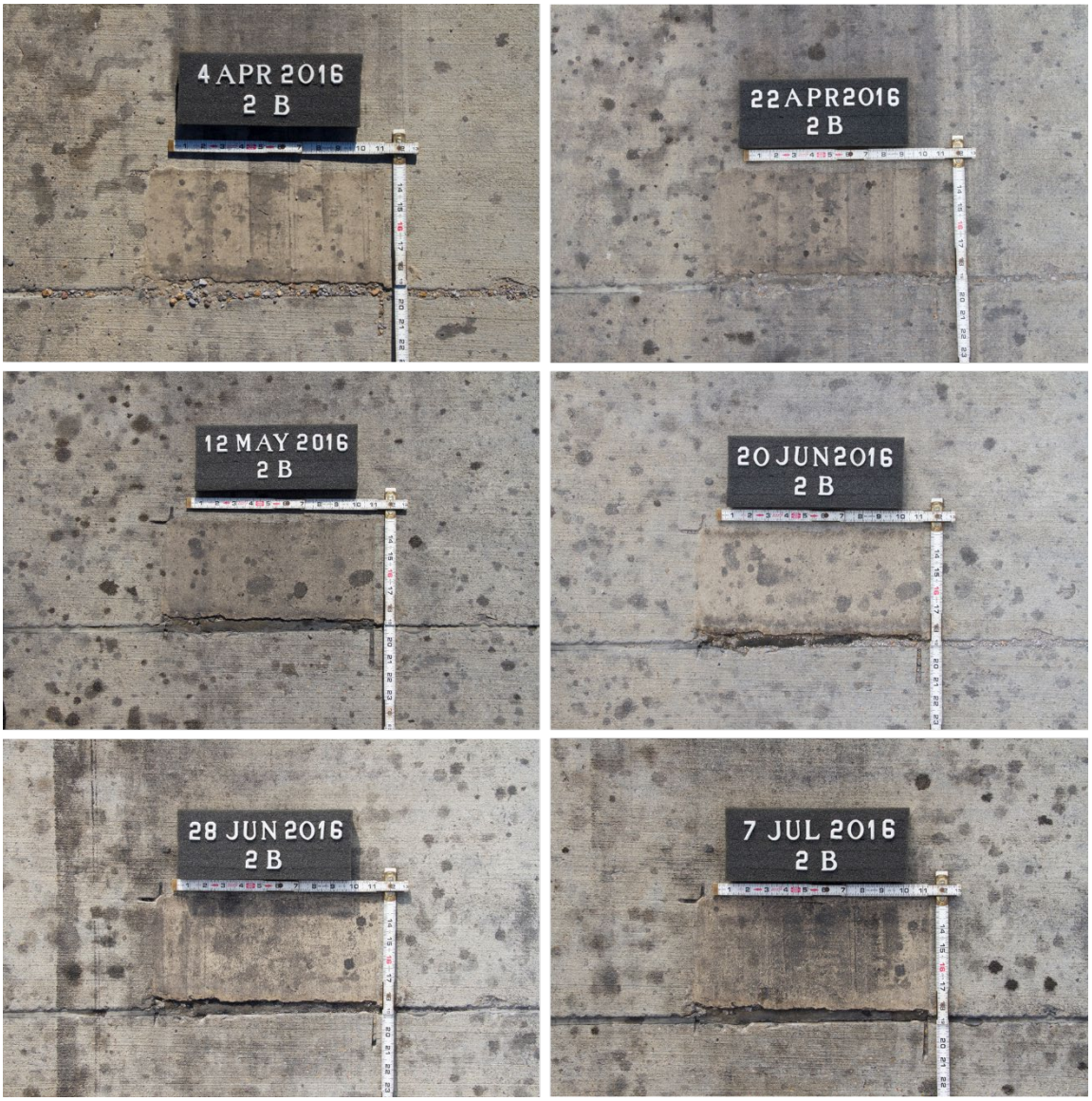

4 APR 2016
1 C
22 APR 2016
1 C
12 MAY 2016
1 C
20 JUN 2016
1 C
28 JUN 2016
1 C
7 JUL 2016
1 C


4 APR 2016
1 D
22 APR 2016
1 D
12 MAY 2016
1 D
20 JUN 2016
1 D
28 JUN 2016
1 D
7 JUL 2016
1 D

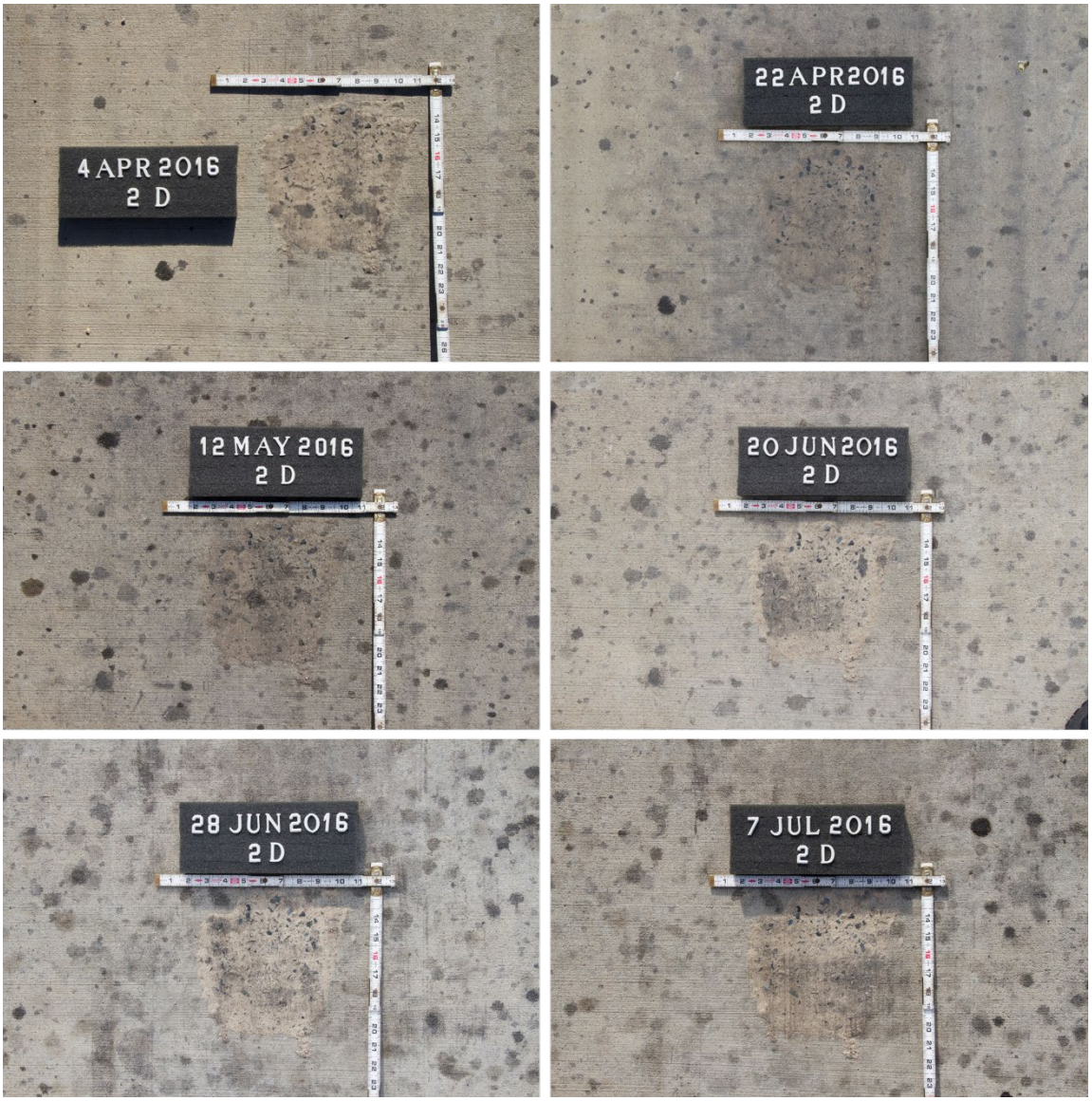
4 APR 2016
1 E
22 APR2016
1 E
12 MAY 2016
1 E
20 JUN2016
1 E
28 JUN 2016
1 E
7 JUL 2016
1 E

DOT Line – Test Slab 2



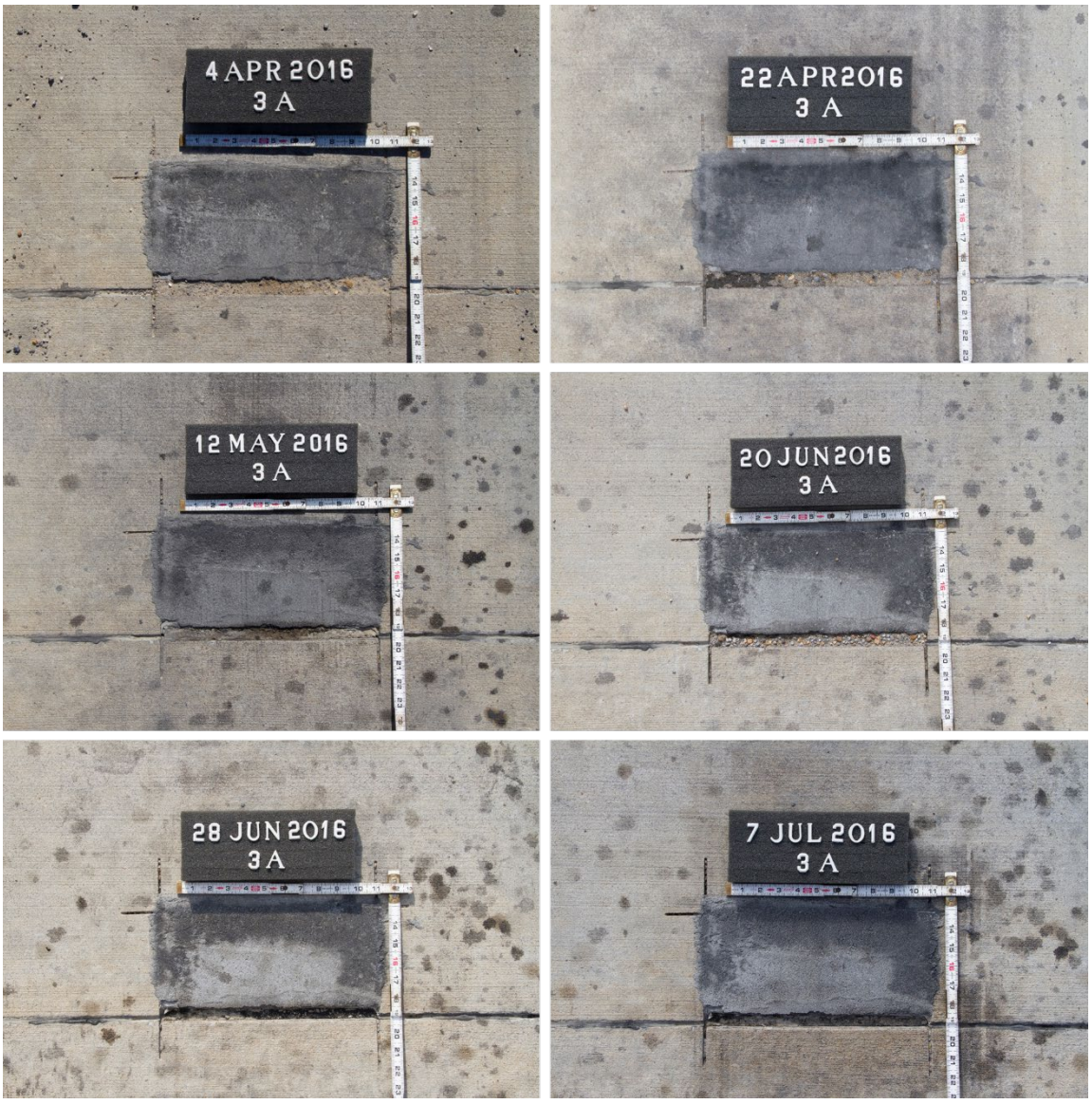

4 APR 2016
2 B
22 APR 2016
2 B
12 MAY 2016
2 B
20 JUN 2016
2 B
28 JUN 2016
2 B
7 JUL 2016
2 B

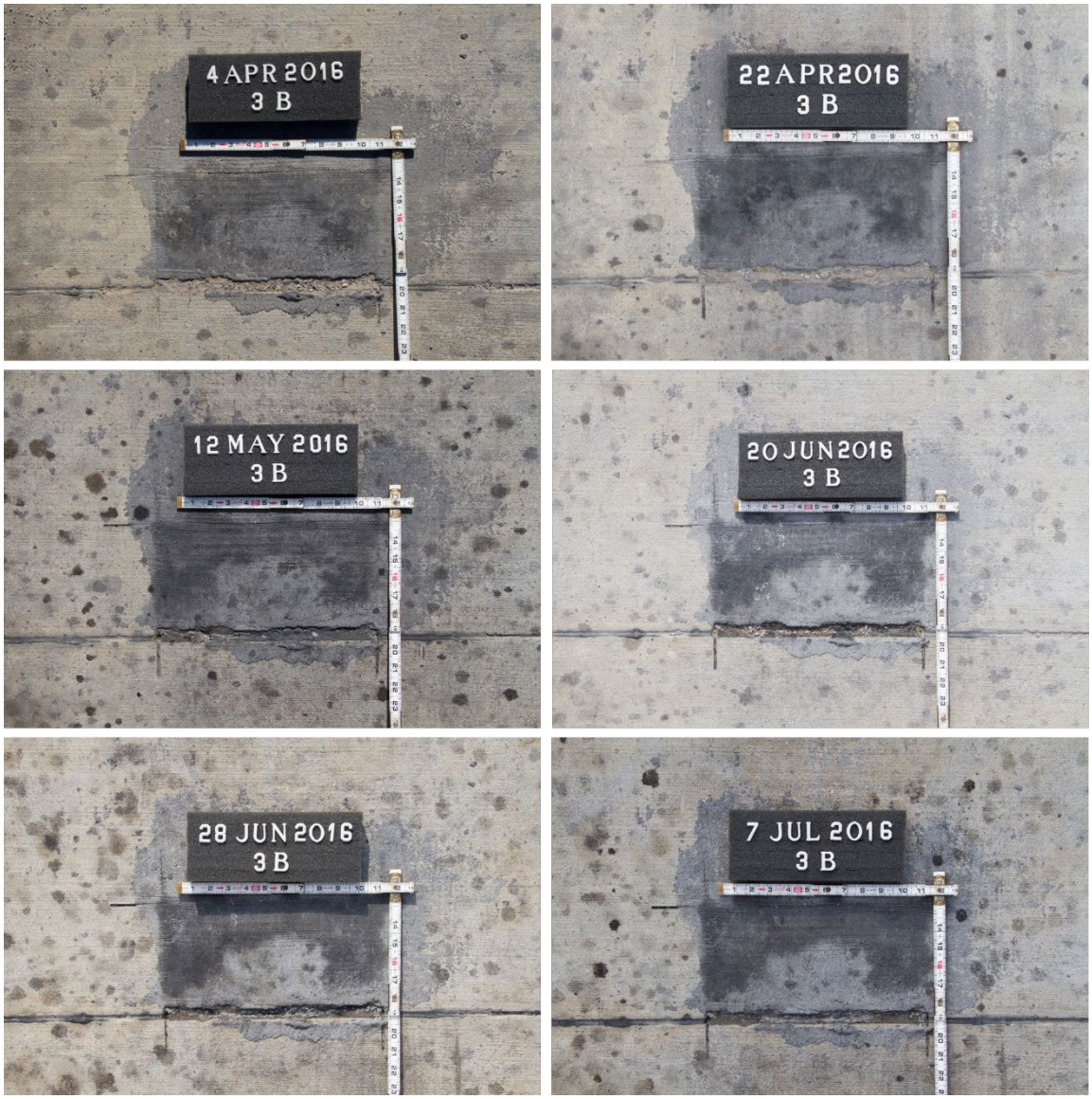
4 APR 2016
2 C
22 APR 2016
2 C
12 MAY 2016
2 C
20 JUN 2016
2 C
28 JUN 2016
2 C
7 JUL 2016
2 C

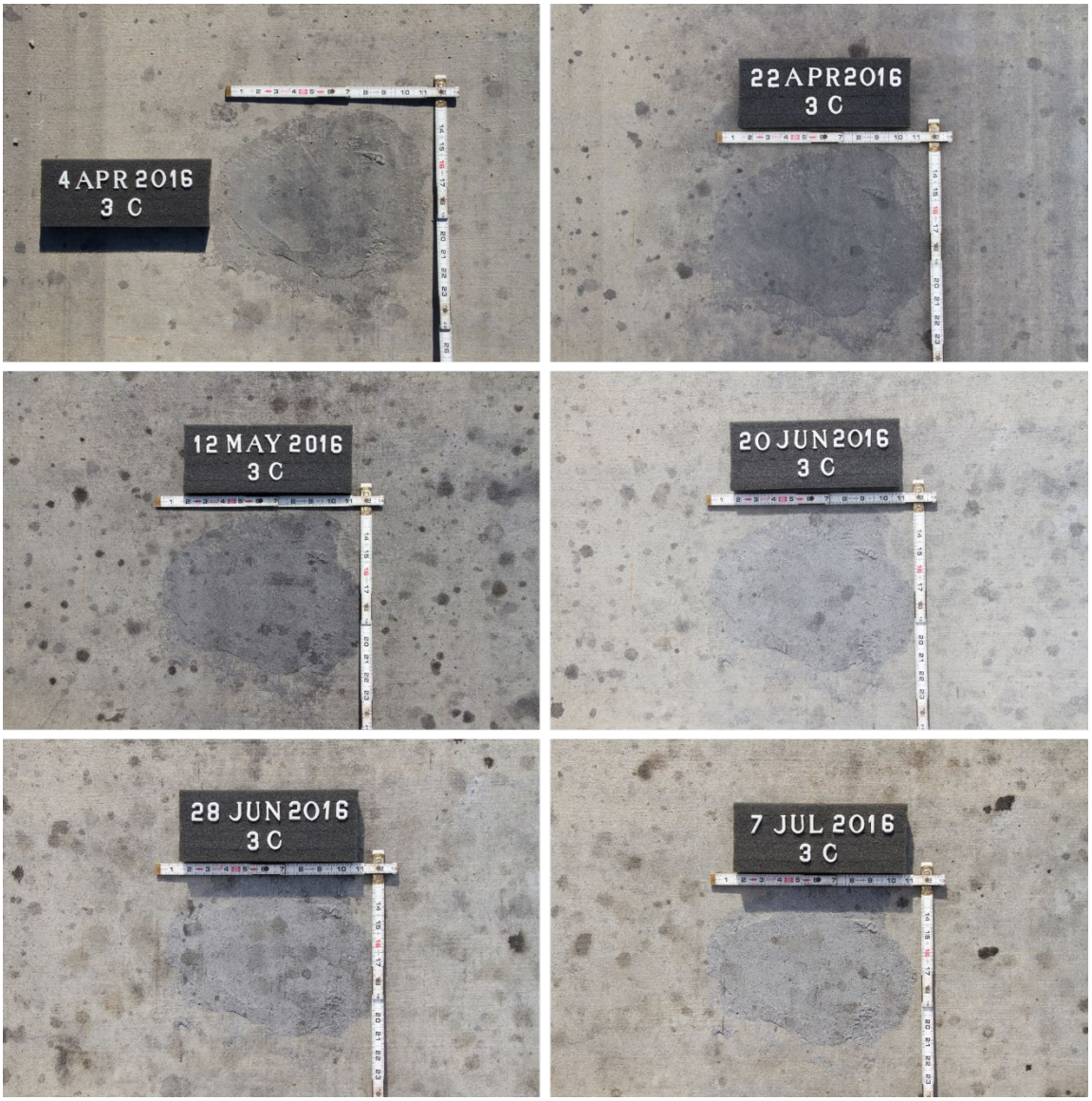

4 APR 2016
2 D
22 APR 2016
2 D
12 MAY 2016
2 D
20 JUN 2016
2 D
28 JUN 2016
2 D
7 JUL 2016
2 D

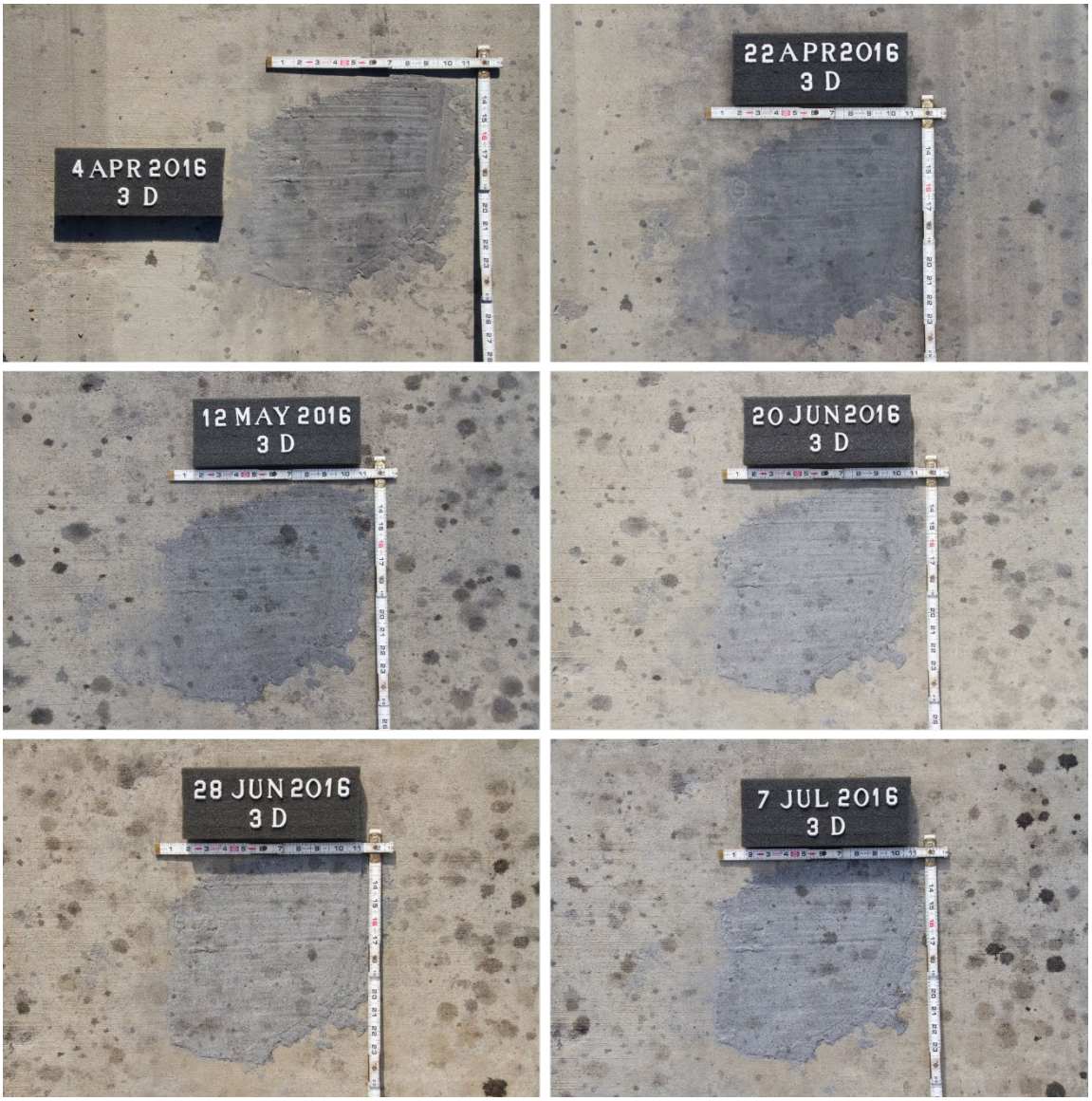
4 APR 2016
2 E
22 APR 2016
2 E
12 MAY 2016
2 E
20 JUN 2016
2 E
28 JUN 2016
2 E
7 JUL 2016
2 E

Pavemend 15 – Test Slab 3



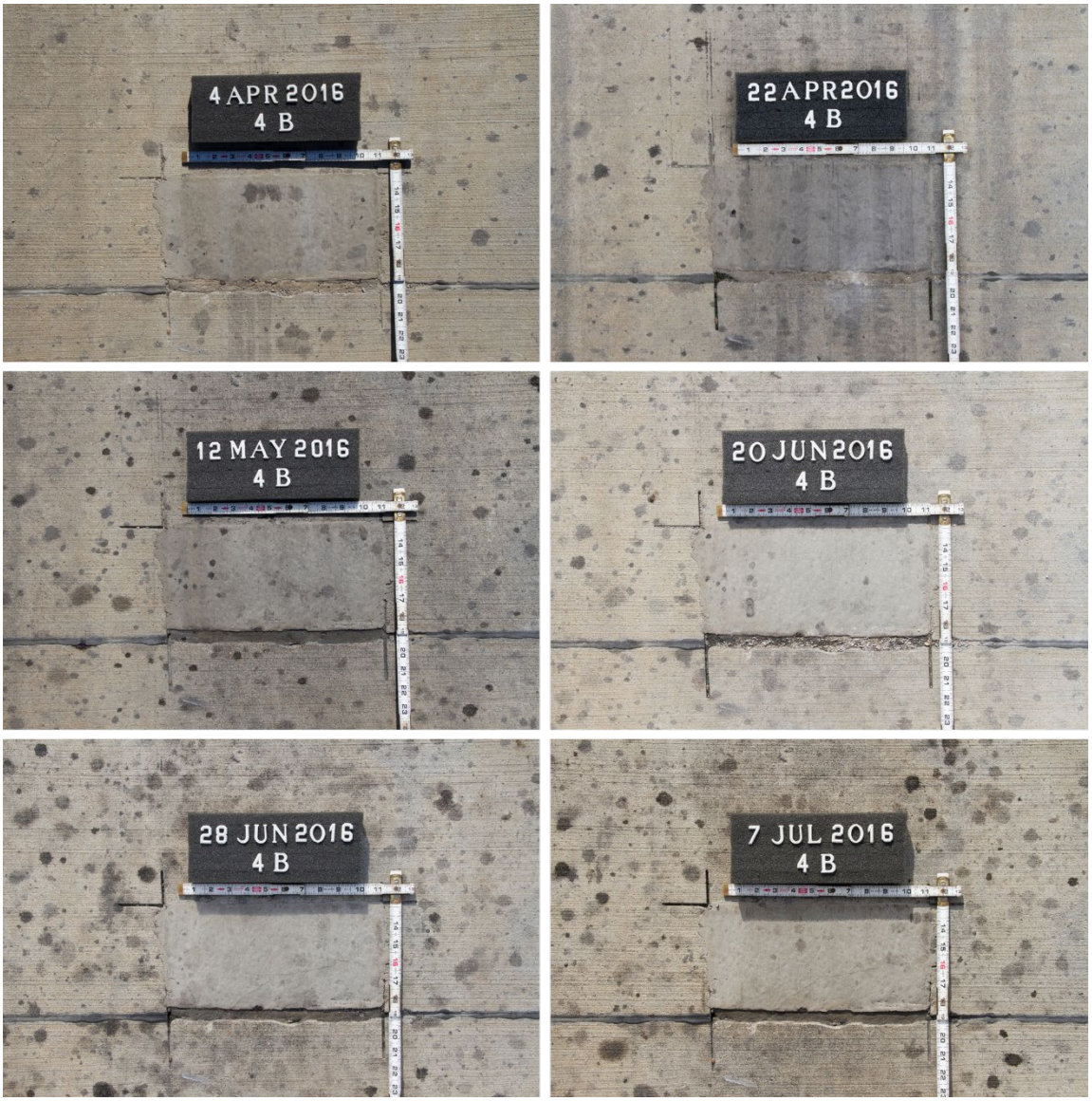

4 APR 2016
3 B
22 APR 2016
3 B
12 MAY 2016
3 B
20 JUN 2016
3 B
28 JUN 2016
3 B
7 JUL 2016
3 B

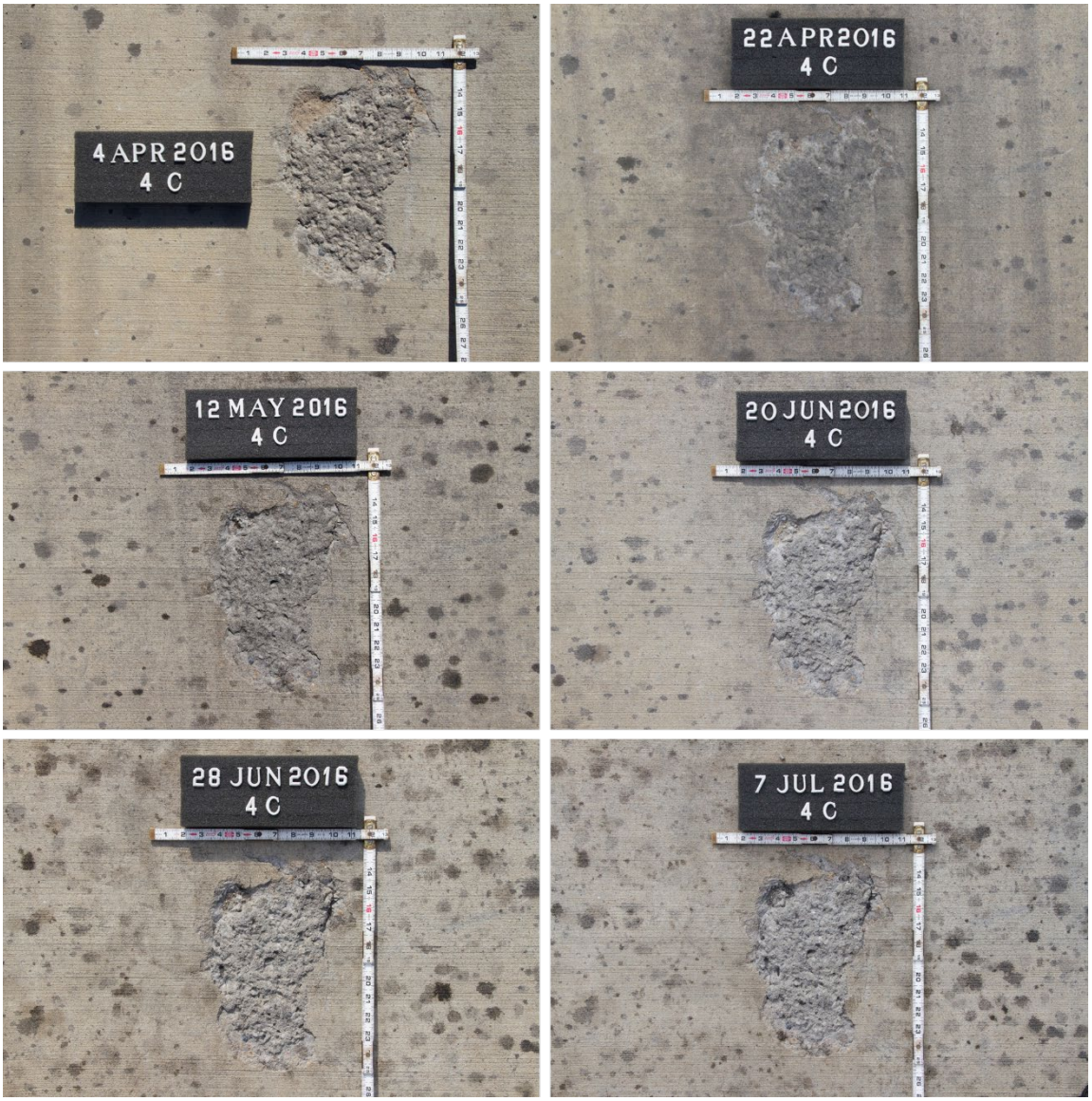

4 APR 2016
3 C
22 APR 2016
3 C
12 MAY 2016
3 C
20 JUN 2016
3 C
28 JUN 2016
3 C
7 JUL 2016
3 C


4 APR 2016
3 D
22 APR 2016
3 D
12 MAY 2016
3 D
20 JUN 2016
3 D
28 JUN 2016
3 D
7 JUL 2016
3 D

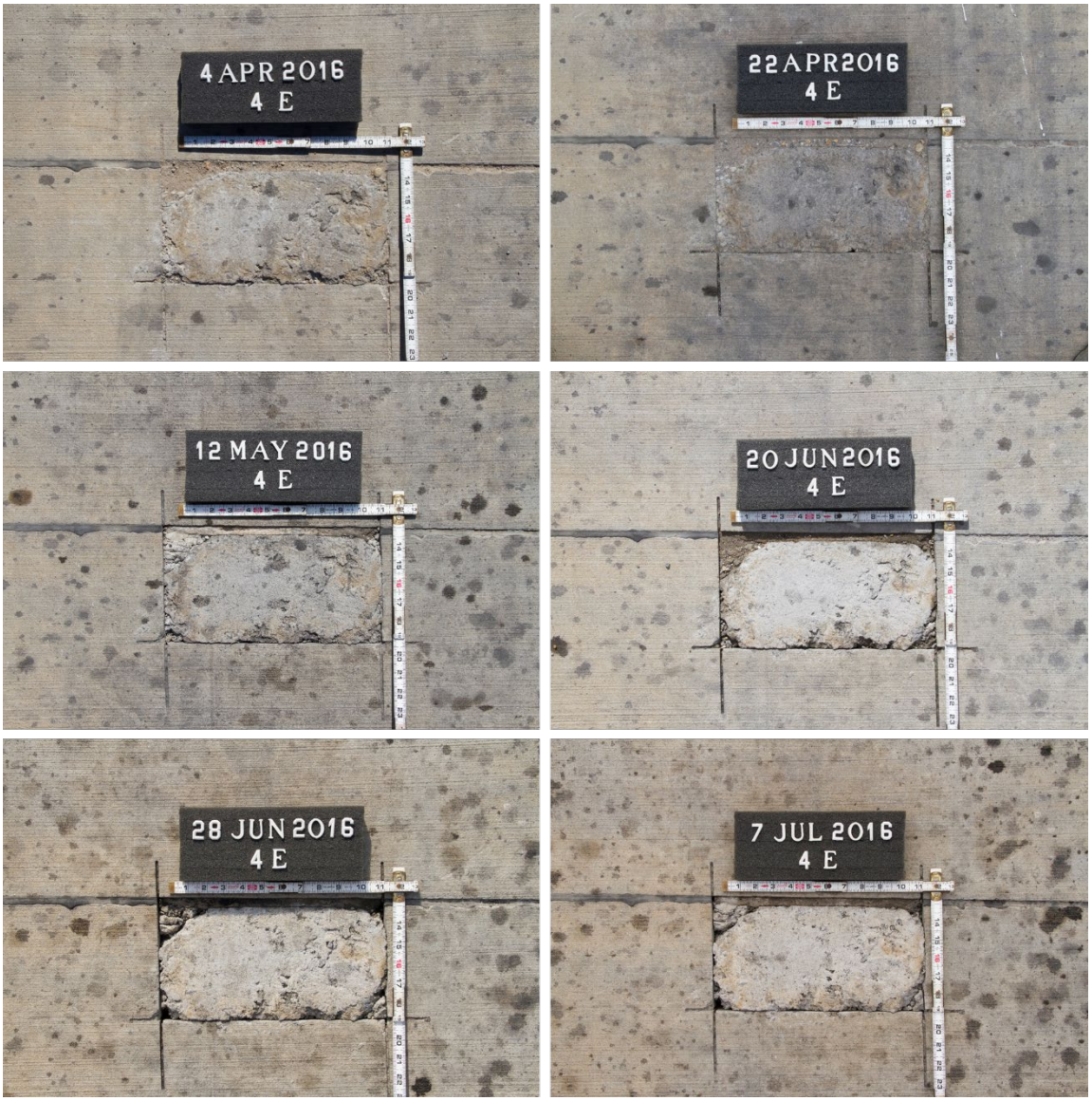
4 APR 2016
3 E
22 APR 2016
3 E
12 MAY 2016
3 E
20 JUN 2016
3 E
28 JUN 2016
3 E
7 JUL 2016
3 E

Ulti Pave 3 – Test Slab 4

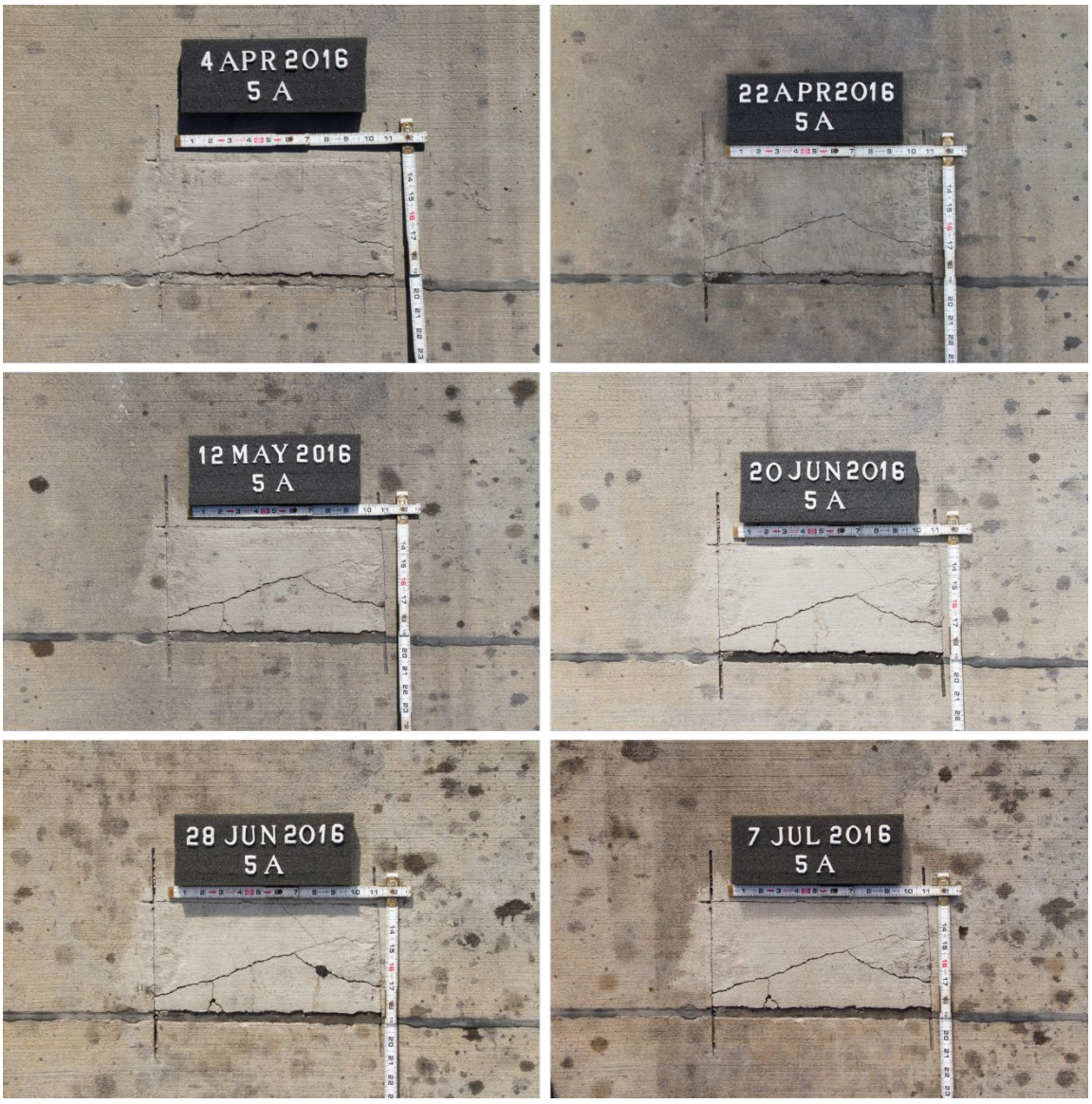

4 APR 2016
4 B
22 APR 2016
4 B
12 MAY 2016
4 B
20 JUN 2016
4 B
28 JUN 2016
4 B
7 JUL 2016
4 B


4 APR 2016
4 C
22 APR 2016
4 C
12 MAY 2016
4 C
20 JUN 2016
4 C
28 JUN 2016
4 C
7 JUL 2016
4 C

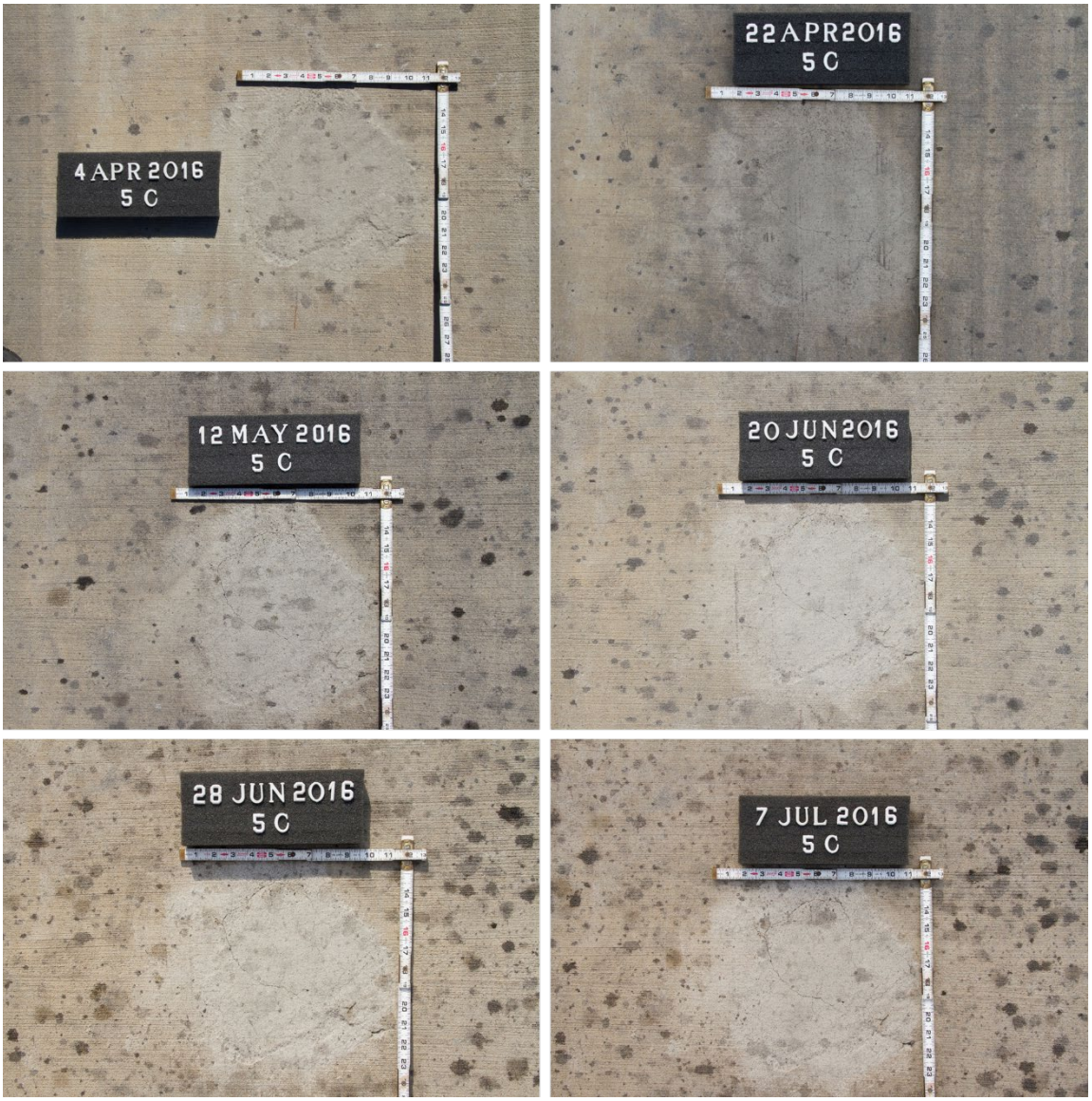
4 APR 2016
4 D
22 APR 2016
4 D
12 MAY 2016
4 D
20 JUN 2016
4 D
28 JUN 2016
4 D
7 JUL 2016
4 D


4 APR 2016
4 E
22 APR 2016
4 E
12 MAY 2016
4 E
20 JUN 2016
4 E
28 JUN 2016
4 E
7 JUL 2016
4 E

Fast Set DOT Mix – Test Slab 5



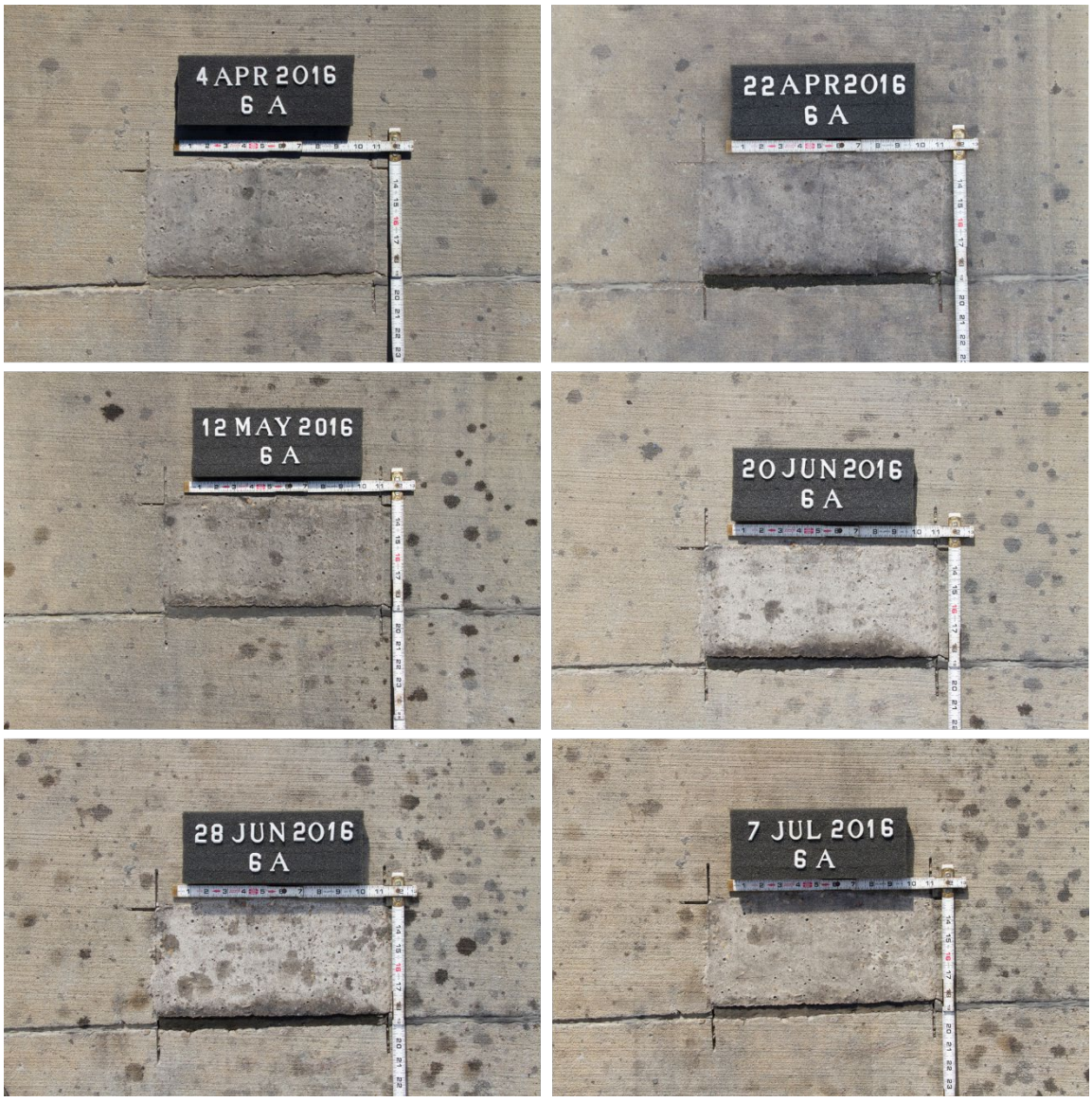
4 APR 2016
5 B
22 APR 2016
5 B
12 MAY 2016
5 B
20 JUN 2016
5 B
28 JUN 2016
5 B
7 JUL 2016
5 B


4 APR 2016
5 C
22 APR 2016
5 C
12 MAY 2016
5 C
20 JUN 2016
5 C
28 JUN 2016
5 C
7 JUL 2016
5 C

4 APR 2016
5 D
22 APR 2016
5 D
12 MAY 2016
5 D
20 JUN 2016
5 D
28 JUN 2016
5 D
7 JUL 2016
5 D

4 APR 2016
5 E
22 APR 2016
5 E
12 MAY 2016
5 E
20 JUN 2016
5 E
28 JUN 2016
5 E
7 JUL 2016
5 E

MasterEmaco T 545HT (Set 45) – Test Slab 6



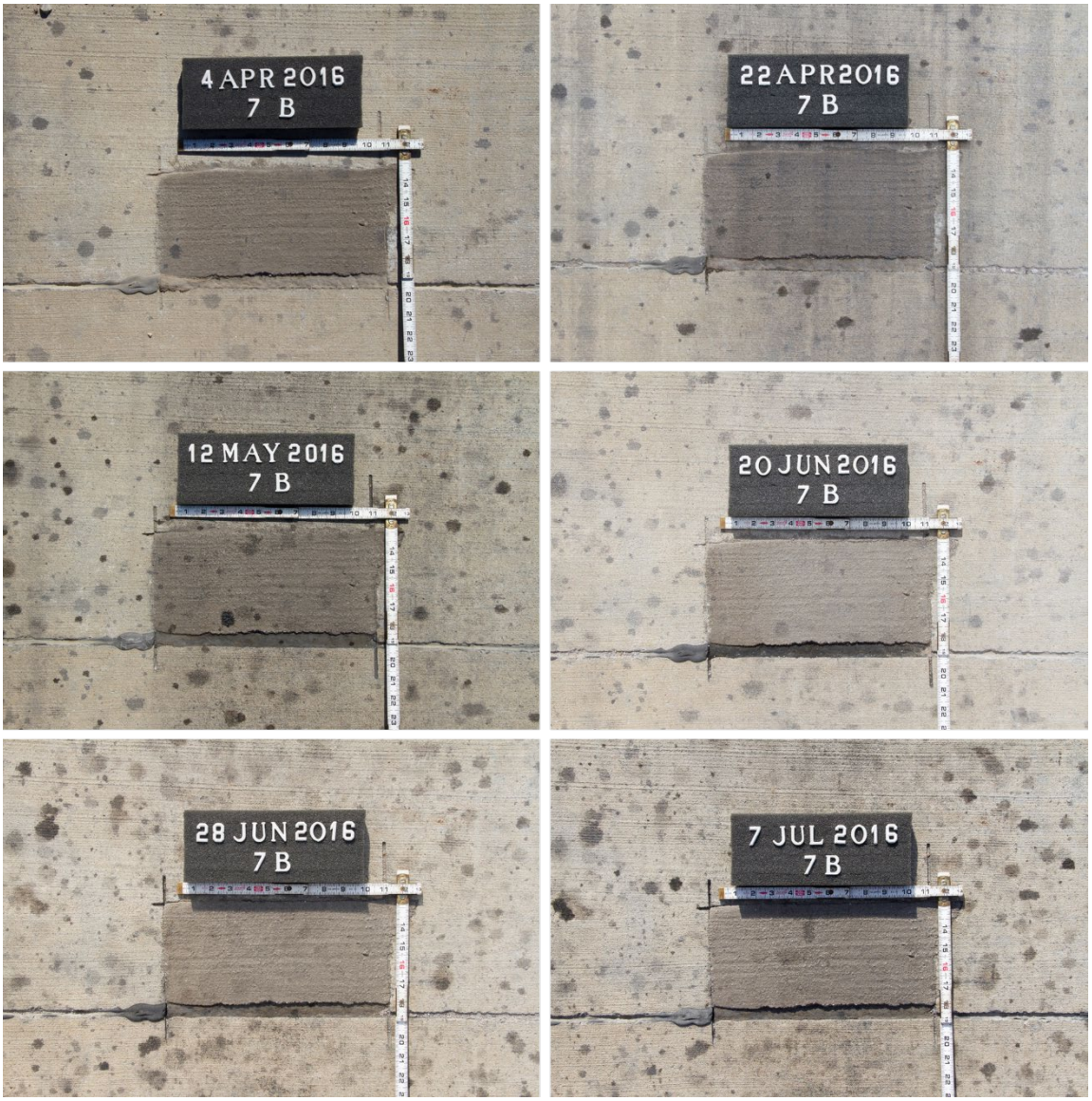
4 APR 2016
6 B
22 APR2016
6 B
12 MAY 2016
6 B
20 JUN 2016
6 B
28 JUN 2016
6 B
7 JUL 2016
6 B

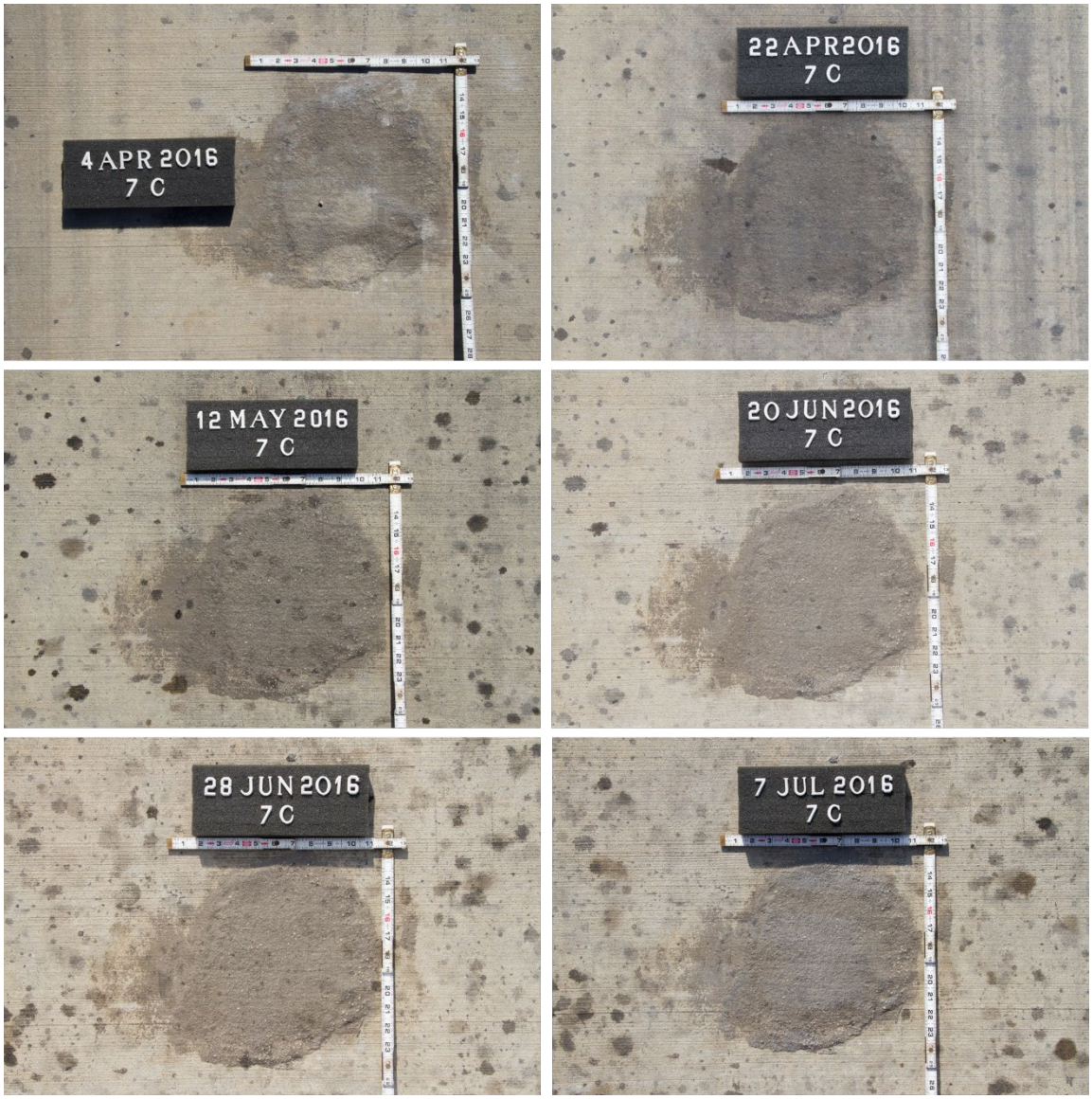
4 APR 2016
6 C
22 APR 2016
6 C
12 MAY 2016
6 C
28 JUN 2016
6 C
28 JUN 2016
6 C
7 JUL 2016
6 C

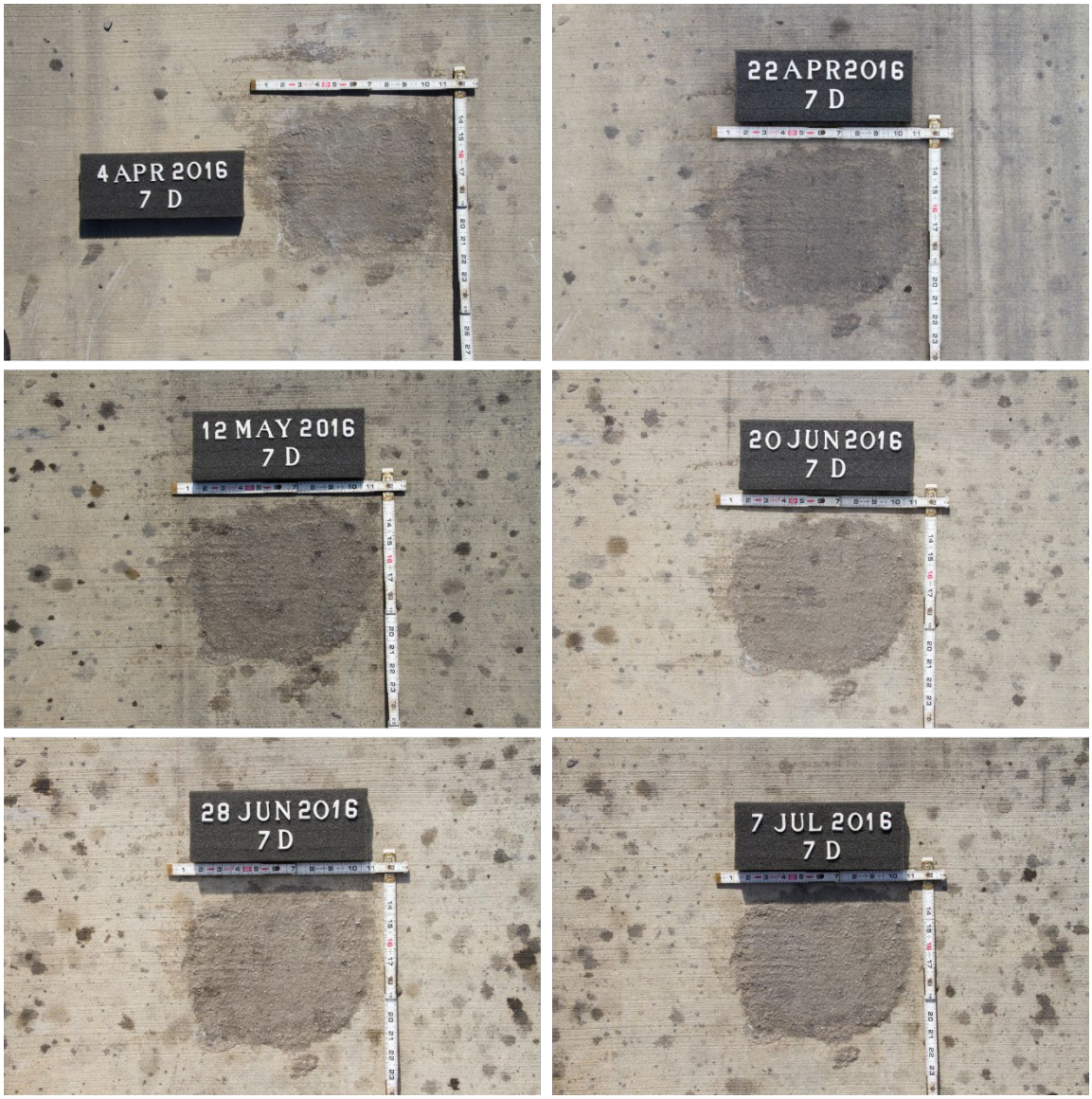
4 APR 2016
6 D
22 APR 2016
6 D
12 MAY 2016
6 D
20 JUN 2016
6 D
28 JUN 2016
6 D
7 JUL 2016
6 D

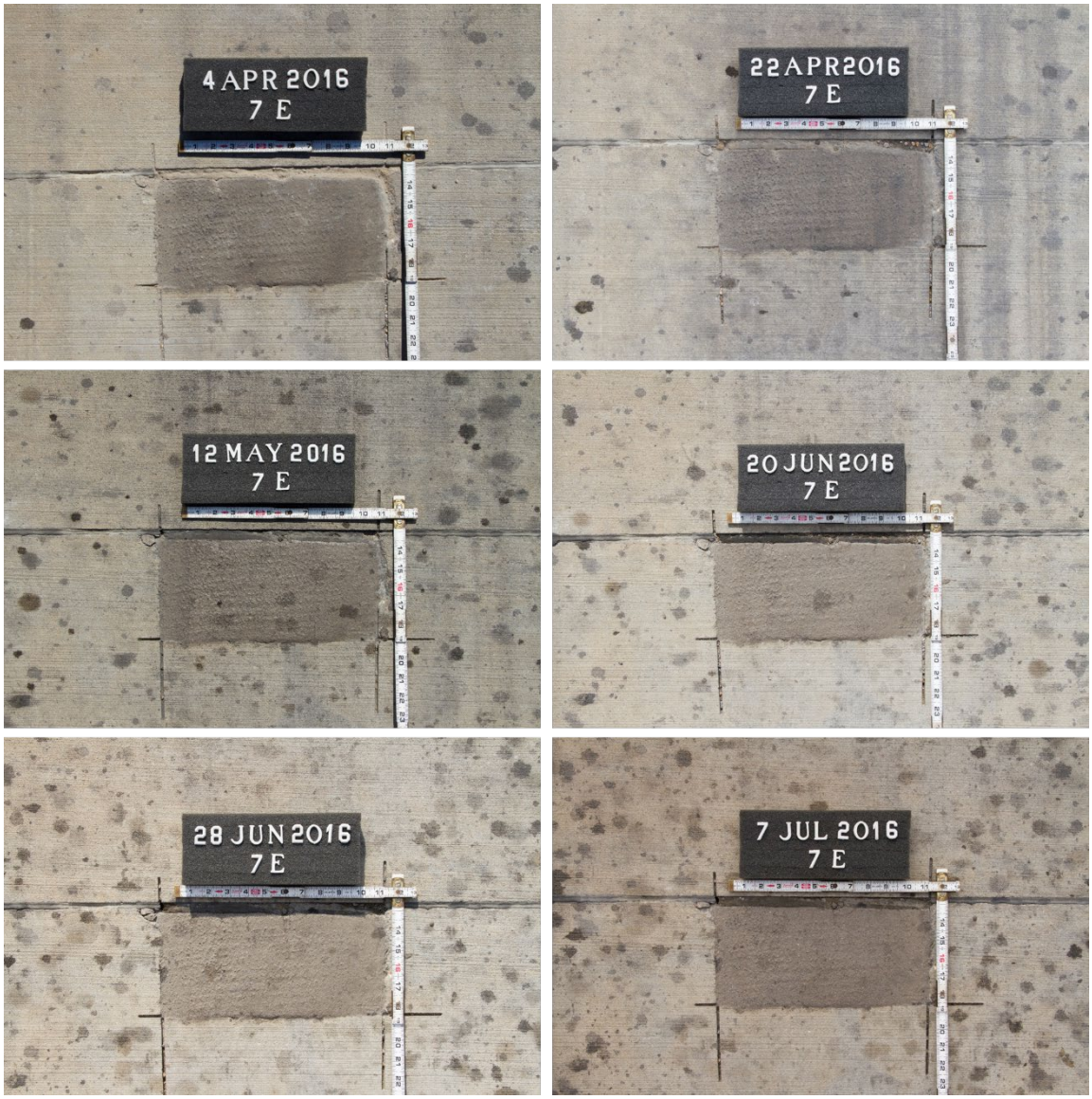
4 APR 2016
6 E
22 APR 2016
6 E
12 MAY 2016
6 E
20 JUN 2016
6 E
28 JUN 2016
6 E
7 JUL 2016
6 E

SikaQuick 2500 – Test Slab 7

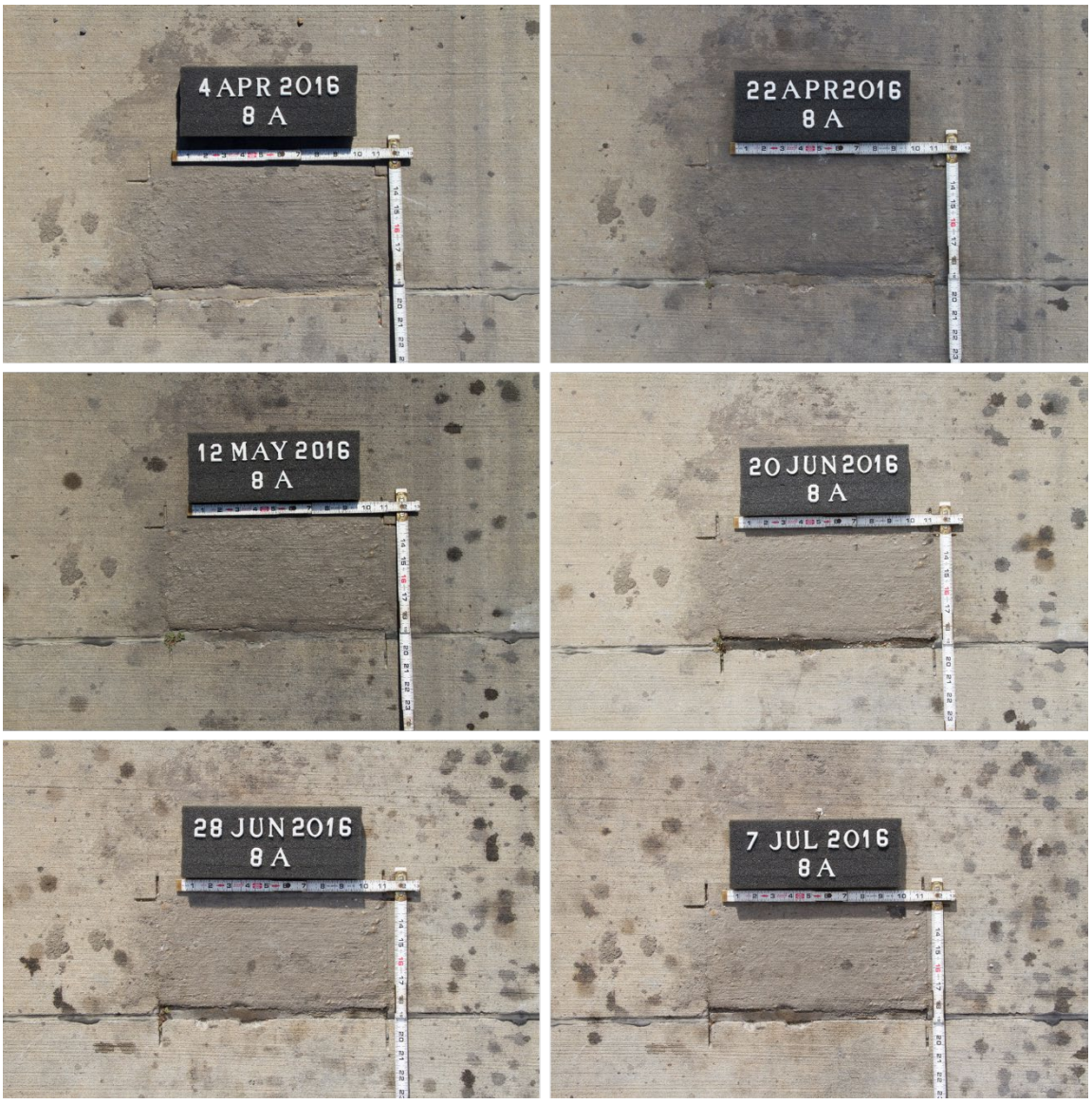

4 APR 2016
7 B
22 APR 2016
7 B
12 MAY 2016
7 B
20 JUN 2016
7 B
28 JUN 2016
7 B
7 JUL 2016
7 B

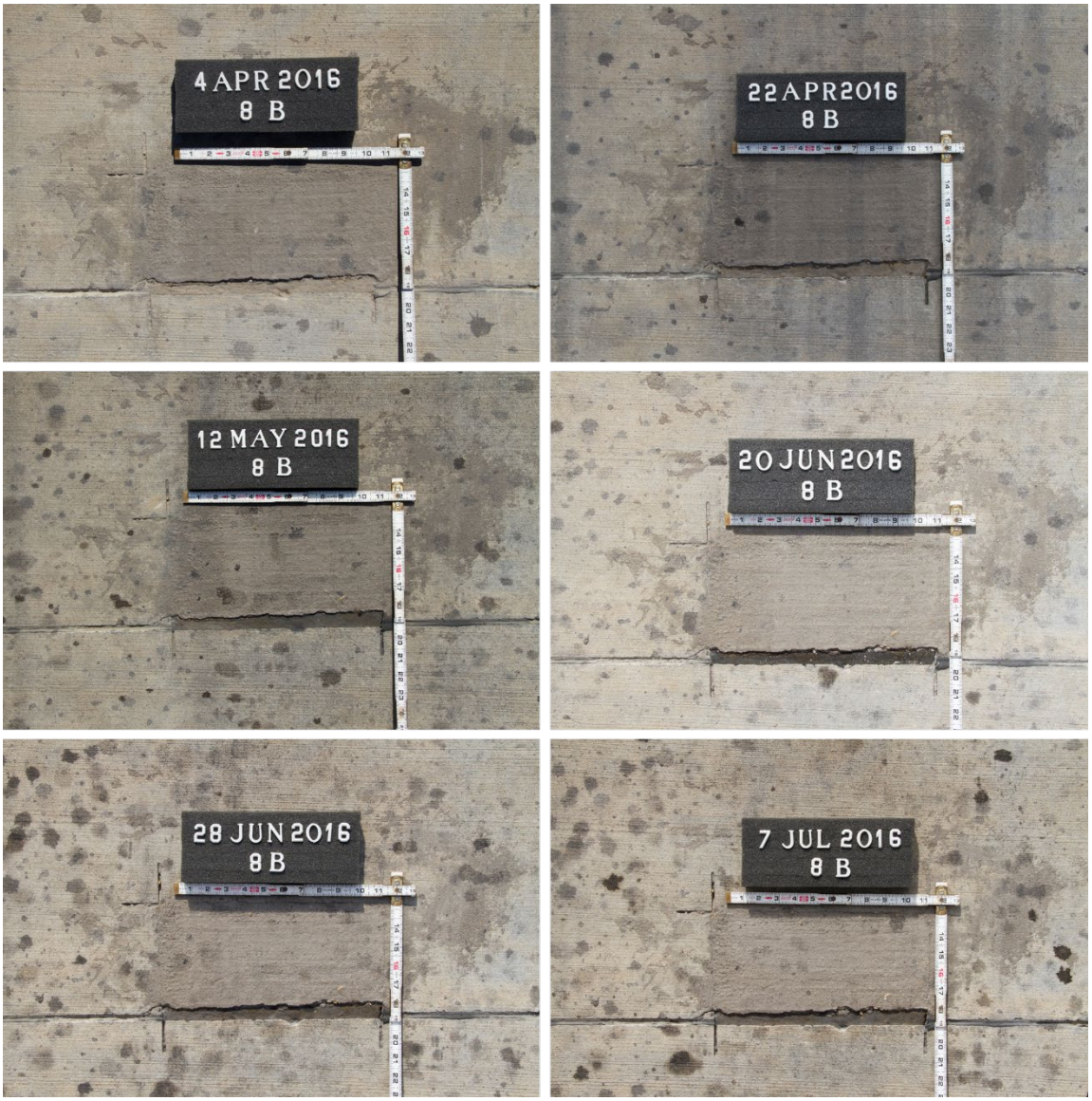

4 APR 2016
7 C
22 APR 2016
7 C
12 MAY 2016
7 C
20 JUN 2016
7 C
28 JUN 2016
7 C
7 JUL 2016
7 C

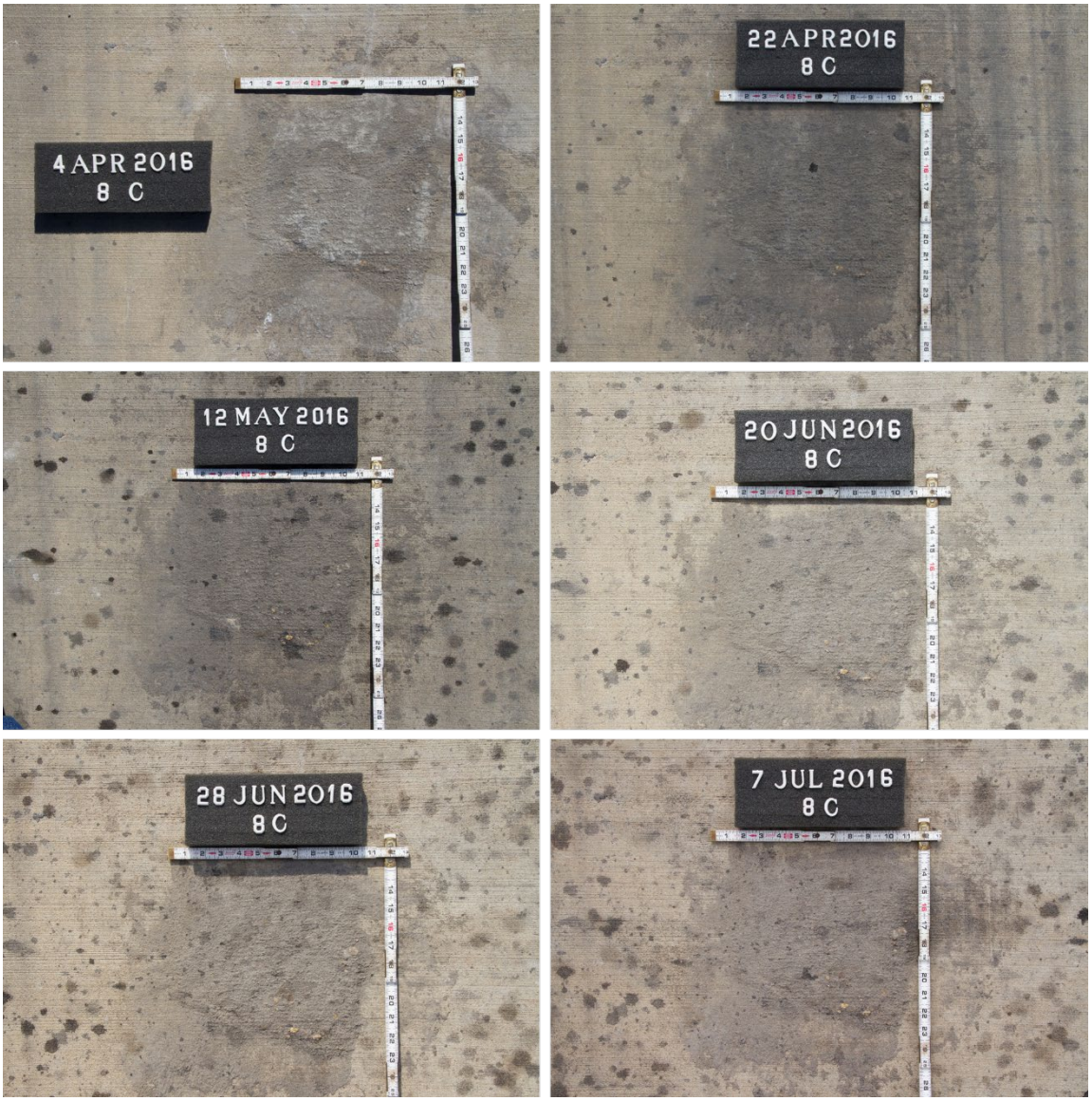

4 APR 2016
7 D
22 APR 2016
7 D
12 MAY 2016
7 D
20 JUN 2016
7 D
28 JUN 2016
7 D
7 JUL 2016
7 D

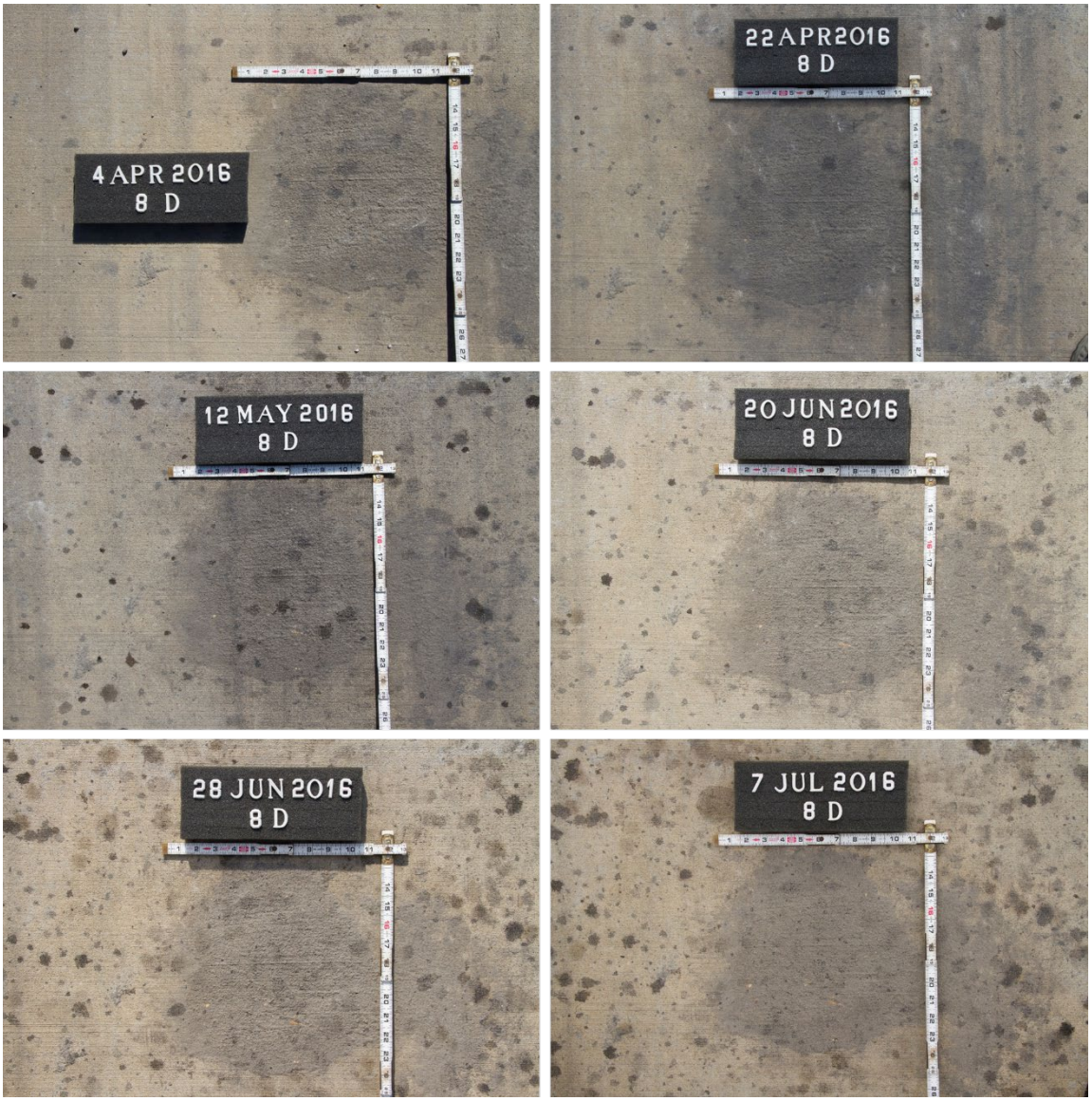

4 APR 2016
7 E
22 APR 2016
7 E
12 MAY 2016
7 E
20 JUN 2016
7 E
28 JUN 2016
7 E
7 JUL 2016
7 E

HD-50 Rapid Set – Test Slab 8



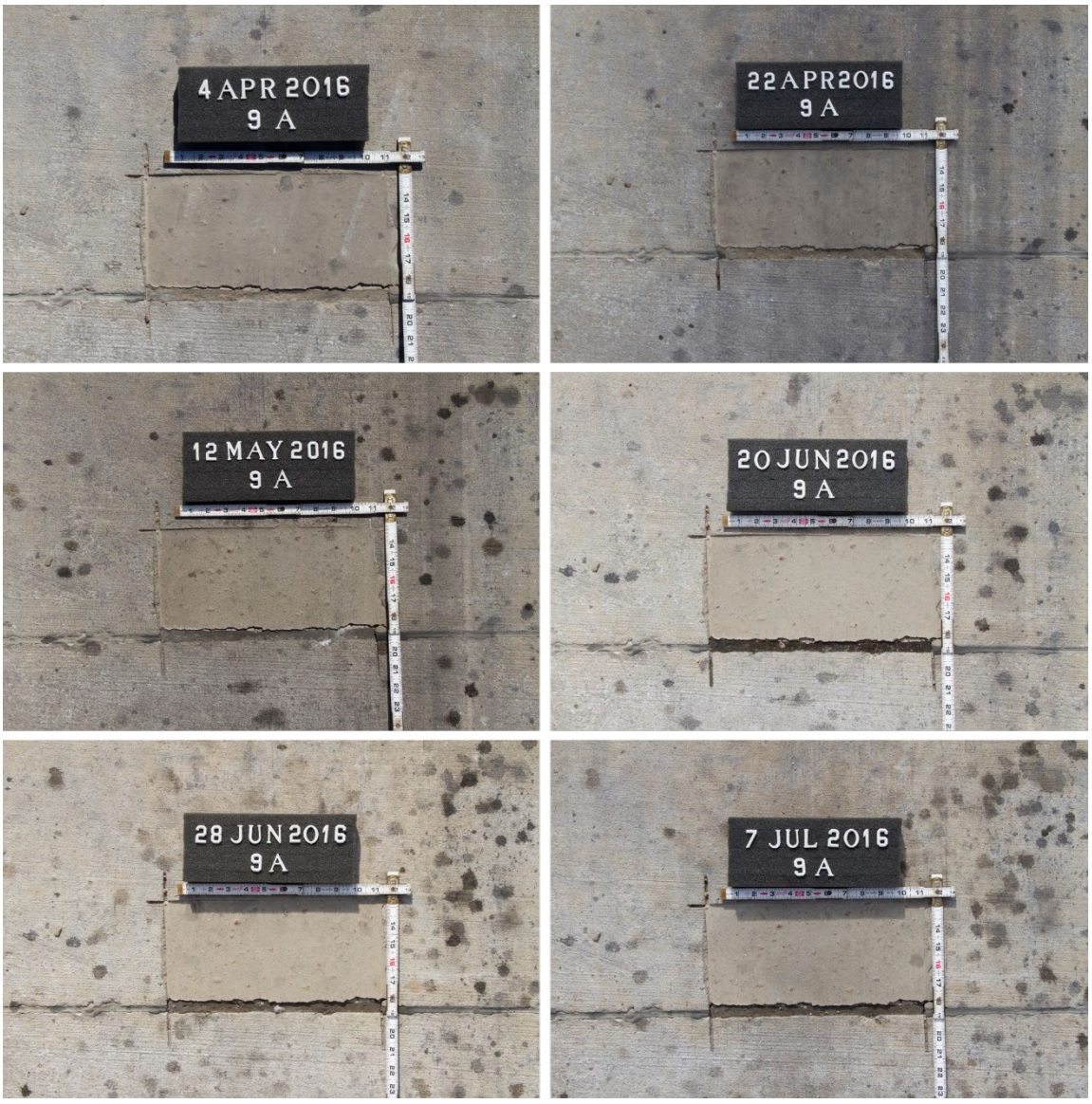

4 APR 2016
8 B
22 APR2016
8 B
12 MAY 2016
8 B
20 JUN2016
8 B
28 JUN 2016
8 B
7 JUL 2016
8 B


4 APR 2016
8 C
22 APR 2016
8 C
12 MAY 2016
8 C
20 JUN 2016
8 C
28 JUN 2016
8 C
7 JUL 2016
8 C


4 APR 2016
8 D
22 APR 2016
8 D
12 MAY 2016
8 D
20 JUN 2016
8 D
28 JUN 2016
8 D
7 JUL 2016
8 D

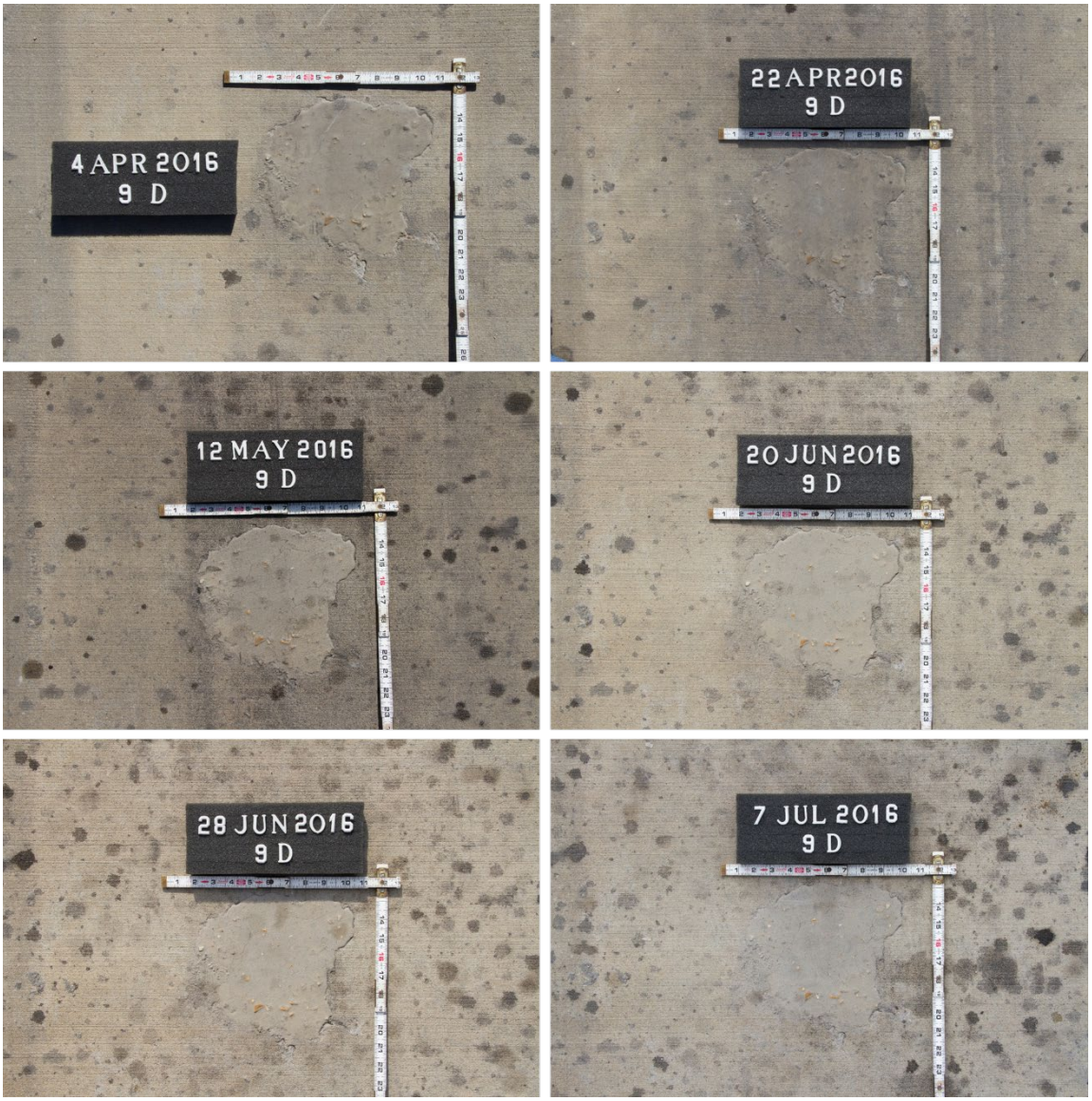
4 APR 2016
8 E
22 APR 2016
8 E
12 MAY 2016
8 E
20 JUN 2016
8 E
28 JUN 2016
8 E
7 JUL 2016
8 E

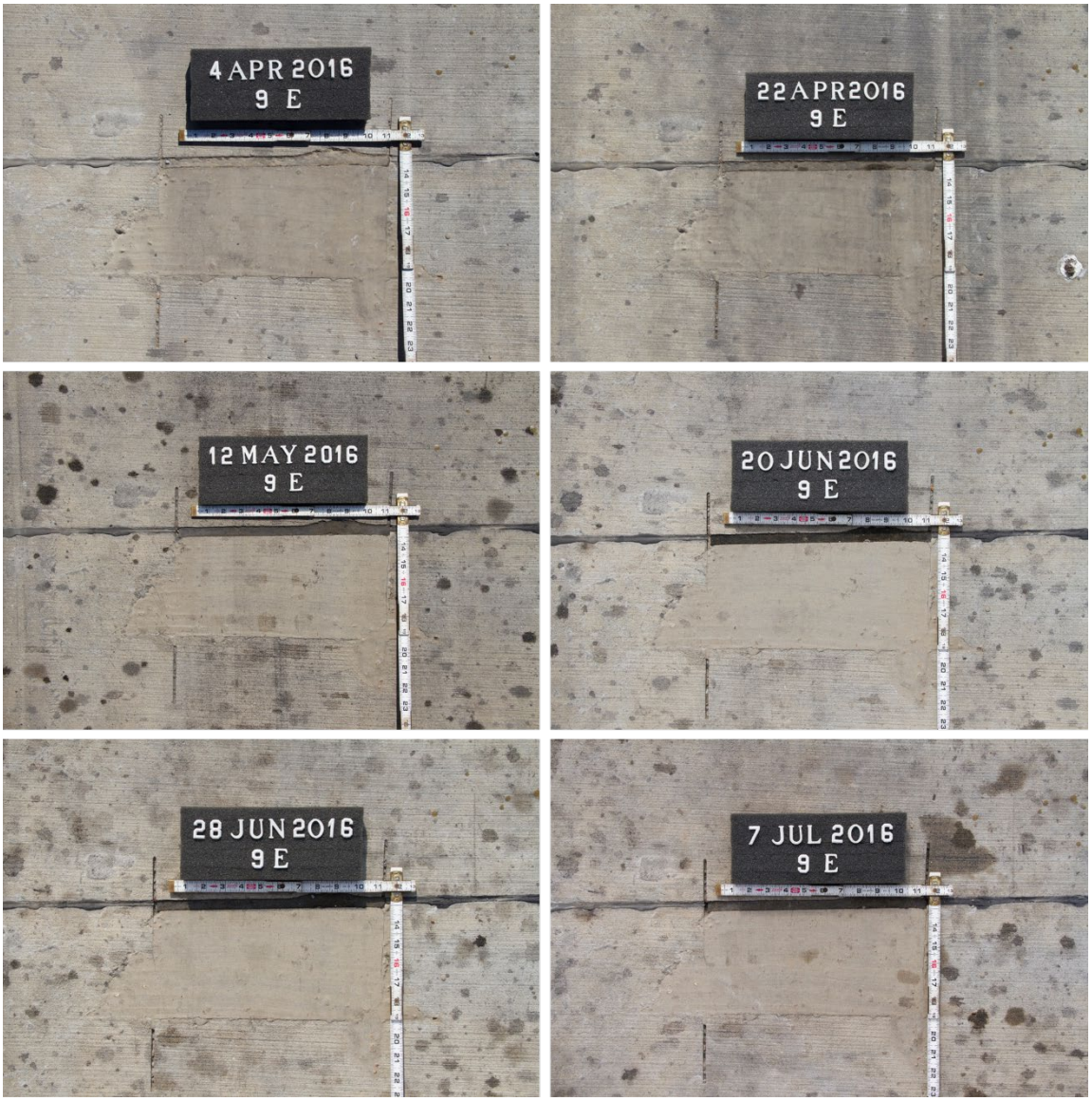
Pavepatch 3000 – Test Slab 9



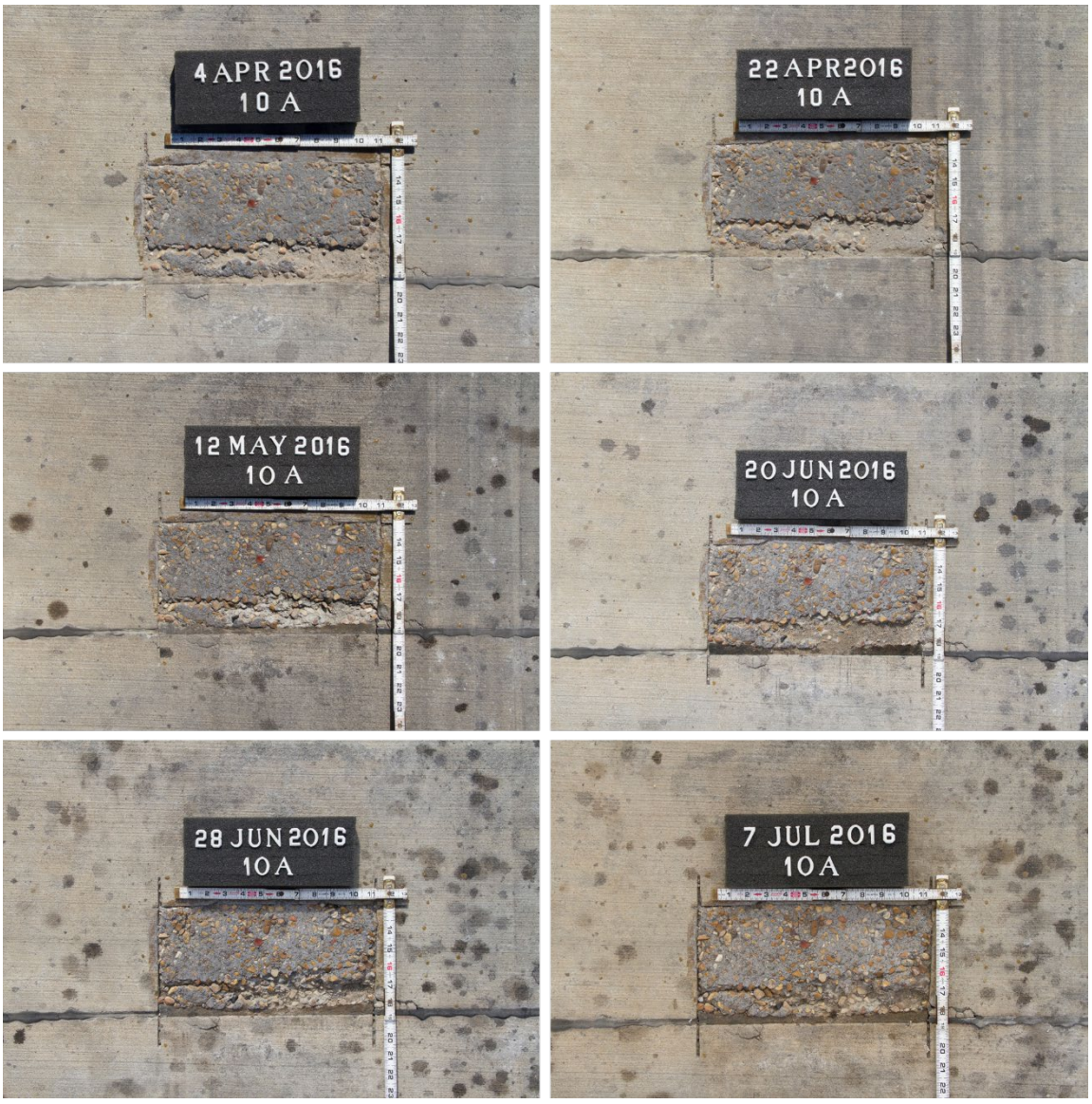
4 APR 2016
9 B
22 APR 2016
9 B
12 MAY 2016
9 B
20 JUN 2016
9 B
28 JUN 2016
9 B
7 JUL 2016
9 B

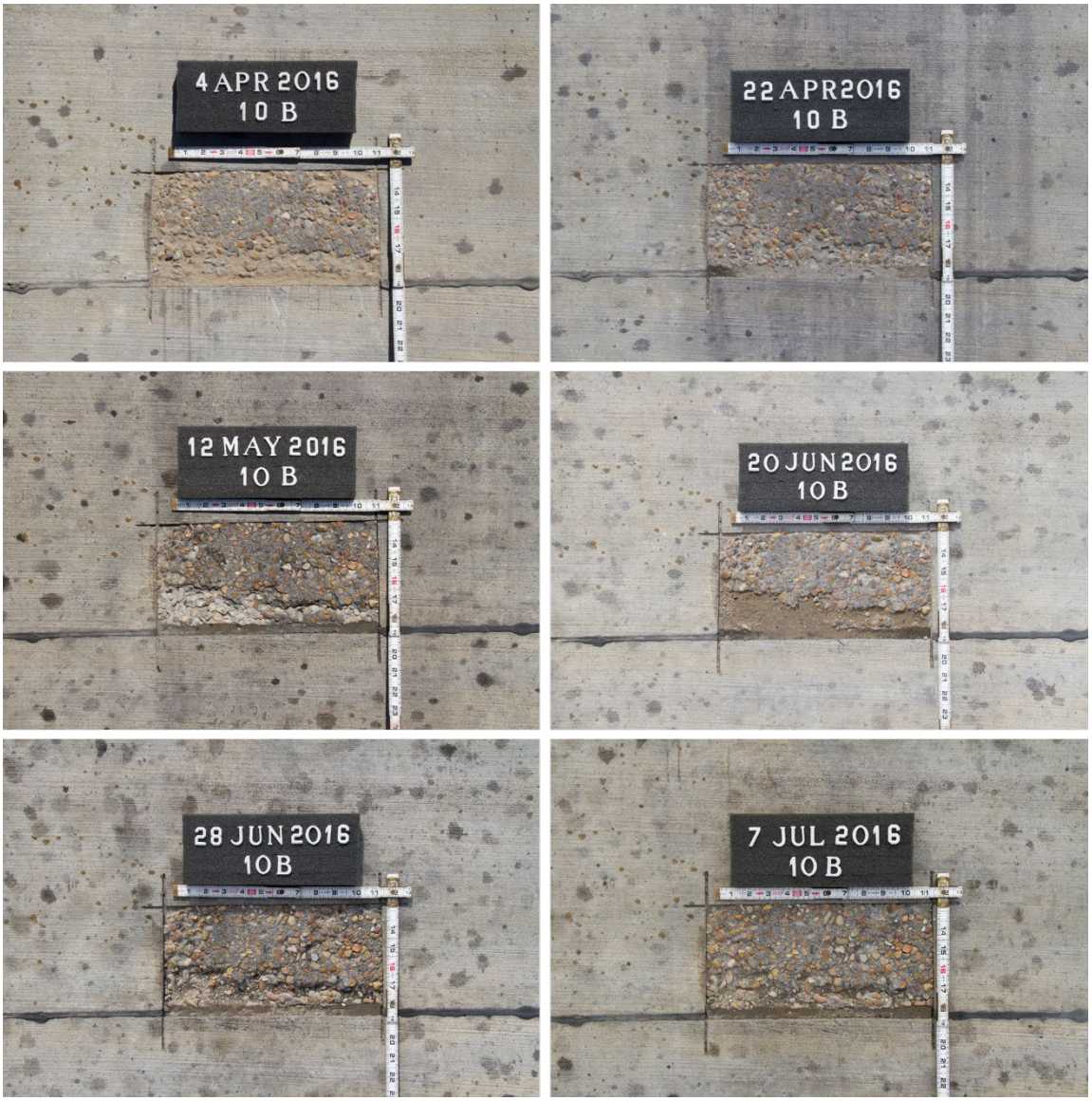
4 APR 2016
9 C
22 APR 2016
9 C
12 MAY 2016
9 C
20 JUN 2016
9 C
28 JUN 2016
9 C
7 JUL 2016
9 C


4 APR 2016
9 D
22 APR 2016
9 D
12 MAY 2016
9 D
20 JUN 2016
9 D
28 JUN 2016
9 D
7 JUL 2016
9 D


4 APR 2016
9 E
22 APR 2016
9 E
12 MAY 2016
9 E
20 JUN 2016
9 E
28 JUN 2016
9 E
7 JUL 2016
9 E

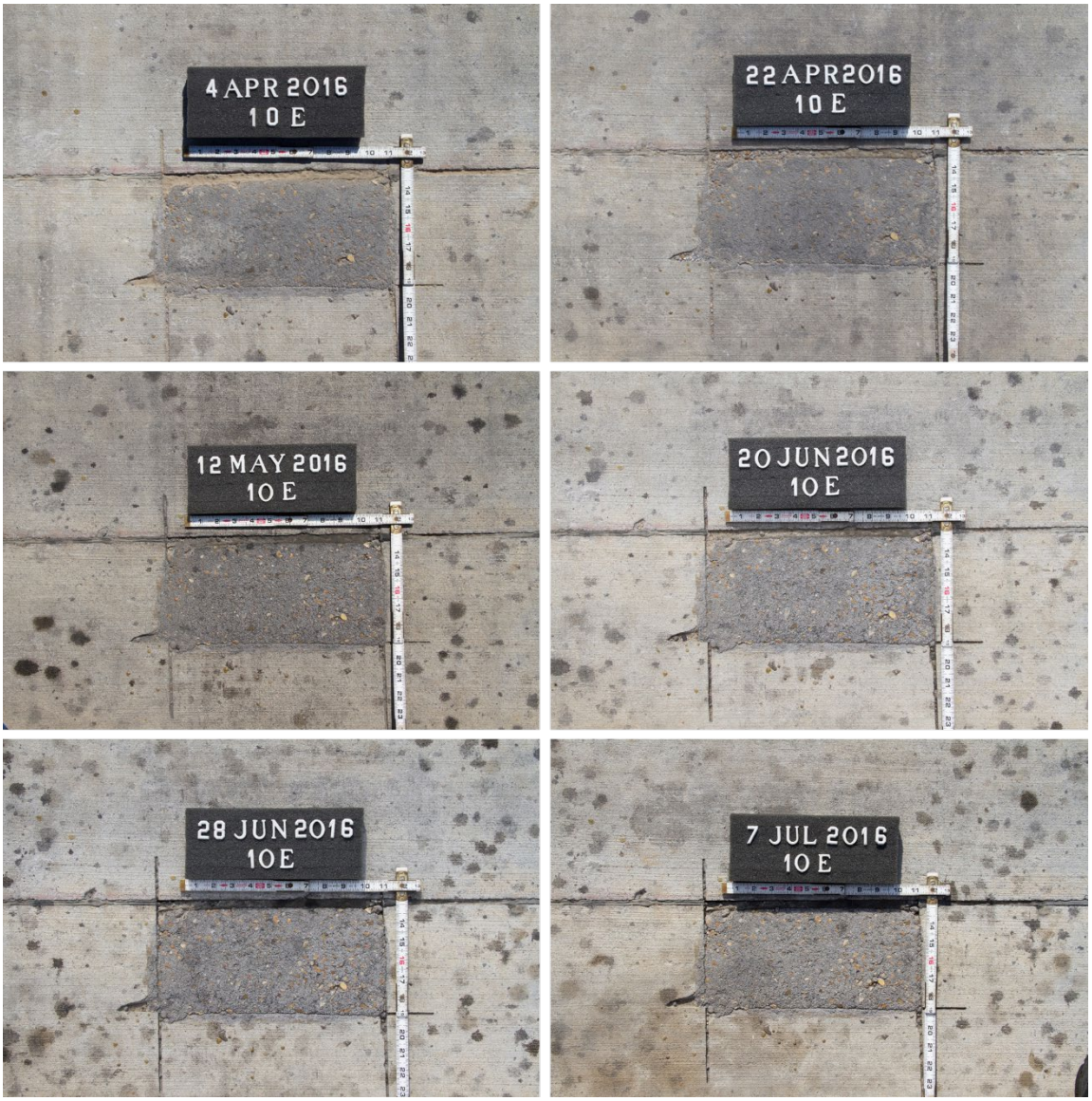
MasterEmaco S 6000 – Test Slab 10



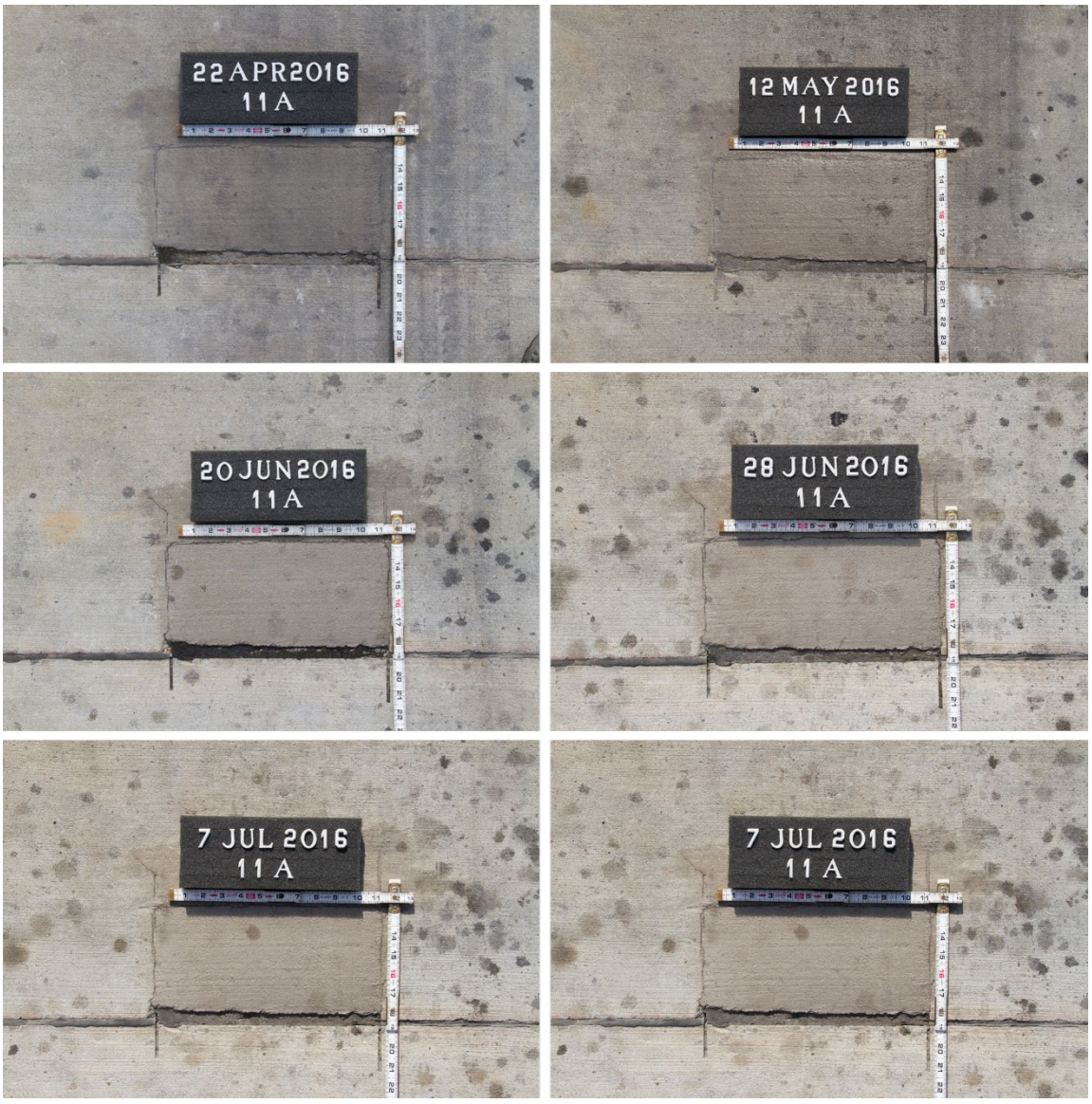

4 APR 2016
10 B
22 APR2016
10 B
12 MAY 2016
10 B
20 JUN2016
10 B
28 JUN 2016
10B
7 JUL 2016
10 B

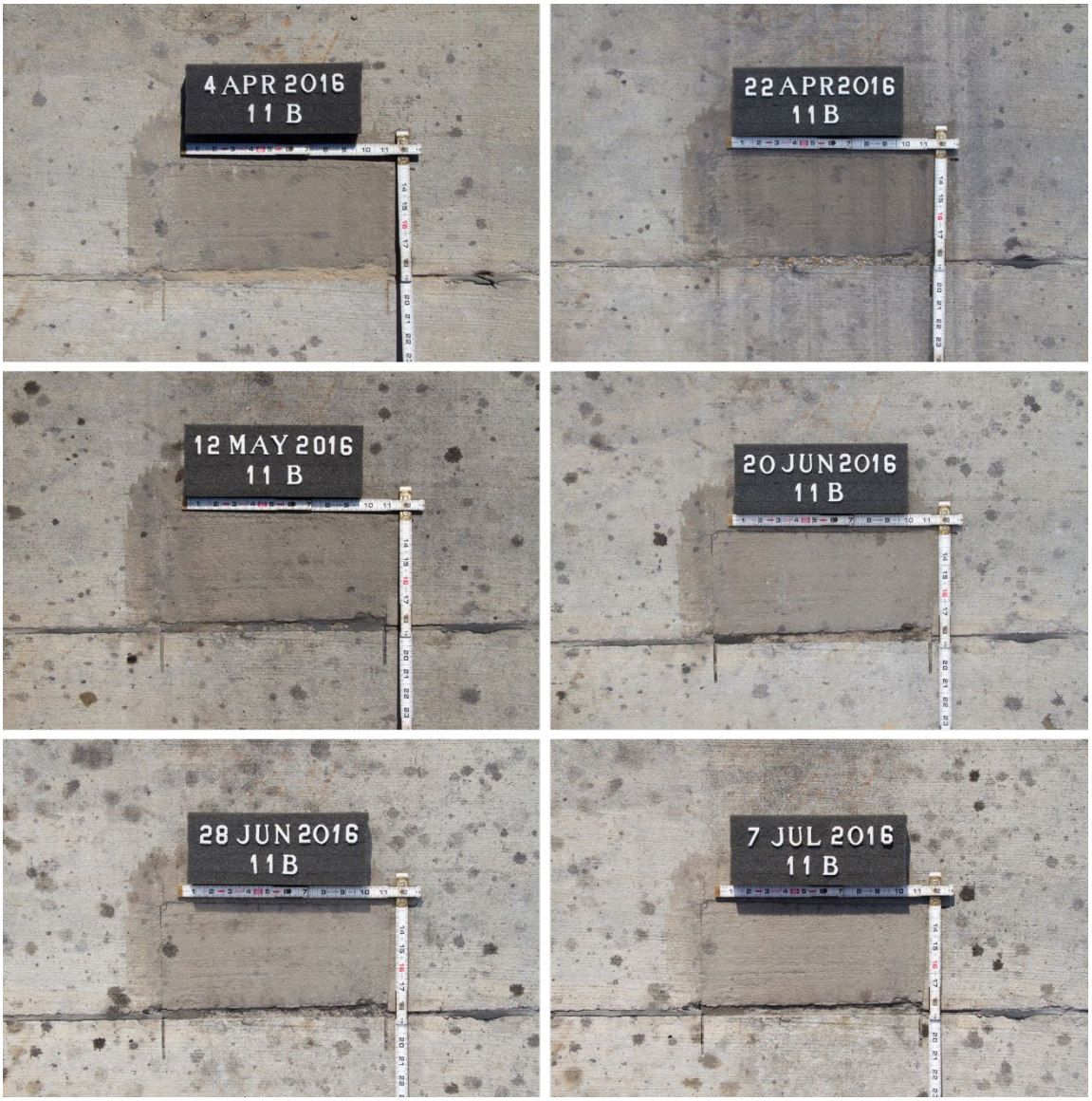
4 APR 2016
10 C
22 APR2016
10 C
12 MAY 2016
10 C
20 JUN2016
10 C
28 JUN 2016
10 C
7 JUL 2016
10 C

4 APR 2016
10 D
22 APR 2016
10 D
12 MAY 2016
10 D
20 JUN 2016
10 D
28 JUN 2016
10 D
7 JUL 2016
10 D


4 APR 2016
10 E
22 APR2016
10 E
12 MAY 2016
10 E
20 JUN2016
10 E
28 JUN 2016
10E
7 JUL 2016
10 E

ProSpec Premium Patch 200 – Test Slab 11



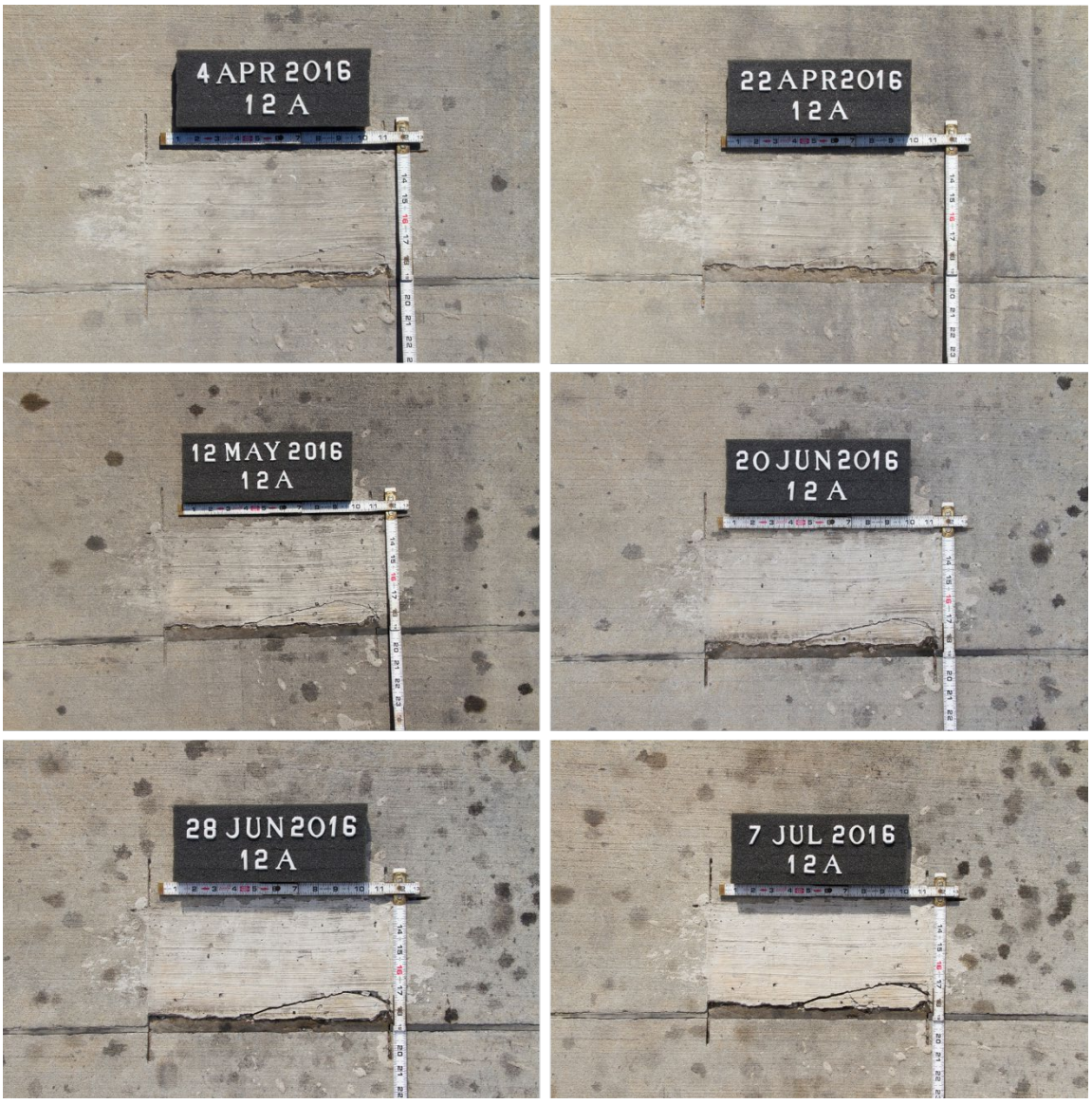

4 APR 2016
11 B
22 APR2016
11 B
12 MAY 2016
11 B
20 JUN2016
11 B
28 JUN 2016
11B
7 JUL 2016
11 B

4 APR 2016
11 C
22 APR2016
11 C
12 MAY 2016
11 C
20 JUN2016
11 C
28 JUN 2016
11C
7 JUL 2016
11 C

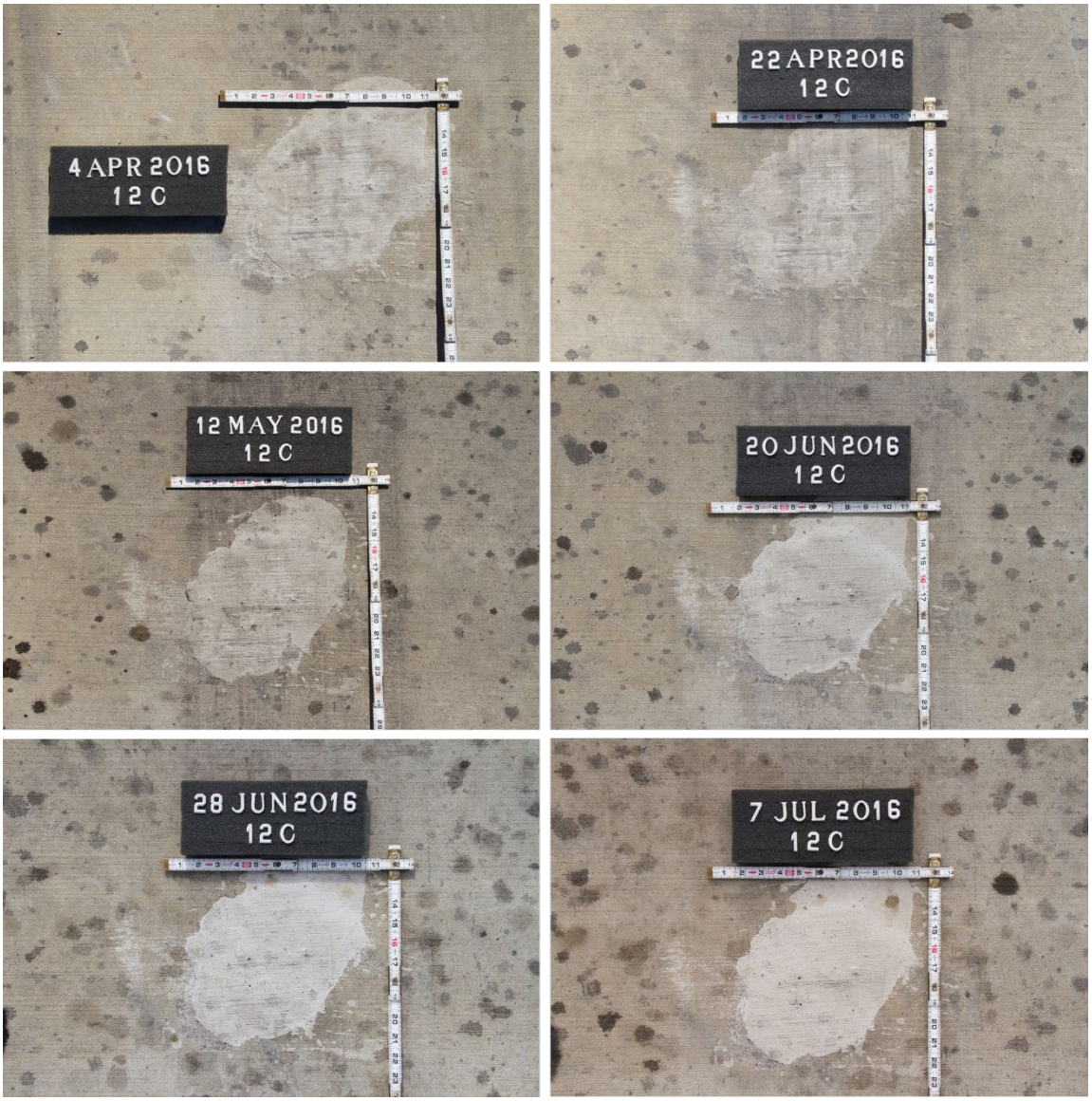
4 APR 2016
11 D
22 APR2016
11 D
12 MAY 2016
11 D
20 JUN2016
11 D
28 JUN2016
11 D
7 JUL 2016
11 D

4 APR 2016
11 E
22 APR2016
11 E
12 MAY 2016
11 E
20 JUN2016
11 E
28 JUN2016
11 E
7 JUL 2016
11 E

Rapid Set Concrete Mix – Test Slab 12



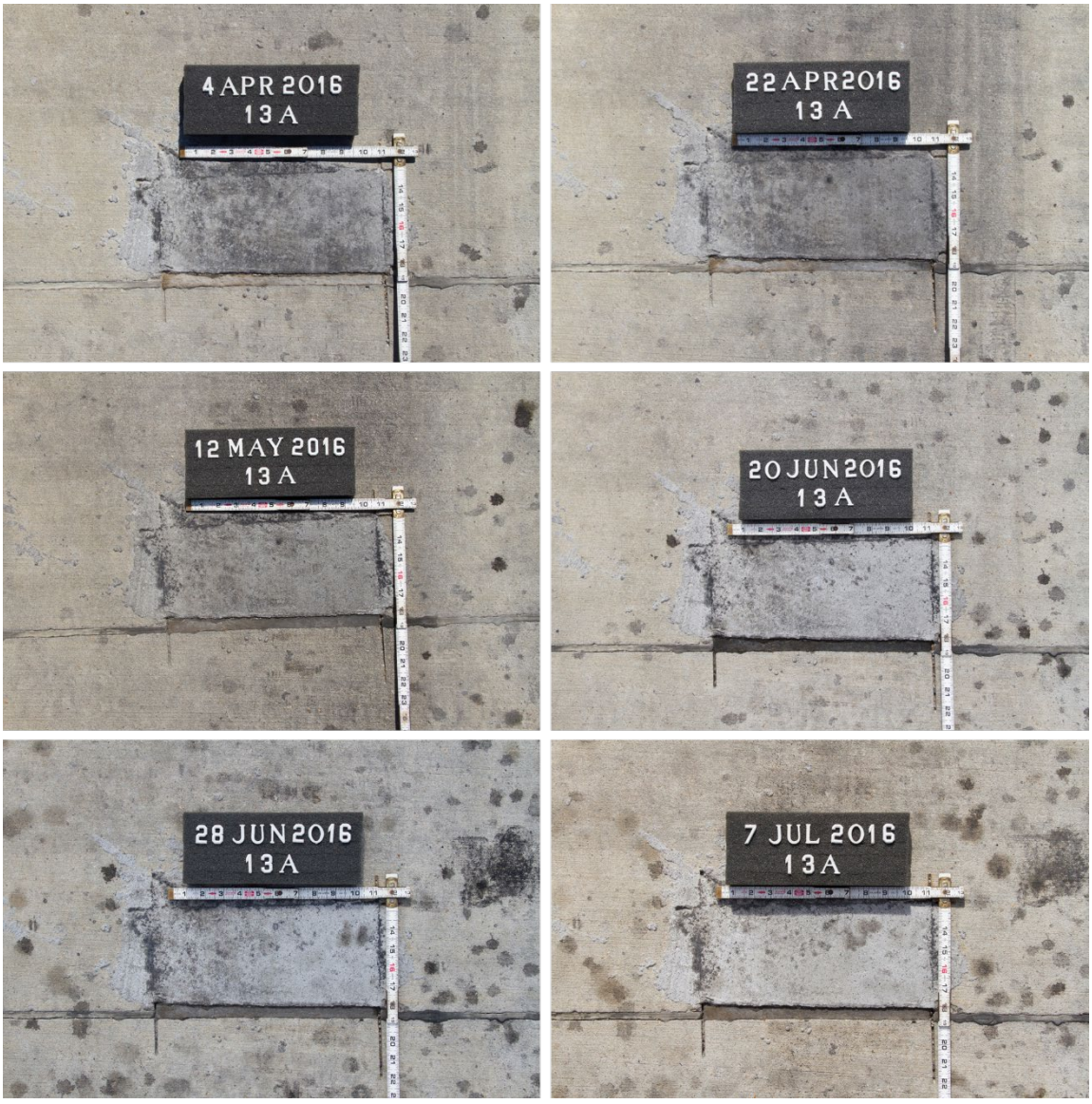
4 APR 2016
12 B
22 APR2016
12 B
12 MAY 2016
12 B
20 JUN2016
12 B
28 JUN2016
12 B
7 JUL 2016
12 B

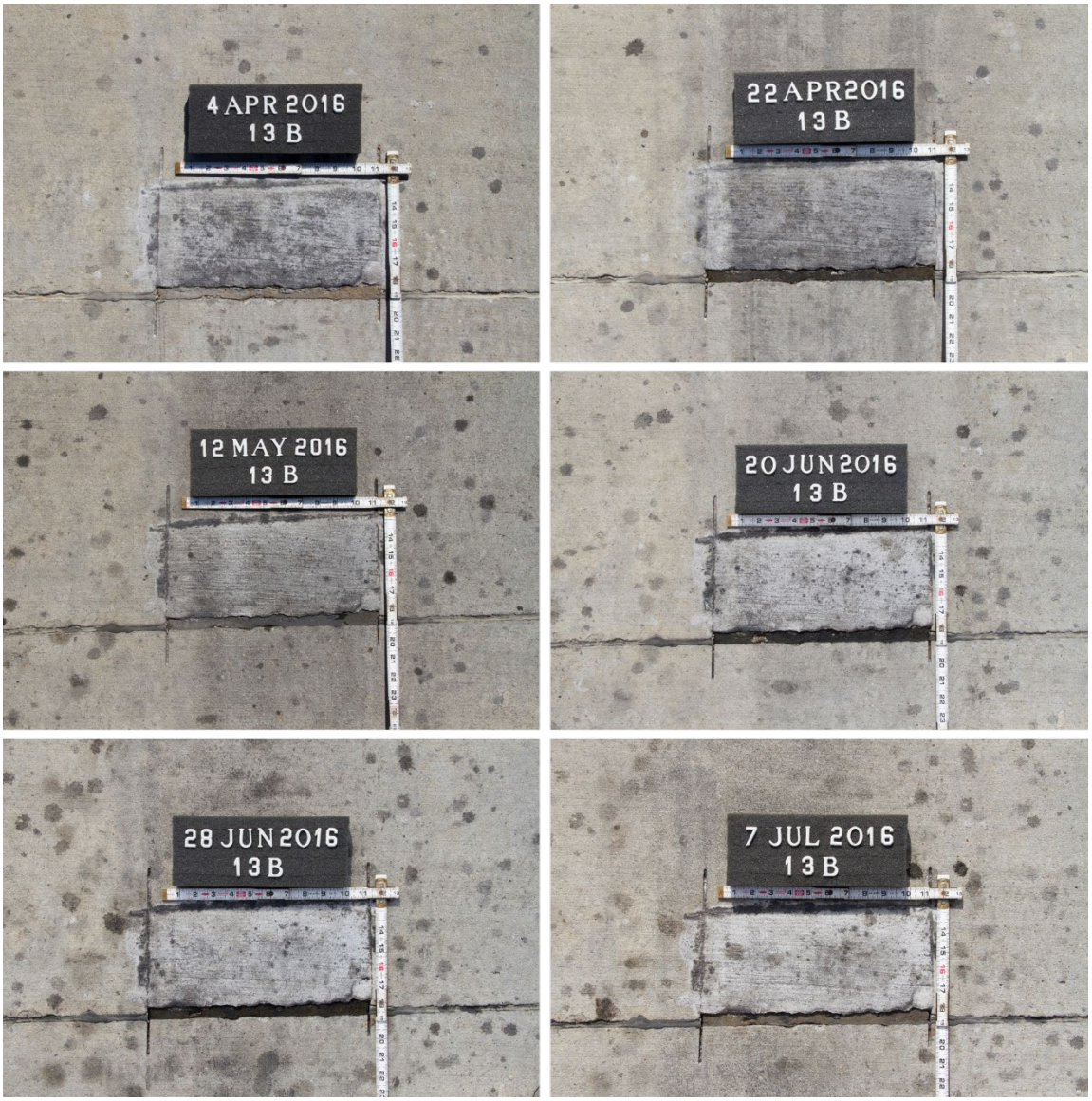

4 APR 2016
12 C
22 APR 2016
12 C
12 MAY 2016
12 C
20 JUN 2016
12 C
28 JUN 2016
12 C
7 JUL 2016
12 C

4 APR 2016
12 D
22 APR2016
12 D
12 MAY 2016
12 D
20 JUN2016
12 D
28 JUN2016
12 D
7 JUL 2016
12 D

4 APR 2016
12 E
22 APR 2016
12 E
12 MAY 2016
12 E
20 JUN 2016
12 E
28 JUN 2016
12 E
7 JUL 2016
12 E

Pavemend SLQ – Test Slab 13




4 APR 2016
13 B
22 APR2016
13 B
12 MAY 2016
13 B
20 JUN2016
13 B
28 JUN2016
13 B
7 JUL 2016
13 B

4 APR 2016
13 C
22 APR 2016
13 C
12 MAY 2016
13 C
20 JUN 2016
13 C
28 JUN 2016
13 C
7 JUL 2016
13 C

4 APR 2016
13 D
22 APR 2016
13 D
12 MAY 2016
13 D
20 JUN 2016
13 D
28 JUN 2016
13 D
7 JUL 2016
13 D

4 APR 2016
13 E
22 APR2016
13 E
12 MAY 2016
13 E
20 JUN2016
13 E
28 JUN2016
13 E
7 JUL 2016
13 E

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
June 2019	Final report	

4. TITLE AND SUBTITLE

Evaluation of Concrete Spall Repair Materials

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Anthony J. Falls

5d. PROJECT NUMBER
449879

5e. TASK NUMBER

5f. WORK UNIT NUMBER
LF0B30

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Engineer Research and Development Center
Geotechnical and Structures Laboratory
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

8. PERFORMING ORGANIZATION REPORT NUMBER

ERDC/GSL TR-19-29

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Headquarters, Air Force Civil Engineer Center
Tyndall Air Force Base, FL 32403-5319

10. SPONSOR/MONITOR'S ACRONYM(S)

AFCEC

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Maintenance and repair activities are critical to economically and efficiently sustain airfield operations with existing pavement infrastructure. Repairing spalls in Portland cement concrete (PCC) pavements is a common work activity used to reduce the costs associated with aircraft damage and prolong the service life of the pavement further reducing the life-cycle costs for the pavement structure. Costs decrease dramatically for every additional year of pavement use that does not cause vehicle damage or require repeated patching or full slab replacement.

Traffic performance of fourteen different concrete repair products was evaluated for repairing spalls in PCC airfield pavement. The objective of this study was to identify within these products suitable repair materials for long-term concrete spall deficiency repairs.

Numerous partial-depth repairs were constructed along joints and in the interior of the test slab and backfilled with the repair products following the manufacturer requirements. After the material cured to the minimum required by each manufacturer, the repairs were trafficked with simulated F-15E aircraft traffic to monitor their long-term performance over successive aircraft loadings. The field evaluations of the selected repair products considered how well each product performed under simulated F-15E traffic as well as the ease of mixing, placing, and finishing.

15. SUBJECT TERMS

Airfield pavement repair
Concrete repair
Expedient spall repair
Long term spall repair
Concrete spalling
Pavement preservation
Preventive maintenance

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UU	156	