# APPENDIX G

# CAP INSPECTION REPORTS

# ENVIRONMENTAL RISK MANAGEMENT SERVICES, INC.

http://www.ermsi.com

13041 North 35th Avenue, Suite C-2, Phoenix, Arizona 85029
(602) 896-2829 fax (602) 896-2830


April 11, 2002

Registered Professional Engineer (Civil) CERTIFICATE NO. 30527 ALAN C. THOMAS Date Signed 4/11/02 ARIZONA, U.S.A.

Mr. Jeff Rothrock
Environmental Flight
56 CES/CEV
14002 W. Marauder Street, Bldg. 302
Luke AFB, AZ 85309-1125

**Subject: Inspection of Concrete Cap**
**Site ST-18, Building 993, Luke AFB, AZ**

Dear Mr. Rothrock:

Environmental Risk Management Services, Inc. (ERMS) has completed an inspection of the concrete cap at Site ST-18 for FY2002. The inspection indicated that the cap has been properly maintained, is functioning as intended, and remains an effective barrier to surface water infiltration.

**Background**

According to information provided by LAFB personnel, the cap was installed in 1987 as a means of controlling access to, and contaminant migration from, soils impacted by releases in the vicinity of three former underground storage tanks west of building 993. The *Final Record of Decision, Operable Unit 2, Luke AFB, AZ* (Geraghty & Miller, 1994) documents the selection of the cap as a remedial measure, and prescribes inspection, maintenance and repair of the cap as the remediation goal. According to design data provided by LAFB, the cap consists of a 30-mil high-density polyethylene (HDPE) liner, covered by six inches of aggregate base, covered by the 9-inch thick reinforced-concrete cap.

**Visual Inspection**

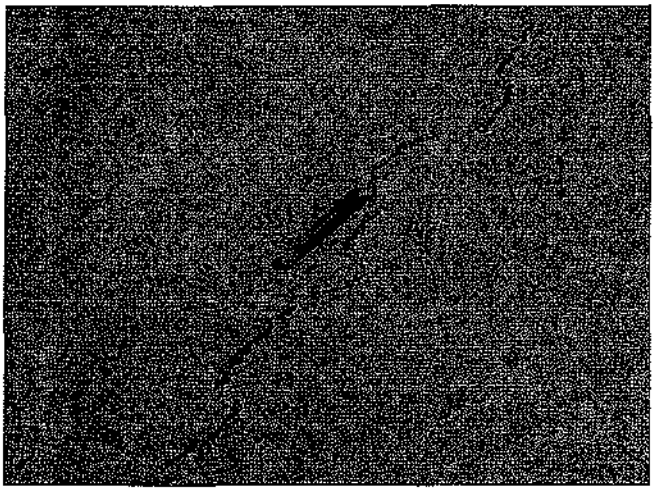
ERMS environmental professional Alan C. Thomas, P.E. conducted a visual inspection of the cap on March 8, 2000, accompanied by Mr. Jeff Rothrock. The inspection consisted of orienting the available diagrams with features observed in the field, then walking numerous transects of the cap area, with detailed visual inspection of cracks, joints, former penetrations, and other features of interest. Photographs located within the text and in Attachment 1 illustrate selected features observed during the inspection.

As the cap is a part of the surrounding airfield pavement, some question had existed during previous inspections regarding the exact location and extent of the area requiring annual inspection and more rigorous maintenance. In order to document this area, ERMS and Luke AFB personnel had previously undertaken coordinate current landmarks with that specific area identified in the *Record of Decision* as having soil concentrations exceeding Program Remediation Goals. Once the area was identified on the ground, corner points were marked on the pavement using white paint, and the points were referenced by measurement to permanent

features of the adjacent building. Attachment 2 provides a modification of the drawing provided in the *Record of Decision* illustrating this area and its reference points, referred to hereinafter as the "Subject" area.

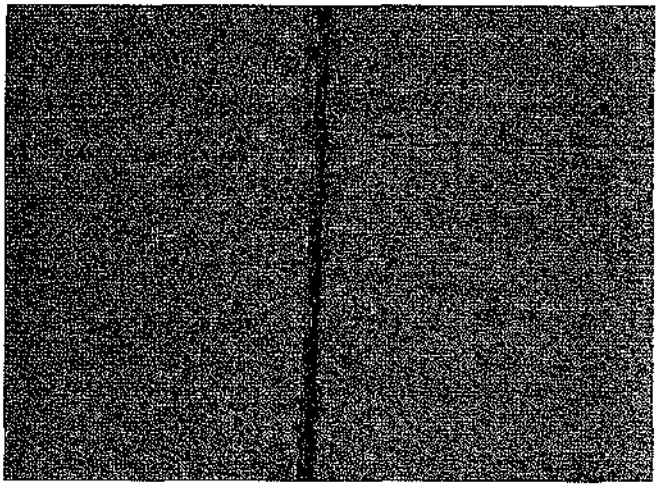
**Current Conditions**

At the time of the inspection, the cap was stable, without buckling or differential settlement discernible to the naked eye. There was no significant vertical displacement at any of the observed cracks or expansion joints. There were no unusual cracking patterns to suggest heaving or settlement in the substrate. There was no spalling or scaling of the surface areas of the cap, the cap surface was not stained, and the surface did not appear to have been impacted by chemical degradation.



**Isolated cracking with beginnings of surface concrete attrition due to vehicular wear and tear.**

A few typical cracks appeared in the cap. Some of these cracks displayed beginnings of surface concrete attrition at the surface due to vehicular wear and tear. In the opinion of ERMS, this condition does currently compromise the integrity of the cap and does not currently warrant corrective action, but does warrant continued inspection and may require maintenance action in coming years.

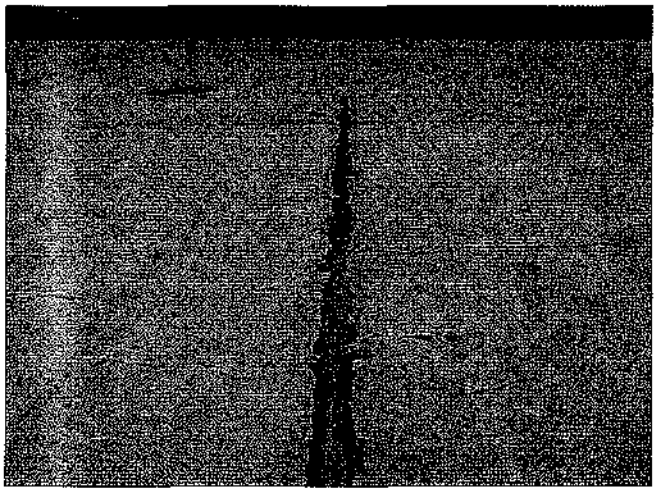


**Original joint seal.**

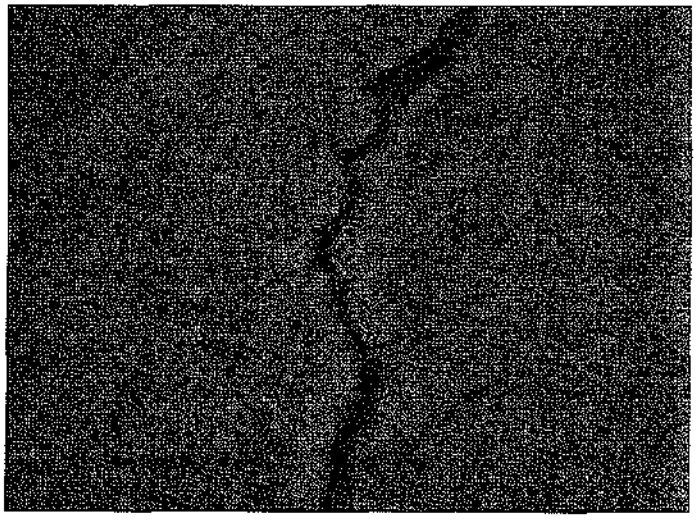
Joints in the concrete were carefully inspected, as they represent the most likely route of surface water infiltration. The original joint material, distinguished by a relatively thin, straight joint vertically recessed from the surface by one-eighth to one-fourth inch, remained in a few areas of the cap. In these remaining areas, the material visibly remains in good repair, and in the opinion of ERMS, continues to provide an effective seal.

Various repairs to the cap have previously been conducted at cracks and in cases where the original joint material previously had deteriorated due to weathering and shrinkage. These repairs primarily consisted of routing and/or sealing cracks and joints, and replacing concrete around a monitoring well vault. These repairs were primarily concentrated in the northern and western portion of the general cap area, outside the Subject area, but some were located within the Subject area. Joints and cracks in the cap have been sealed in three distinct "generations."

The first generation of joint and crack seal was distinguished by an asphaltic-type material, apparently brush-stroked on in swaths of one to three inches in width, and done in repair of construction joints and small irregular cracks, as shown in the photo to the right. In general, these repairs appeared still to be effective, based on ERMS' visual inspection. However, in some places, weathering and shrinkage had previously hardened this material and created small fissures and/or caused separation from the crack edges. All such areas have been repaired during one of the two subsequent rounds of repairs described below



**Typical first-generation joint repair.**



**Typical second-generation crack repair.**

The second generation of repairs was completed in 1999 by ARCADIS Geraghty & Miller, reportedly using an epoxy material applied both to construction joints and to cracks. These repairs were uniformly very tight and in good condition, as illustrated in the photo to the left.

The most recent repairs were done by AGATE, Inc. during August, 2001, using Sikaflex-2c NS, a petroleum-resistant polyurethane elastomeric sealant applied both to joints and to cracks, as illustrated in the photo to the right. All of these third-generation repairs also were uniformly very tight and in good condition. Three small bubbles were observed at separate points in the material, but in the opinion of ERMS these small imperfections did not degrade the effectiveness of the cap.

**Typical third-generation crack repair using Sikaflex-2c NS.**

**Conclusion**
The inspection indicated that the cap has been properly maintained, is functioning as intended, and remains an effective barrier to surface water infiltration. ERMS recommends on-going maintenance and inspection of the cap in accordance with the ROD and to ensure the cap's effectiveness.

Thank you for the opportunity to be of service in this matter. If you have any questions regarding this report, please do not hesitate to contact us at (602) 896-2829.

Respectfully submitted,

**ENVIRONMENTAL RISK MANAGEMENT SERVICES, INC.**

Alan C. Thomas, P.E.
Principal

Registered Professional Engineer (Civil)
CERTIFICATE NO.
30527
ALAN C.
THOMAS
Date Signed
ARIZONA, U.S.A.

Attachments: 1. Selected Photographs
2. Modified Site Diagram

# Attachment 1

## Selected Photographs

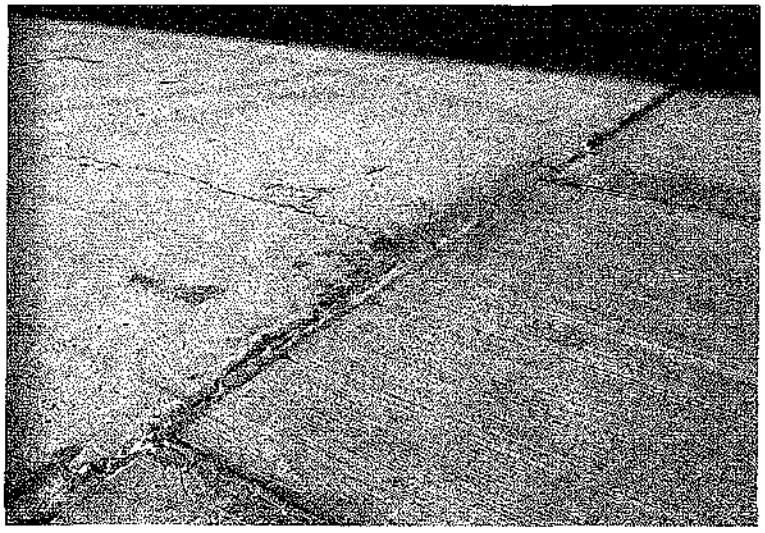


**Photo #1:** Small area where concrete was replaced in FY01.

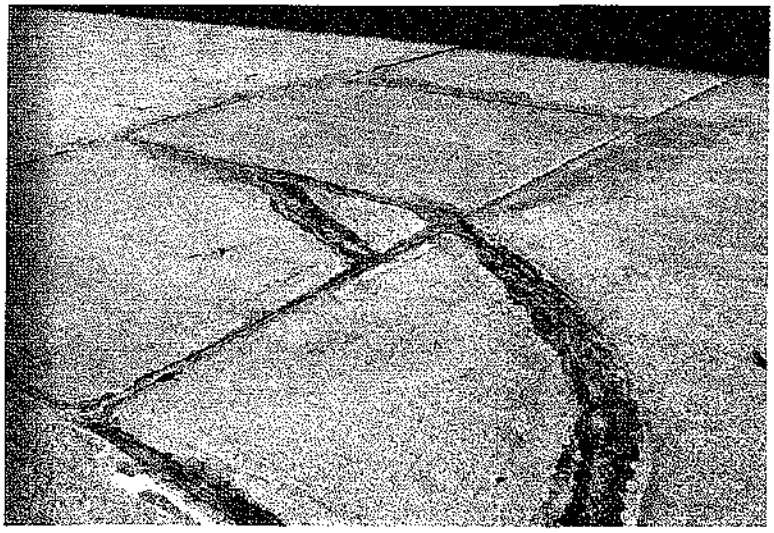


**Photo #2:** Patching and small area where concrete was replaced in FY01.

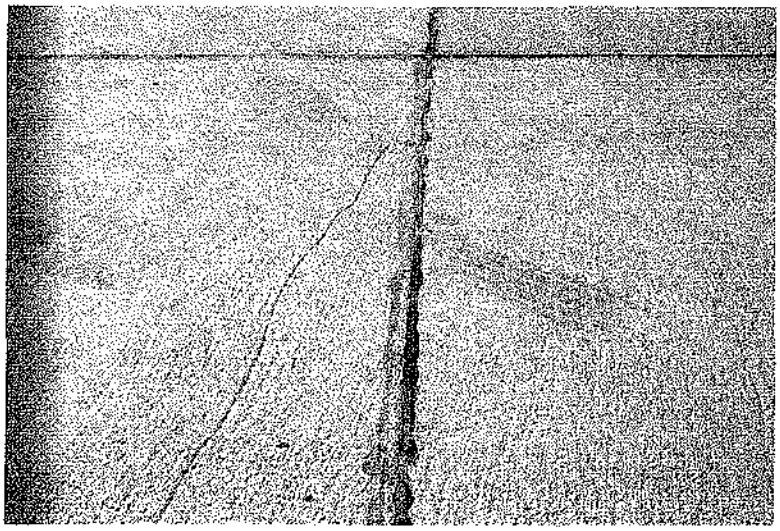


**Photo #3:** Typical 3rd–generation repair in foreground.

**Photo #4:** Typical composite repairs, original material and 3rd-generation.

**Photo #5:** Typical composite repairs, original material and 3rd-generation.

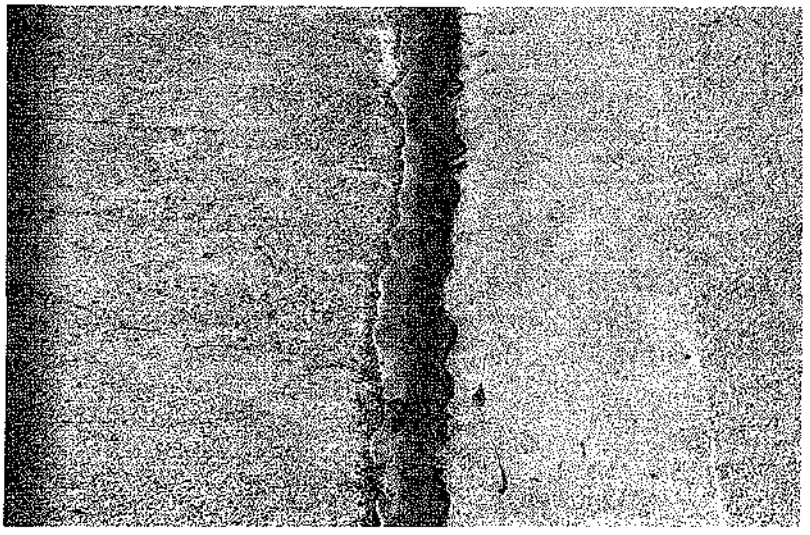


**Photo #6**: 3rd-generation repair

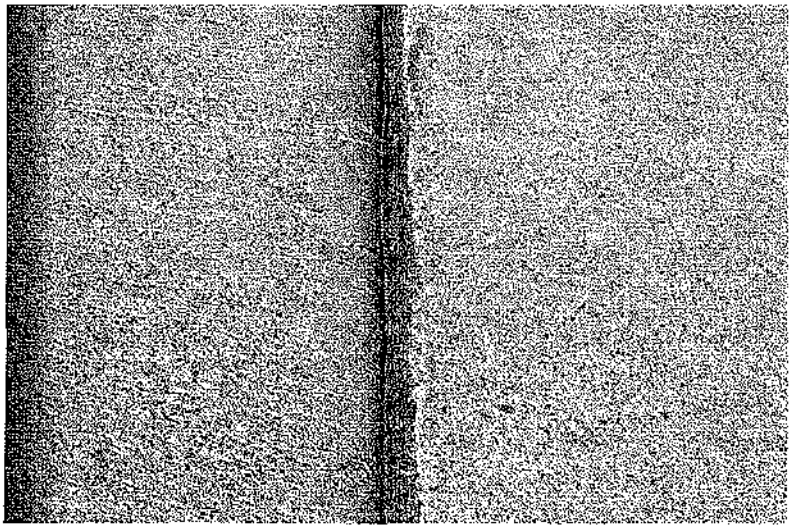


**Photo #7:** Original joint material.

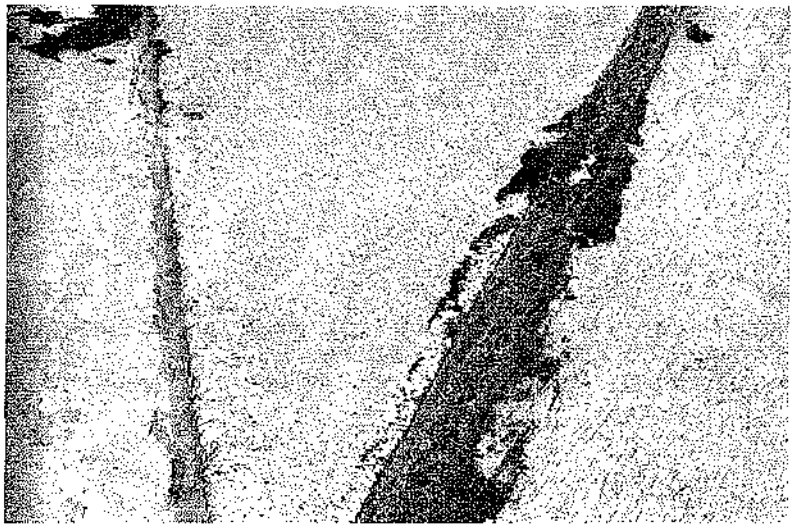


**Photo #8:** 1st and 3rd-generation repairs adjacent to one another.

**Photo #9:** Wellhead vault.

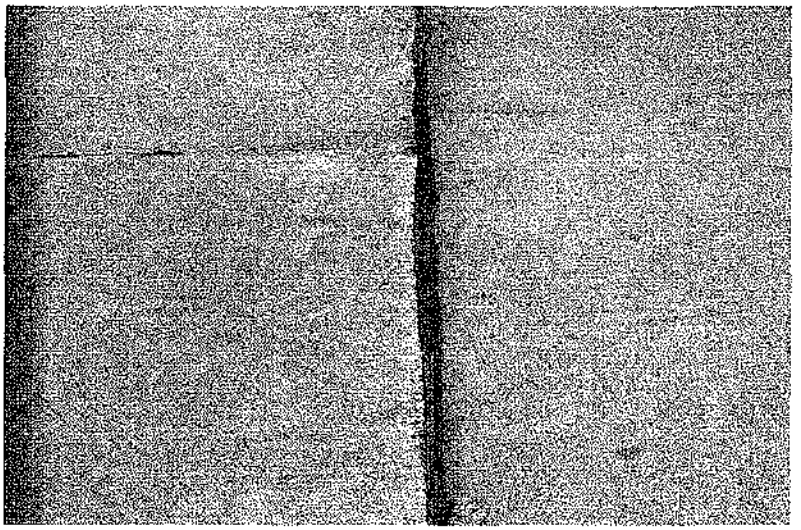


**Photo #10:** Original joint material.

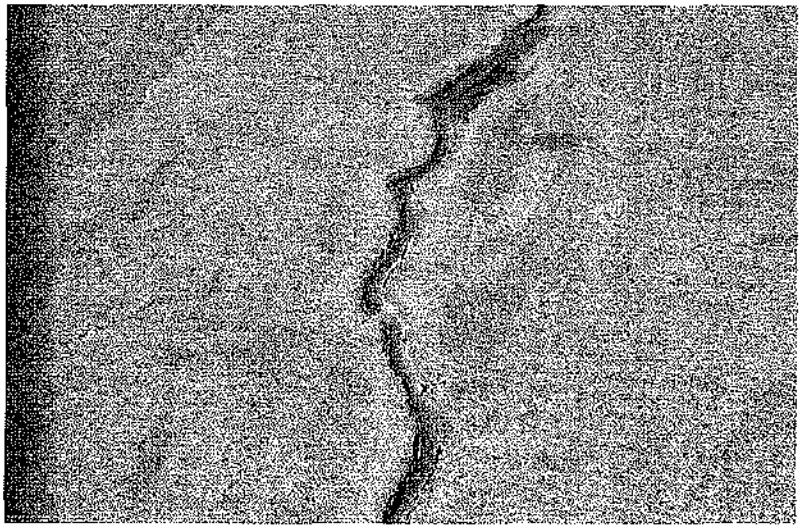


**Photo #11:** Second-generation crack repair.

**Photo #12:** Second-generation crack repair with minor surface cracking adjacent.

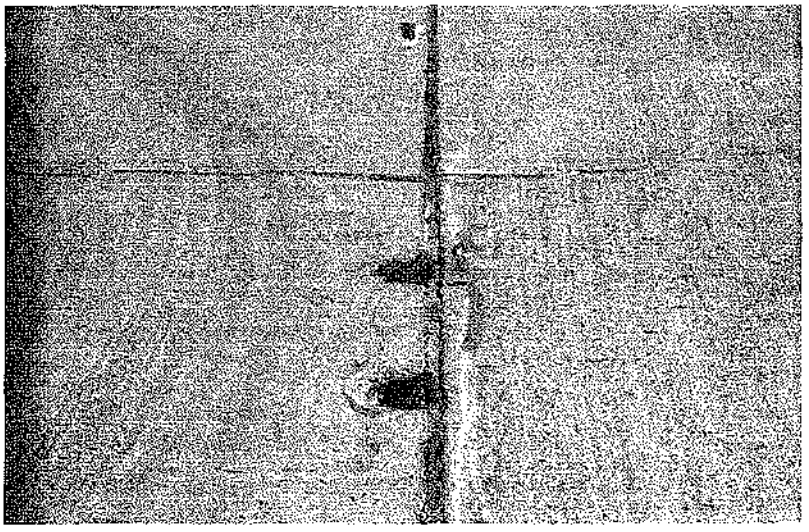


**Photo #13:** 3rd-generation repair with remnants of 1st-generation repair.

**Photo #14:** Former soil boring patch with second-generation repair.

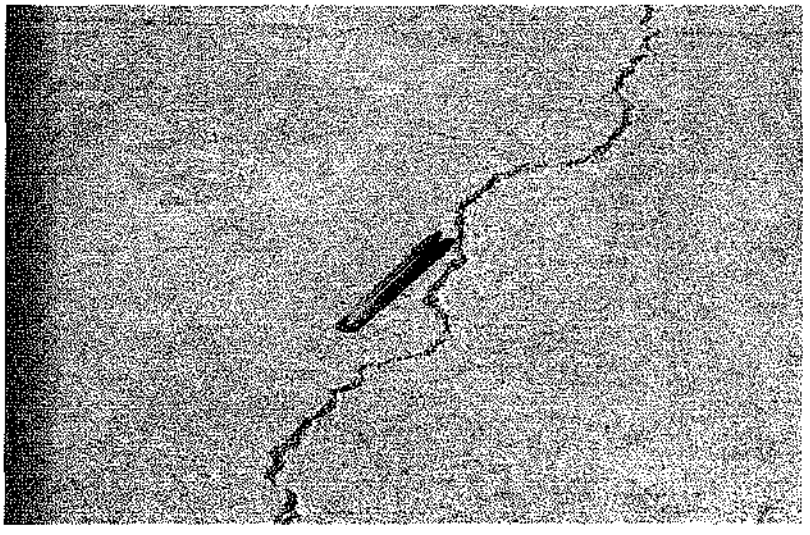


**Photo #15:** Typical crack with minor concrete attrition.

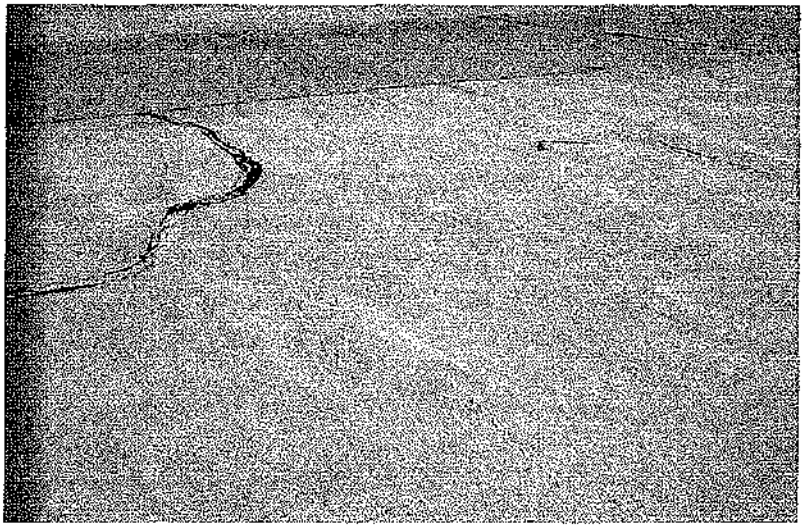


**Photo #16:** Typical expanse of cap with first-generation crack repair.

**Photo #17:** Typical area of original joint material.

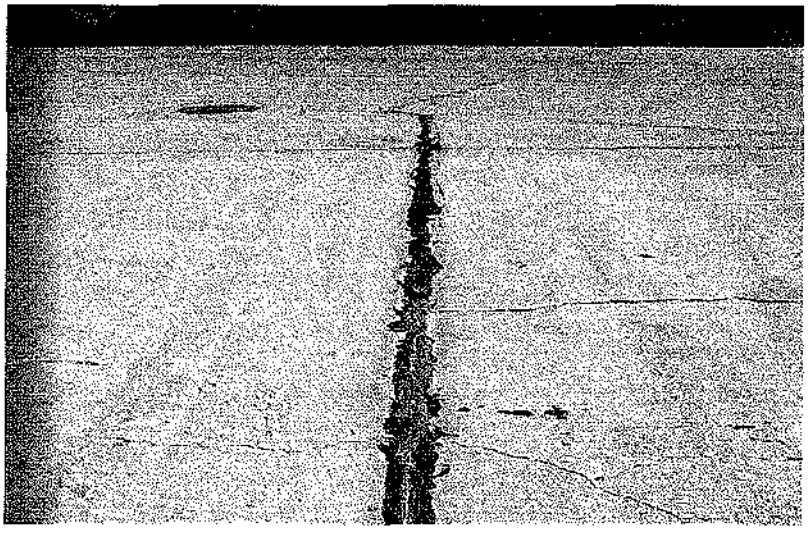


**Photo #18:** Typical section of 1st-generation joint repair.

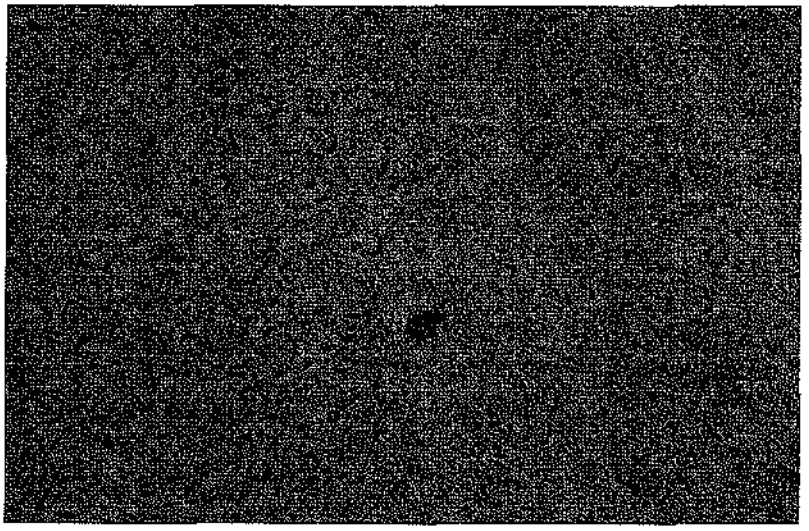


**Photo #19:** Small area where a piece of aggregate had broken free at the surface.

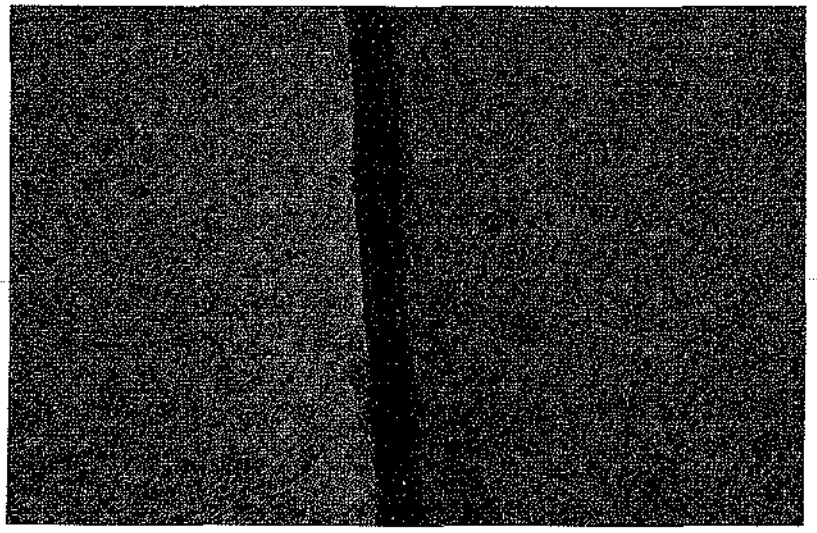
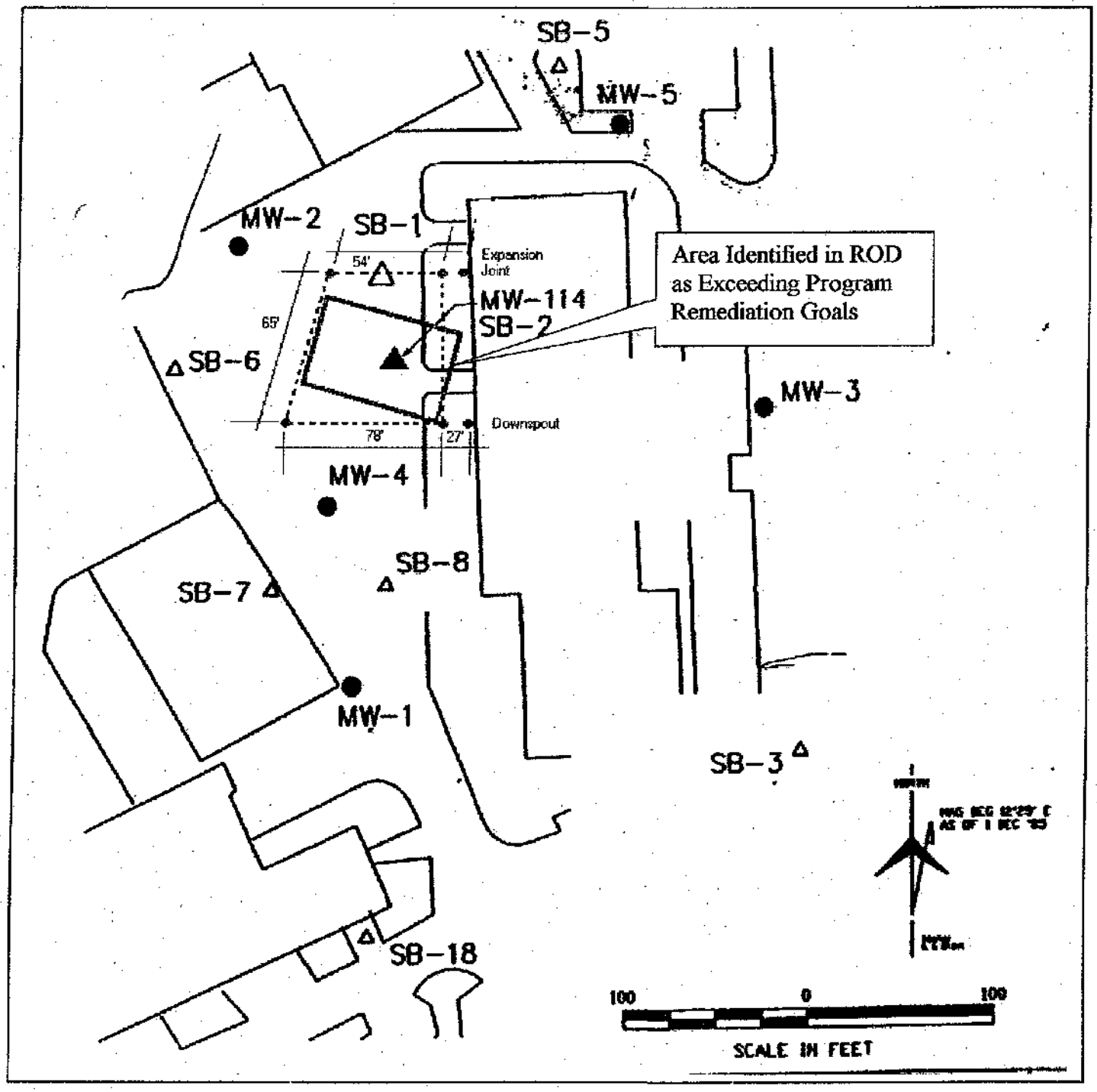


**Photo #20:** Section of 3rd-generation joint repair.

**Attachment 2**

**Modified Site Diagram**




**Site Diagram**

Modified from Figure 4, *Final Record of Decision, Operable Unit 2, Luke AFB, AZ* (Geraghty & Miller, 1994)

# ENVIRONMENTAL RISK MANAGEMENT SERVICES, INC.

http://www.ermsi.com

13041 North 35th Avenue, Suite C-2, Phoenix, Arizona 85029
(602) 896-2829 fax (602) 896-2830


April 17, 2003

Registered Professional Engineer (Civil) CERTIFICATE NO. 30527 ALAN C. THOMAS Date Signed 4-17-03 ARIZONA, U.S.A.

Mr. Jeff Rothrock
Environmental Flight
56 CES/CEV
14002 W. Marauder Street, Bldg. 302
Luke AFB, AZ 85309-1125

**Subject: Inspection of Concrete Cap, Site ST-18, Building 993, Luke AFB, AZ**

Dear Mr. Rothrock:

Environmental Risk Management Services, Inc. (ERMS) has completed an inspection of the concrete cap at Site ST-18 for FY2003. The inspection indicated that the cap has been properly maintained, is functioning as intended, and remains an effective barrier to surface water infiltration. ERMS recommends that minor repairs be anticipated and programmed for FY04, and recommends on-going inspection of the cap in accordance with the Record of Decision (ROD) and to ensure the cap's effectiveness.

**Background**

According to information provided by LAFB personnel, the cap was installed in 1987 as a means of controlling access to, and contaminant migration from, soils impacted by releases in the vicinity of three former underground storage tanks located west of building 993. The *Final Record of Decision, Operable Unit 2, Luke AFB, AZ* (Geraghty & Miller, 1994) documents the selection of the cap as a remedial measure, and prescribes inspection, maintenance and repair of the cap as the remediation goal. According to design data provided by LAFB, the cap consists of a 30-mil high-density polyethylene (HDPE) liner, covered by six inches of aggregate base, covered by the 9-inch thick reinforced-concrete cap.

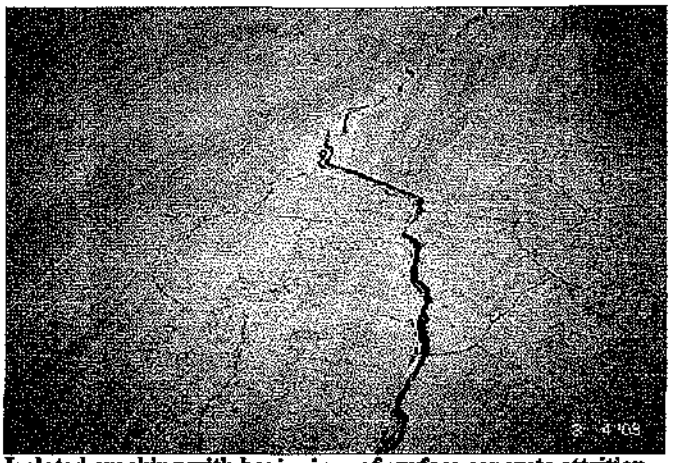
**Visual Inspection**

ERMS environmental professional Alan C. Thomas, P.E. conducted a visual inspection of the cap on March 4, 2003, accompanied by Mr. Jeff Rothrock. The inspection consisted of orienting the available diagrams with features observed in the field, then walking numerous transects of the cap area, with detailed visual inspection of cracks, joints, former penetrations, and other features of interest. Photographs located within the text and in Attachment 1 illustrate selected features observed during the inspection.

As the cap is a part of the surrounding airfield pavement, some question had existed during previous inspections regarding the exact location and extent of the area requiring annual inspection and more rigorous maintenance. In order to document this area, ERMS and Luke AFB personnel had previously undertaken coordinate current landmarks with that specific area identified in the *Record of Decision* as having soil concentrations exceeding Program Remediation Goals. Once the area was identified on the ground, corner points were marked on the pavement using white paint, and the points were referenced by measurement to permanent features of the adjacent building. Attachment 2 provides a modification of the drawing provided in the *Record of Decision* illustrating this area and its reference points, referred to hereinafter as the "Subject" area.

**Current Conditions**

At the time of the inspection, the cap was stable, without buckling or differential settlement discernible to the naked eye. There was no significant vertical displacement at any of the observed cracks or expansion joints. There were no unusual cracking patterns to suggest heaving or settlement in the substrate. There was no spalling or scaling of the surface areas of the cap, the cap surface was not stained, and the surface did not appear to have been impacted by chemical degradation.



**Isolated cracking with beginnings of surface concrete attrition due to vehicular wear and tear (previously routed/repaired crack in center).**

A few typical cracks appeared in the cap. Some of these cracks displayed beginnings of surface concrete attrition at the surface due to vehicular wear and tear. In the opinion of ERMS, this condition does not currently compromise the integrity of the cap and does not currently warrant corrective action, but does warrant continued inspection and may require maintenance action in coming years.

**Original construction joint seal beginning to pull away from *concrete in isolated spots.***

Joints in the concrete were carefully inspected, as they represent the most likely route of surface water infiltration. The original joint material, in most cases distinguished by a relatively thin, straight joint vertically recessed from the surface by one-eighth to one-fourth inch, remained in a few areas of the cap. In most of these remaining areas, the material visibly remains in good repair, and in the opinion of ERMS, continues to provide an effective seal.

However, in one specific area, a larger construction joint formed by a multi-ply felt and asphaltic material, approximately three-quarters of an inch in width, had begun to pull away from the concrete, as indicated by the ease of insertion of a knife blade shown to the left. Although in the opinion of ERMS this material currently continues to provide an effective seal, this area was marked with blue striping paint so that it could be identified and visually monitored in coming years.

Various repairs to the cap were previously conducted at cracks and in cases where the original joint material previously had deteriorated due to weathering and shrinkage. These repairs primarily consisted of routing and/or sealing cracks and joints, and replacing concrete around a monitoring well vault. These repairs were mostly concentrated in the northern and western portion of the general cap area, outside the Subject area, but some were located within the Subject area. Joints and cracks in the cap have been sealed in three distinct "generations."

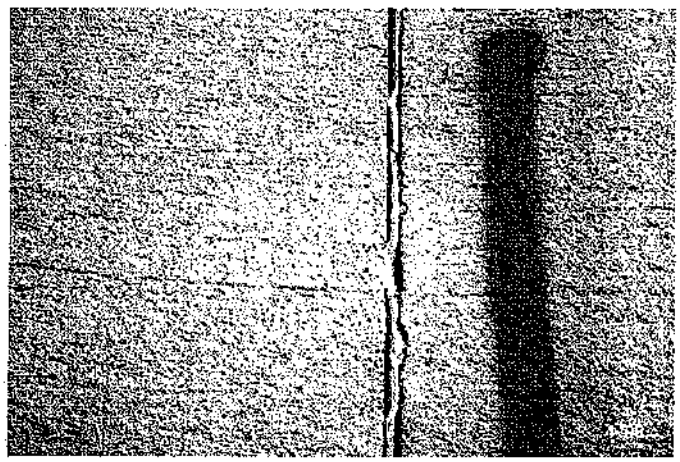
**Typical first-generation joint repair.**

The first generation of joint/crack seal was distinguished by an asphaltic-type material, apparently brush-stroked on in swaths of one to three inches in width, and done in repair of construction joints and small irregular cracks, as shown in the photo to the right. In general, these repairs appeared still to be effective, based on ERMS' visual inspection. However, in some places, weathering and shrinkage had previously hardened this material and created small fissures and/or caused separation from the crack edges. All such areas have been repaired during one of the two subsequent rounds of repairs described below.

The second generation of repairs was completed in 1999 by Truesdell Corporation, as subcontractor to ARCADIS Geraghty & Miller, reportedly using an epoxy material applied both to construction joints and to cracks. These repairs remained uniformly very tight and in good condition, as illustrated in the photo to the right.

**Typical second-generation crack repair by Truesdell Corporation as subcontractor to ARCADIS Geraghty & Miller.**

The most recent repairs were done by AGATE, Inc. during August, 2001, using Sikaflex-2c NS, a petroleum-resistant polyurethane elastomeric sealant applied both to joints and to cracks, as illustrated in the photo below. In some places, weathering and shrinkage had hardened this material and created small fissures and/or caused separation from the crack edges.



Although in the opinion of ERMS this material currently continues to provide an effective seal, these areas were marked with blue striping paint so that they could be identified and visually monitored in coming years.

**Conclusion**

The inspection indicated that the cap has been properly maintained, is functioning as intended, and remains an effective barrier to surface water infiltration. However, ERMS suggests budgeting in FY04 for relatively minor crack repairs in the areas marked by blue spray paint, in order to ensure on-going effectiveness of the cap. Given that the third-generation repairs appear to already require maintenance is some areas, and that the second-generation repairs remain tight and in good condition, ERMS suggests utilizing a method and material similar to the second-generation repairs for subsequent maintenance actions.

Based on historical cost data for the 1999 second-generation repairs, ERMS estimates approximately $8 per linear foot for irregular cracks and joints. Thus, very conservatively assuming a scope of 800 linear feet for repairs, the total budget figure would be estimated at approximately $6,400.

ERMS also recommends on-going maintenance and inspection of the cap in accordance with the ROD and to ensure the cap's effectiveness.

Thank you for the opportunity to be of service in this matter. If you have any questions regarding this report, please do not hesitate to contact us at (602) 896-2829.

Respectfully submitted,

**ENVIRONMENTAL RISK MANAGEMENT SERVICES, INC.**

Alan C. Thomas, P.E.
Principal

Registered Professional Engineer (Civil)
CERTIFICATE NO.
30527
ALAN C.
THOMAS
Date Signed 4-15-03
ARIZONA, U.S.A.

Attachments: 1. Selected Photographs
2. Modified Site Diagram

**Attachment 1**

**Selected Photographs**

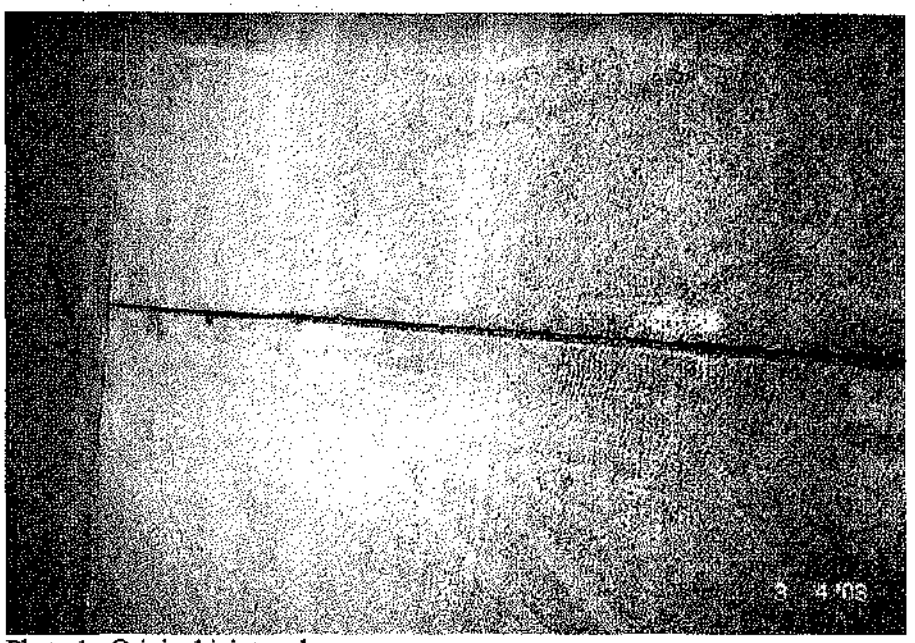


Photo 1: Original joint seal.

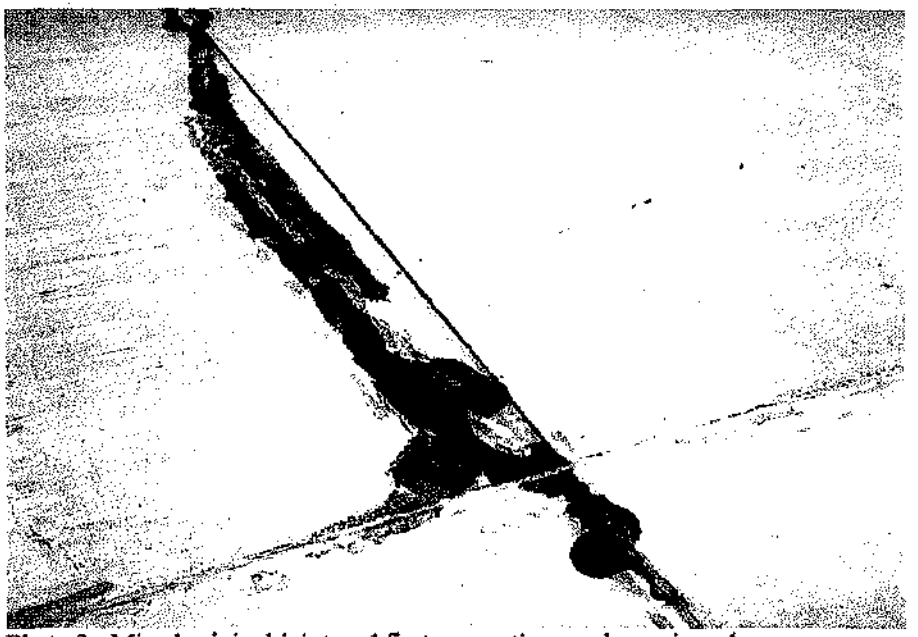


Photo 2: Mixed original joint seal first-generation crack repair and third-generation joint and crack repair.

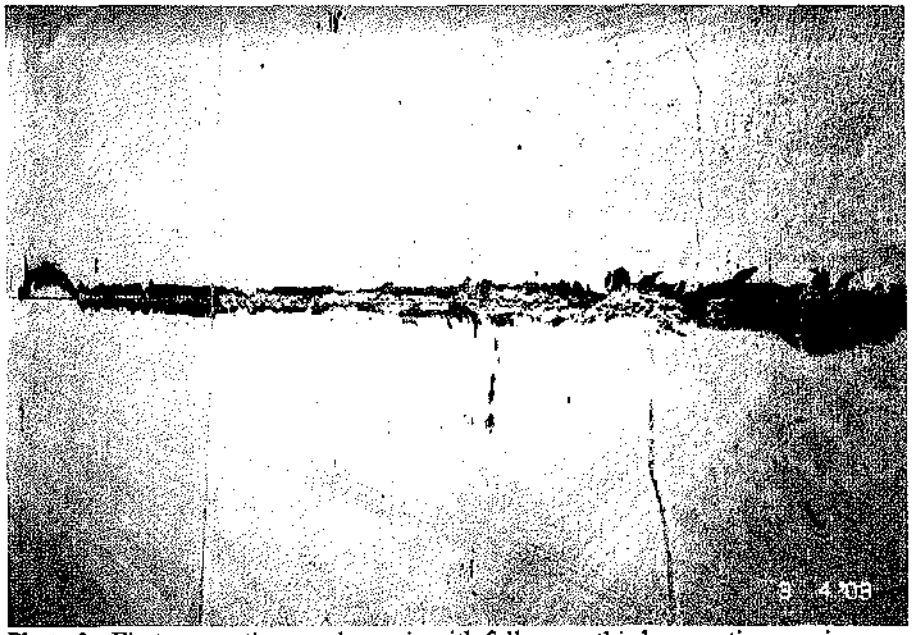


Photo 3: First-generation crack repair with follow-up third generation repair.

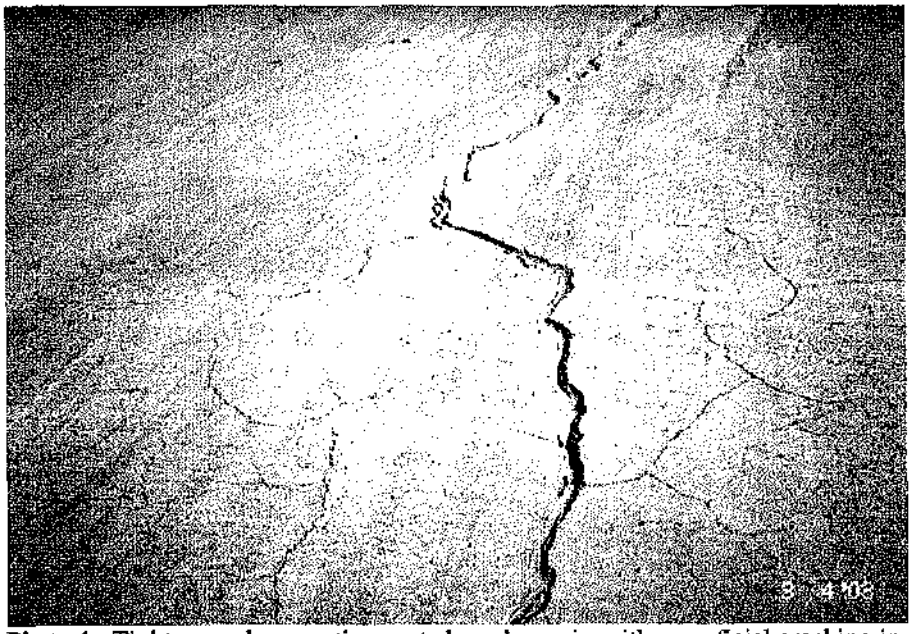


Photo 4: Tight second-generation routed crack repair, with superficial cracking in vicinity.

Photo 5: Tight second-generation routed crack repair, with superficial cracking in vicinity.

Photo 6: Tight second-generation routed crack repair, with superficial cracking in vicinity.

Photo 7: Third-generation joint repair.

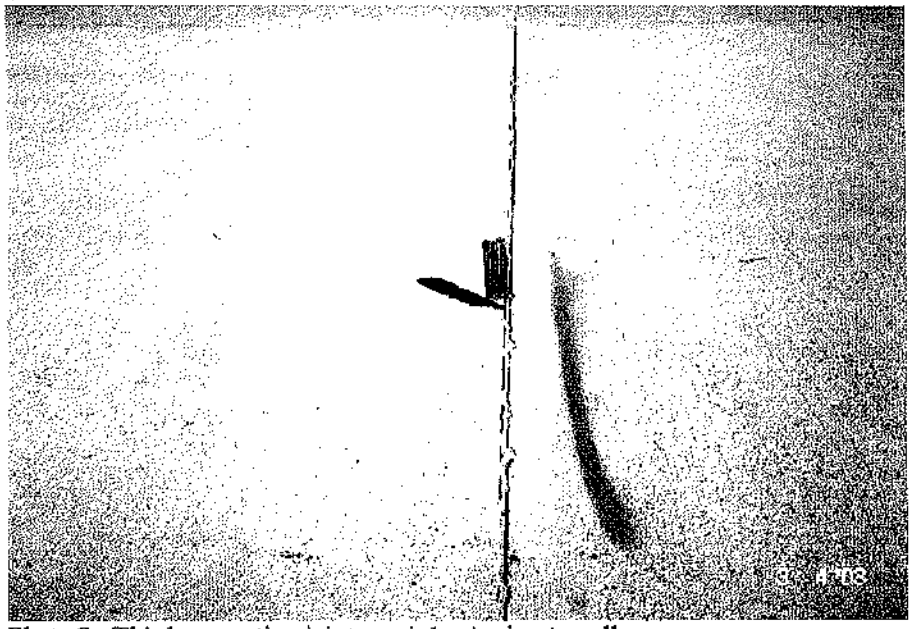


Photo 8: Third-generation joint repair beginning to pull away.

# ENVIRONMENTAL RISK MANAGEMENT SERVICES, INC.

http://www.ermsi.com

23821 N. 43rd Drive, Glendale, Arizona 85310
(623) 581-0840 fax (623) 581-0845


Registered Professional Engineer (Civil) CERTIFICATE NO. 30527 ALAN C. THOMAS Date Signed 6/30/04 ARIZONA, U.S.A.

June 30, 2004

Mr. Jeff Rothrock
Environmental Flight
56 CES/CEV
14002 W. Marauder Street, Bldg. 302
Luke AFB, AZ 85309-1125

**Subject: Inspection of Concrete Cap, Site ST-18, Building 993, Luke AFB, AZ**

Dear Mr. Rothrock:

Environmental Risk Management Services, Inc. (ERMS) has completed the annual inspection of the concrete cap at Site ST-18 for FY2004. The inspection indicated that the cap has been properly maintained, including recent repairs, is functioning as intended, and remains an effective barrier to surface water infiltration. ERMS recommends on-going inspection of the cap in accordance with the Record of Decision (ROD) and to ensure the cap's effectiveness.

**Background**

According to information provided by LAFB personnel, the cap was installed in 1987 as a means of controlling access to, and contaminant migration from, soils impacted by releases in the vicinity of three former underground storage tanks located west of building 993. The *Final Record of Decision, Operable Unit 2, Luke AFB, AZ* (Geraghty & Miller, 1994) documents the selection of the cap as a remedial measure, and prescribes inspection, maintenance and repair of the cap as the remediation goal. According to design data provided by LAFB (Plate 1, in pocket), the cap consists of a 30-mil high-density polyethylene (HDPE) liner, covered by six inches of aggregate base, covered by the 9-inch thick reinforced-concrete cap.

**Visual Inspection**

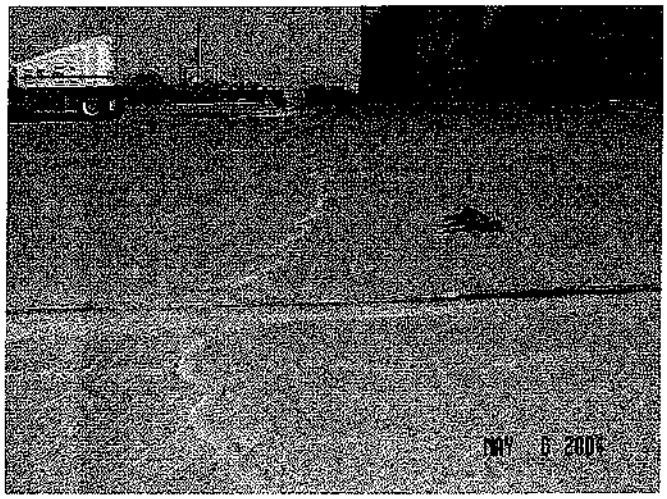
ERMS environmental professional Alan C. Thomas, P.E. conducted a visual inspection of the cap on May 6, 2004, accompanied by Ms. Dana Downs, 56 CES/CEVR. The inspection consisted of orienting the available diagrams with features observed in the field, then walking numerous transects of the cap area, with detailed visual inspection of cracks, joints, former penetrations, and other features of interest. Photographs located within the text illustrate selected features observed during the inspection.

As the cap is a part of the surrounding airfield pavement, some question had existed during previous inspections regarding the exact location and extent of the area requiring annual inspection and more rigorous maintenance. In order to document this area, ERMS and Luke AFB personnel previously coordinated current landmarks with that specific area identified in the *Record of Decision* as having soil concentrations exceeding Program Remediation Goals. Once the area was identified on the ground, corner points were marked on the pavement using

white paint, and the points were referenced by measurement to permanent features of the adjacent building. Attachment 1 provides a modification of the drawing provided in the *Record of Decision* illustrating this area and its reference points, referred to hereinafter as the "Subject" area.

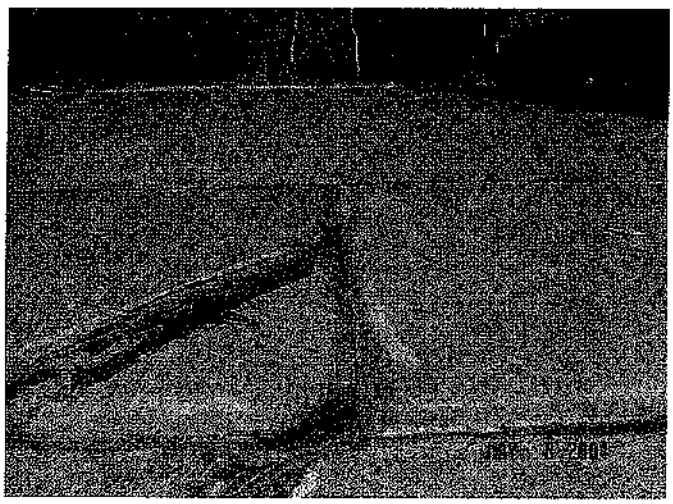
**Current Conditions**

At the time of the inspection, the cap was stable, without buckling or differential settlement discernible to the naked eye. There was no significant vertical displacement at any of the observed cracks or expansion joints. There were no unusual cracking patterns to suggest heaving or settlement in the substrate. There was no spalling or scaling of the surface areas of the cap, the cap surface was not stained, and the surface did not appear to have been impacted by chemical degradation.



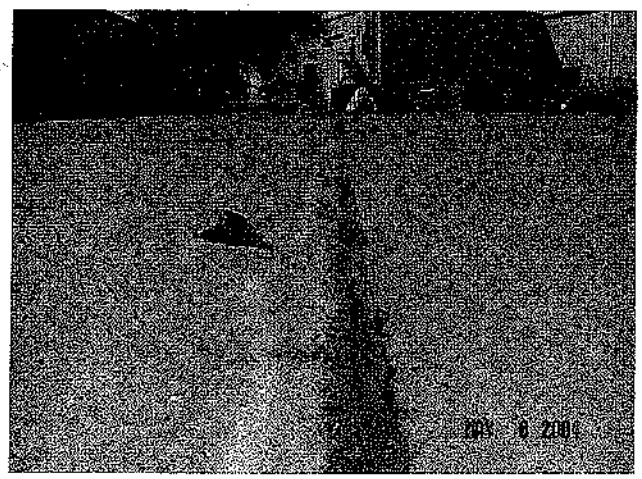
**View across the northern portion of the cap along second-generation crack repair, recent fourth-generation joint repair in background.**

Joints and cracks in the concrete were carefully inspected, as these locations represent the most likely route of any minor surface water infiltration. Three separate generations of repairs to the cap had been previously conducted at joints and cracks. These repairs primarily consisted of routing and/or sealing cracks and joints, and replacing concrete around a monitoring well vault. The first generation of joint/crack seal was distinguished by an asphaltic-type material, apparently brush-stroked on in swaths of one to three inches in width, and done in repair of construction joints and small irregular cracks. The second generation of repairs was completed in 1999 by Truesdell Corporation, as subcontractor to ARCADIS Geraghty & Miller, reportedly using an epoxy material applied both to construction joints and to cracks. The third-generation repairs were done by AGATE, Inc. during August, 2001, using Sikaflex-2c NS, a petroleum-resistant polyurethane elastomeric sealant applied both to joints and to cracks.



**Recent fourth-generation crack and joint repairs over previous first-generation asphaltic repairs and third-generation Sikaflex-2c repairs.**

During FY2003, ERMS identified approximately 800 linear feet of joints and cracks for proactive maintenance activities on the cap. These areas represented primarily original joint seal material, first-generation asphaltic crack/joint seal repairs and third-generation Sikaflex-2c



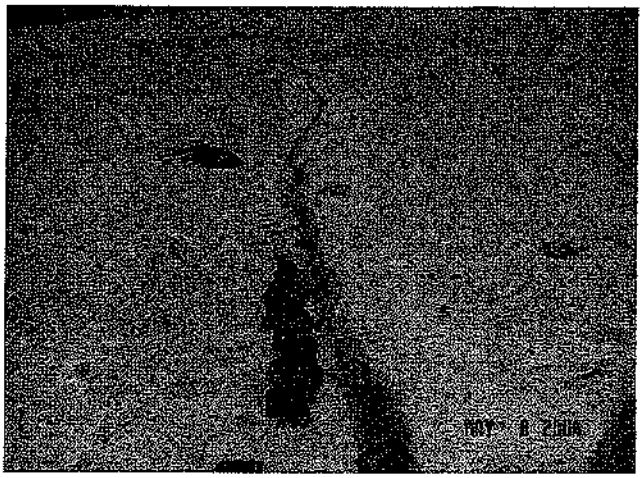
**Recent fourth-generation joint repair replacing third-generation Sikaflex-2c repair.**

ERMS carefully inspected these fourth-generation repairs during the site visit and found them to be very tight and in good condition.

**Conclusion**

As of the date of this inspection, the original joint material, first-generation asphaltic crack/joint seal and third-generation Sikaflex-2c have all been replaced by either second or fourth-generation crack/joint seal material.

The inspection indicated that the cap has been properly maintained, is functioning as intended, and remains an effective barrier to surface water infiltration. ERMS does not suggest repair or maintenance activities for FY2004.



**Fourth-generation crack repairs.**

NS crack/joint seal repairs. The second-generation epoxy repairs were uniformly tight and in good condition, and did not warrant repair. The marked areas were repaired during October 2003 by routing cracks and joints and re-sealing them using Crafco Roadsaver Silicone SL. The manufacturer's product data sheet, included as Attachment 2, specifies it for use in airfield pavements, as it is designed to be resistant to jet blast, high ambient temperatures and intermittent fuel and oil spills.

**Typical intersection of original joint material, recently replaced with fourth-generation repairs, first-generation asphaltic repair replaced with fourth-generation repair, and incidental soil boring core location replaced with a tight concrete seal.**

ERMS does recommend on-going inspection of the cap in accordance with the ROD and to ensure the cap's effectiveness in coming years.

Thank you for the opportunity to be of service in this matter. If you have any questions regarding this report, please do not hesitate to contact us at (623)581-0840.

Respectfully submitted,

**ENVIRONMENTAL RISK MANAGEMENT SERVICES, INC.**

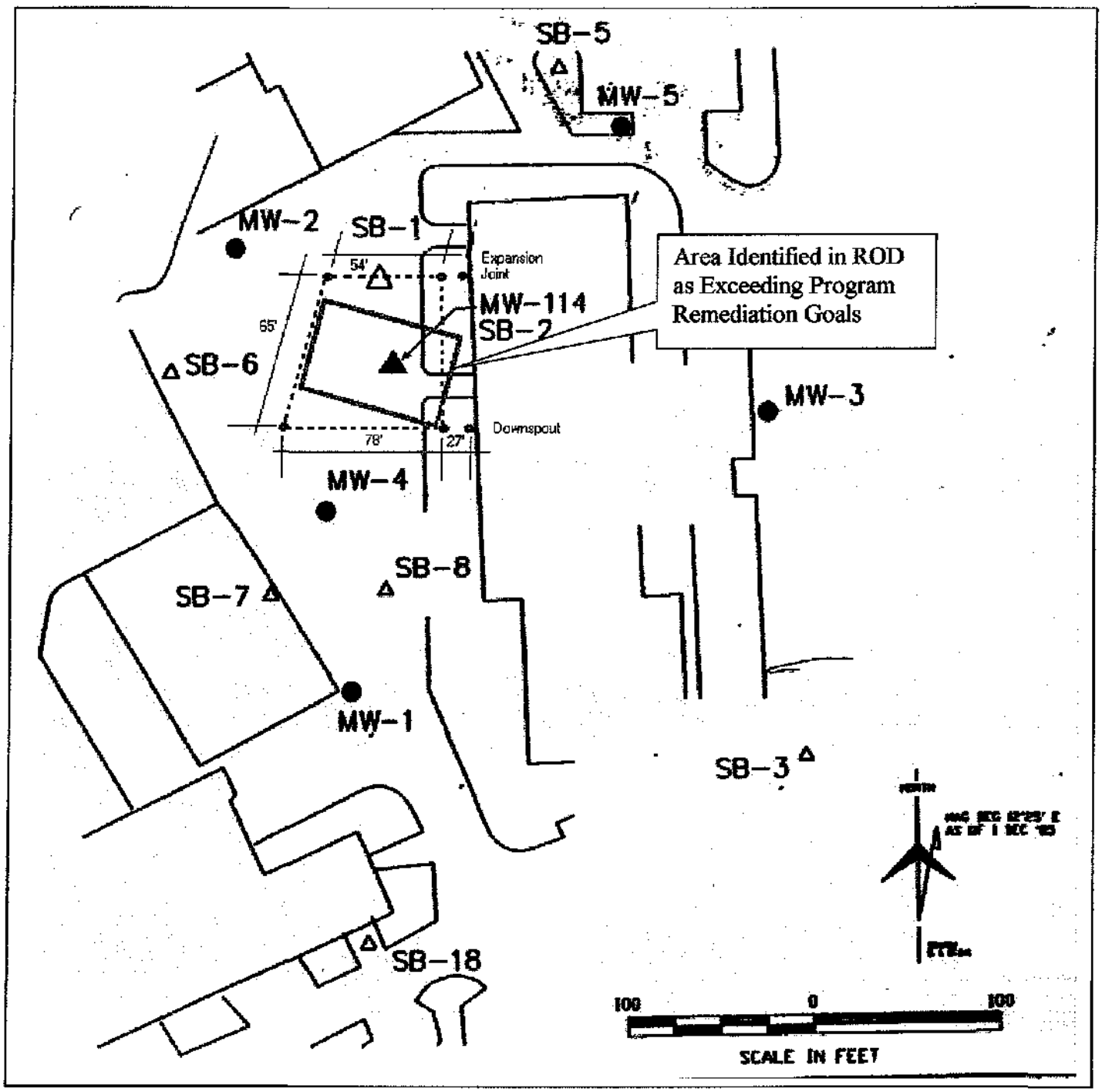
Registered Professional Engineer (Civil)
CERTIFICATE NO.
30527
ALAN C.
THOMAS
Date Signed 6/14/04
ARIZONA, U.S.A.

Alan C. Thomas, P.E.
Principal

Attachments: 1. Modified Site Diagram
2. Crafco Roadsaver Silicone SL Product Data Sheet

**Attachment 1**

**Modified Site Diagram**




**Site Diagram**

Modified from Figure 4, *Final Record of Decision, Operable Unit 2, Luke AFB, AZ* (Geraghty & Miller, 1994)

**Attachment 2**

**Crafco Roadsaver Silicone SL Product Data Sheet**

CRAFCO INC
AN ERGON COMPANY
420 N. Roosevelt Ave. • Chandler AZ 85226
1-800-528-8242 • (602) 276-0406 • FAX (480) 961-0513
www.crafco.com

PRODUCT DATA SHEET

# ROADSAVER SILICONE SL

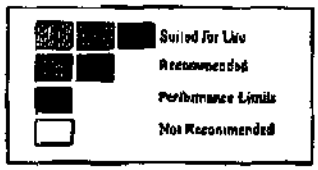
PART NO. 94903

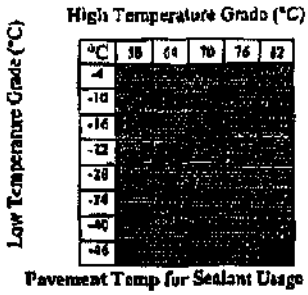
JANUARY 2004

READ BEFORE USING THIS PRODUCT

**GENERAL** Crafco RoadSaver Silicone SL is a low modulus silicone which offers the performance and durability characteristics of conventional silicone with the ease of installation of self-leveling materials. Crafco Roadsaver Silicone SL is supplied as a ready to use one component moisture curing system which provides a lasting and flexible seal. Crafco Roadsaver Silicone SL offers outstanding weathering resistance, remains flexible down to temperatures as low as –50°F (-46°C), is jet-blast resistant and will maintain field serviceability when exposed to intermittent fuel and oil spills. It bonds strongly to concrete joints without the use of a primer. Crafco Roadsaver Silicone SL can be used in all typical concrete joint applications on highway and airfield pavements in all climates. RoadSaver Silicone sealant is compatible with asphalt pavement. RoadSaver Silicone SL is easily applied to concrete joints using bulk dispensing system units such as those available from manufacturers including Pyles/Graco and Johnstone. The levelling characteristics insure that the required joint wetting for development of appropriate adhesion occurs during application, no tooling is required.

**USAGE GUIDELINES** RoadSaver Silicone SL pavement temperature performance limits are 82-46 for joint sealing. Usage recommendations are shown in Crafco pavement temperature grade charts shown at the right. Refer to Crafco Product Selection Procedures to determine sealant or filler and pavement temperature grades.




**SPECIFICATION CONFORMANCE** Crafco RoadSaver Silicone SL conforms to specifications for low modulus silicone for many highway departments and federal agencies. The product also meets and exceeds all requirements of ASTM D5893. "Standard Specification for Cold-Applied Single Component, Chemically Curing Silicone Sealant for Portland Cement Concrete Pavements" for type SL sealants. In the following specifications several of the D5893 parameters are more restrictive to better reflect properties of RoadSaver Silicone SL.

| ASTM D5893 Physical Requirements | ASTM D5893 SL Requirements | RoadSaver Silicone SL Requirements |
|---|---|---|
| Cure Evaluation | Pass at 21 days | Pass at 21 day max. |
| Rheological Properties (ASTM C639) | Type 1, smooth level surface | Type 1, smooth level surface |
| Extrusion Rate (ASTM C1183) | Type S, 50 ml/ min. minimum | Type S, 200 ml/min. minimum |
| Tack Free Time (ASTM C 679) | 5 hr. max. | 3 hr. max. |
| Effects of Heat Aging (ASTM C 792) | 10% max. Loss | 10% max. Loss |
| Bond. -29°C (-20°F), 100% Extension | | |
| Non-Immersed | Pass 5 Cycles | Pass 5 Cycles |
| Water Immersed | Pass 5 Cycles | Pass 5 Cycles |
| Oven-Aged | Pass 5 Cycles | Pass 5 Cycles |
| Hardness (ASTM C 661) | | |
| -29°C (-20°C), Type A2 | 25 max. | 10 max. |
| 23°C (73°F), Type 00 | 30 min. | 40-80 min. |
| Flow | No flow | No flow |
| Rubber Properties in Tension | | |
| Ultimate Elongation | 600% min. | 800% min. |
| Stress at 150% Elongation | 310 K pa (45 psi) max. | 207 K pa (30 psi) max. |
| Effects of Accelerated Weathering | Pass 500 hours | Pass at 5000 hours |
| Resilience | 75% min. | 75% min. |

**Additional properties of RoadSaver Silicone SL Sealant are:**

| | |
|---|---|
| Specific Gravity (ASTM D792-A) (1) | 1.10-1.40 |
| Adhesion to Concrete (MIL 8802) (2) | 20 pli (3.5 kg/cm) min. |
| Bond and Movement Capability +/- 50% (ASTM C719) (2) | Pass 10 cycles |
| Bond to Mortar (AASHTO T132) (2) | 50 psi (34.4 N/cm$^2$) min. |
| Tensile Adhesion, %(ASTM D5329) (3) | 600% min. |

Notes: (1) Specimens shall be obtained from 1/8 inch (3mm) thickness sheets of material which has been cured for 7 days at 77+/- 3°F (25+/-2°C) and 50 +/- 5% relative humidity.
(2) Specimens cured for 28 days at 77 +/- 3°F (25+/-2°C) and 50 +/- 5% humidity prior to testing.
(3) Specimens shall be 1/2" x 1/2" x 2" (1.2cm x 1.2cm x 5.0cm), cured 7 days at 77 +/- 3°F (25+/-2°C) and 50% +/- 5% relative humidity.

©2003, Crafco, Inc., All Rights Reserved

**APPLICATION** The unit weight is 10.7 pounds per gallon (1.28 kg/L). One gallon will seal 150 feet (45.7m) of 1/2 inch (1.2cm) wide by 1/4 inch (0.6cm) deep joint. Exact yield will vary depending on thickness of sealant, waste, application techniques, etc. Prior to use, the user must read and follow Application Instructions for RoadSaver Silicone Sealants (January 2002) to verify proper product selections, applicator pumps, pavement preparation procedures, application geometry, usage precautions and safety procedures. These instructions are provided with each drum of sealant.

**PACKAGING** Roadsaver Silicone SL Sealant is packaged in plastic lined open head 55 gallon (208 L) drums which contain 50 gallons (189 L) of material. Additionally, for small applications the sealant is available in plastic 5 gallon (19 L) pails and quart (.95 L) caulking tubes.

**WARRANTY** CRAFCO, Inc. warrants that CRAFCO sealants meet applicable ASTM, AASHTO, Federal or State specifications at time of shipment. Techniques used for the preparation of the cracks and joints prior to sealing are beyond our control as are the use and application of the sealants; therefore, Crafco shall not be responsible for improperly applied or misused sealants. Remedies against Crafco, Inc., as agreed to by Crafco, are limited to replacing nonconforming product or refund (full or partial) of purchase price from Crafco, Inc. All claims for breach of this warranty must be made within three (3) months of the date of use or twelve (12) months from the date of delivery by Crafco, Inc. whichever is earlier. There shall be no other warranties expressed or implied. **For optimum performance, follow Crafco recommendations for sealant installation.**

©2005, Crafco, Inc., All Rights Reserved

**DEPARTMENT OF THE AIR FORCE**
**AIR EDUCATION AND TRAINING COMMAND**
**56TH CIVIL ENGINEER SQUADRON**
**LUKE AFB, AZ 85309**

Registered Professional Engineer (Civil) CERTIFICATE NO. 30527 ALAN C. THOMAS Date Signed 2/1/06 ARIZONA, U.S.A.

26 Jan 2006

MEMORANDUM FOR THE RECORD

FROM: 56 Civil Engineer Squadron, Environmental Flight
56 CES/CEVQR
13970 W. Lightning St., Building 302
Luke AFB, AZ 85309

SUBJECT: Inspection of Concrete Cap, Site ST-18, Building 993

1. An inspection of the concrete cap at Site ST-18 was completed on 26 Jan 2006. This inspection indicated that the cap has been properly maintained, is functioning as intended, and remains an effective barrier to surface water infiltration. Inspection of the cap annually will continue to ensure the cap's ongoing effectiveness, in accordance with the Record of Decision (ROD).

**2. Background.** The cap was installed in 1987 as a means of controlling access to, and contaminant migration from, soils impacted by releases in the vicinity of three former underground storage tanks located west of building 993. The *Final Record of Decision, Operable Unit 2, Luke AFB, AZ* (Geraghty & Miller, 1994) documents the selection of the cap as a remedial measure, and prescribes inspection, maintenance and repair of the cap as the remediation goal. According to design data, the cap consists of a 30-mil high-density polyethylene (HDPE) liner, covered by six inches of aggregate base, covered by the 9-inch thick reinforced-concrete cap.

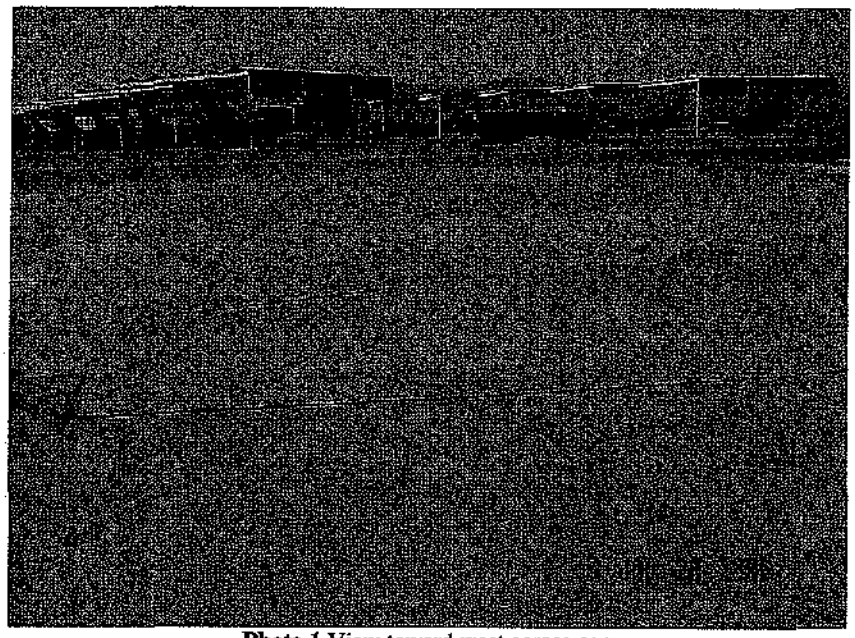


**Photo 1** View toward west across cap

**3. Visual Inspection.** Alan C. Thomas, P.E. conducted a visual inspection of the cap on 26 Jan 2006. The inspection consisted of orienting the available diagrams with features observed in the field, then walking numerous transects of the cap area, with detailed visual inspection of cracks, joints, former penetrations, and other features of interest. Photographs located within the text illustrate selected features observed during the inspection.

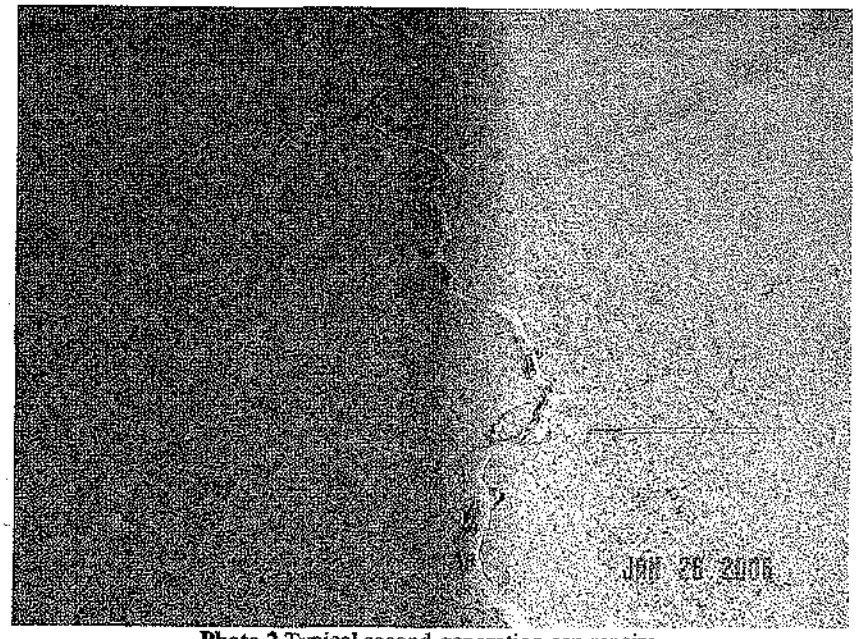


**Photo 2** Typical second-generation cap repairs.

**4. Subject Area.** As the cap is a part of the surrounding airfield pavement, some question had existed during previous inspections regarding the exact location and extent of the area requiring annual inspection and more rigorous maintenance. In order to document this area, Luke AFB personnel had previously undertaken to coordinate current landmarks with that specific area identified in the *Record of Decision* as having soil concentrations exceeding Program Remediation Goals. Once the area was identified on the ground, corner points were marked on the pavement using white paint, and the points were referenced by measurement to permanent features of the adjacent building. These references are documented in previous cap inspection reports.

**5. Current Conditions.** At the time of the inspection, the cap was stable, without buckling or differential settlement discernible to the naked eye. There was no significant vertical displacement at any of the observed cracks or expansion joints. There were no unusual cracking patterns to suggest heaving or settlement in the substrate. There was no spalling or scaling of the surface areas of the cap, the cap surface was not stained, and the surface did not appear to have been impacted by chemical degradation. Joints and cracks in the concrete were carefully inspected, as these locations represent the most likely route of any minor surface water infiltration.

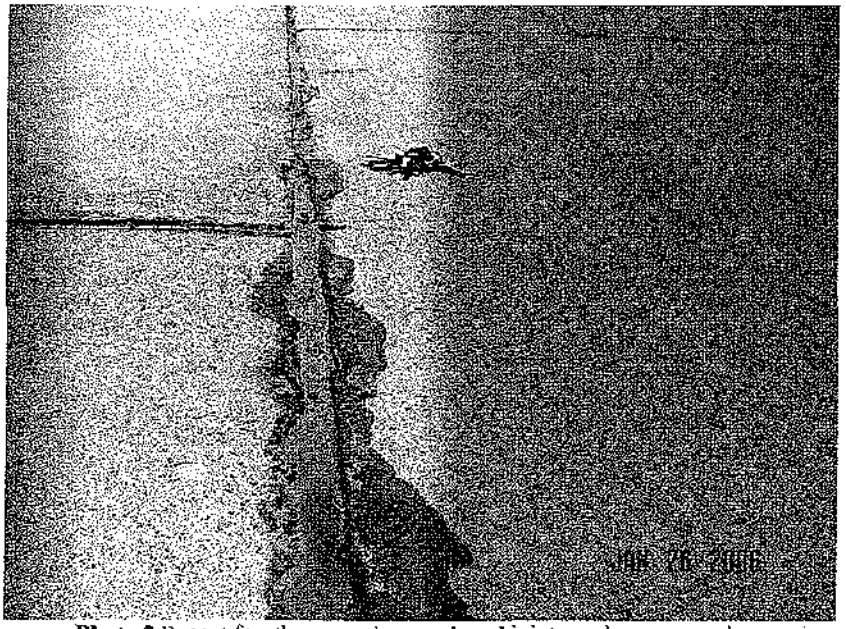


**Photo 2** Recent fourth-generation crack and joint repairs over previous first-generation asphaltic repairs and third-generation Sikaflex-2c repairs.

**6. Previous Repairs.** Four separate generations of repairs to the cap had been previously conducted at joints and cracks. These repairs primarily consisted of routing and/or sealing cracks and joints, and replacing concrete around a monitoring well vault. The first generation of joint/crack seal was distinguished by an asphaltic-type material, apparently brush-stroked on in swaths of one to three inches in width, and done in repair of construction joints and small irregular cracks. The second generation of repairs was completed in

1999 by Truesdell Corporation, as subcontractor to ARCADIS Geraghty & Miller, reportedly using an epoxy material applied both to construction joints and to cracks. The third-generation repairs were done by AGATE, Inc. during August, 2001, using Sikaflex-2c NS, a petroleum-resistant polyurethane elastomeric sealant applied both to joints and to cracks. During FY2003, approximately 800 linear feet of joints and cracks were identified identified for proactive maintenance activities on the cap. These areas represented primarily original joint seal material, first-generation asphaltic crack/joint seal repairs and third-generation Sikaflex-2c NS crack/joint seal repairs. The second generation epoxy repairs were uniformly tight and in good condition, and did not warrant repair. The marked areas were repaired during FY2003 by routing cracks and joints and re-sealing them using Crafco Roadsaver Silicone SL. The manufacturer's product data sheet specifies it for use in airfield pavements, as it is designed to be resistant to jet blast, high ambient temperatures and intermittent fuel and oil spills. These fourth-generation repairs were carefully inspected during the site visit and found to be very tight and in good condition.

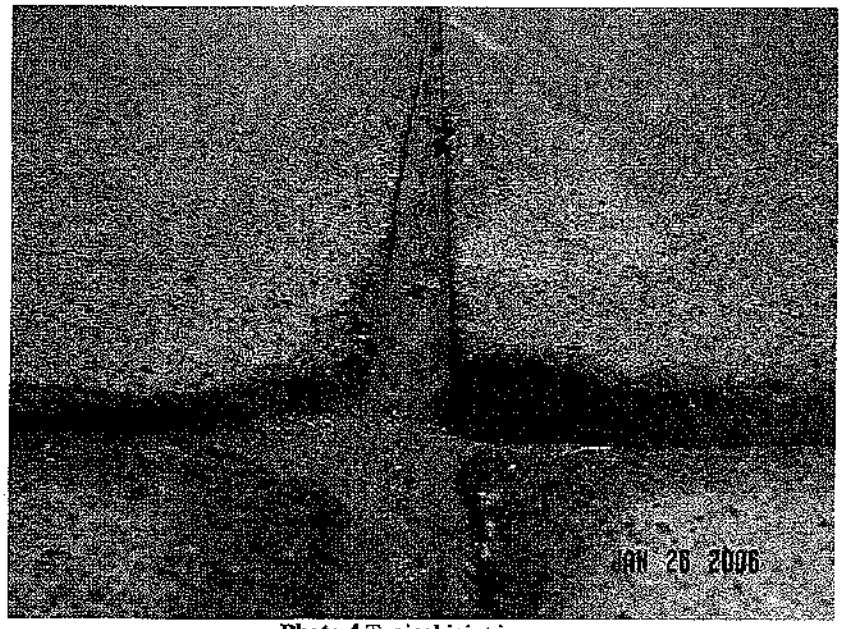


**Photo 4** Typical joint in cap.

**7. Conclusions.** As of the date of this inspection, the original joint material, first-generation asphaltic crack/joint seal and third-generation Sikaflex-2c have all been replaced by either second or fourth-generation crack/joint seal material. The inspection indicated that the cap has been properly maintained, is still functioning as intended, and remains an effective barrier to surface water infiltration. No repair or maintenance activities are suggested for FY2006. Inspection of the cap annually will continue to ensure the cap's ongoing effectiveness, in accordance with the Record of Decision (ROD).

ALAN C. THOMAS, GS-0819-11, DAF
Restoration Program Manager

Registered Professional Engineer (Civil)
CERTIFICATE NO.
30527
ALAN C.
THOMAS
Date Signed 2/1/06
ARIZONA, U.S.A.