ARIZONA
TRANSPORTATION
RESEARCH
CENTER

THORITE AND ROADPATCH

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PRODUCT EVALUATION

84-08

THORO PRODUCT DEMONSTRATION

JULY 18, 1986

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16. ABSTRACT

This report contains a product evaluation of Thoro System's "Roadpatch" and "Thorite."

Roadpatch is a cement base, fast-setting patching material. The material is fortified with special alkali resistant glass fibers. It is designed to repair potholes in portland cement concrete.

Roadpatch was demonstrated in Arizona on a section of concrete pavement. In a two-year evaluation, the product performed well. All of the patches held up under heavy traffic. The Arizona Transportation Research Center recommends that this material be considered for use on maintenance projects.

Thorite is another Thoro System product. It is a fast-setting, non-shrink material for patching curbs.

The Thorite material cracked and failed within one year. The patch did not bond well to the original concrete or to the other patches. Based on its poor performance, the Arizona Transportation Research Center has recommended not using it on further curb patching projects.

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INDEX

	PAGE
INTRODUCTION	1
LOCATION OF TEST SECTIONS	2
TEST CONDITIONS AND PROCEDURES	4
CONSTRUCTION ANALYSIS	8
EVALUATION	11
RECOMMENDATIONS	14
APPENDIX	
MAP OF LOCATION	A1
MATERIAL INFORMATION	B1

I. INTRODUCTION:

Joint breakouts in concrete pavement are becoming an ever increasing problem along the Black Canyon Freeway (I-17). As the joints begin to deteriorate potholes form in the pavement. To repair these potholes, a 6-7 man maintenance crew is usually required. Their effective work time is limited to the hours between 9:00 a.m. and 2:30 p.m. to avoid rush hour traffic. Previous repair work has utilized Set 45 and Cono-crete 149. The Set 45 repairs failed within one year but the Cono-crete 149 seems to perform satisfactorily.

Another form of spalling which has received a great deal of attention from the District Maintenance Section is curb spalling along the off ramps at intersections. The concrete curbs along these intersections are severely cracked and deteriorated due to truck traffic. These curbs are usually repaired by patching but most have deteriorated so severely that they may have to be removed and replaced.

Thoro System Products has introduced two products which deal with pothole patching and curb spalling problems. Thoro's "Roadpatch" is a cement base, fast-setting patching material. The material is fortified with special alkali resistant glass fibers. The glass fibers improve the impact, flexural and tensile strengths of this high compression strength mix to resist cracking and abrasion resistance. With Roadpatch, traffic bearing patches can be put back into service in two hours.

Thoro System Products has also developed "Thorite" to patch old or deteriorated concrete curbs. Thorite is a fast-setting, nonshrink patching material especially prepared to repair

concrete. Thorite can be used to rehabilitate disintegrated areas without the need for formwork. It can also be used on spalling bridge decks.

II. CONSTRUCTION REPORT

Thoro System Products demonstrated its products on December 6, 1984 at two locations in the Phoenix area. In attendance were Larry Foppe and Bill Briscoe of ADOT, Ian Barberton of Thoro, and Don Sobczak of Builders Specialty Supply. A pothole was patched on I-17 at Van Buren Street using Roadpatch, and a deteriorated curb section at Beardsley Road and I-17 was repaired using Thorite patching material. An evaluation of these products was performed over an eighteen month period. Arizona Transportation Research Center was contacted to aid in the evaluation and document the test sites.

A. LOCATION OF TEST SECTIONS

1) Roadpatch

The Roadpatch material was placed in a pothole located on I-17 just south of Van Buren Street (Figure 1). The pothole is located in the southbound travel lane at Station 137-45.

2) Thorite

The Thorite test site is located on Beardsley Road at the I-17 northbound on-ramp intersection (Figure 2). The northwest corner curb was reconstructed using Thorite and was marked with white spray paint (Figure 3). Points "a" to "b" represent the area patched with Thorite and "b" to "c" represent the area patched with Thorite and pea gravel. The second section ("b" to "c") was completed one week after the original section.

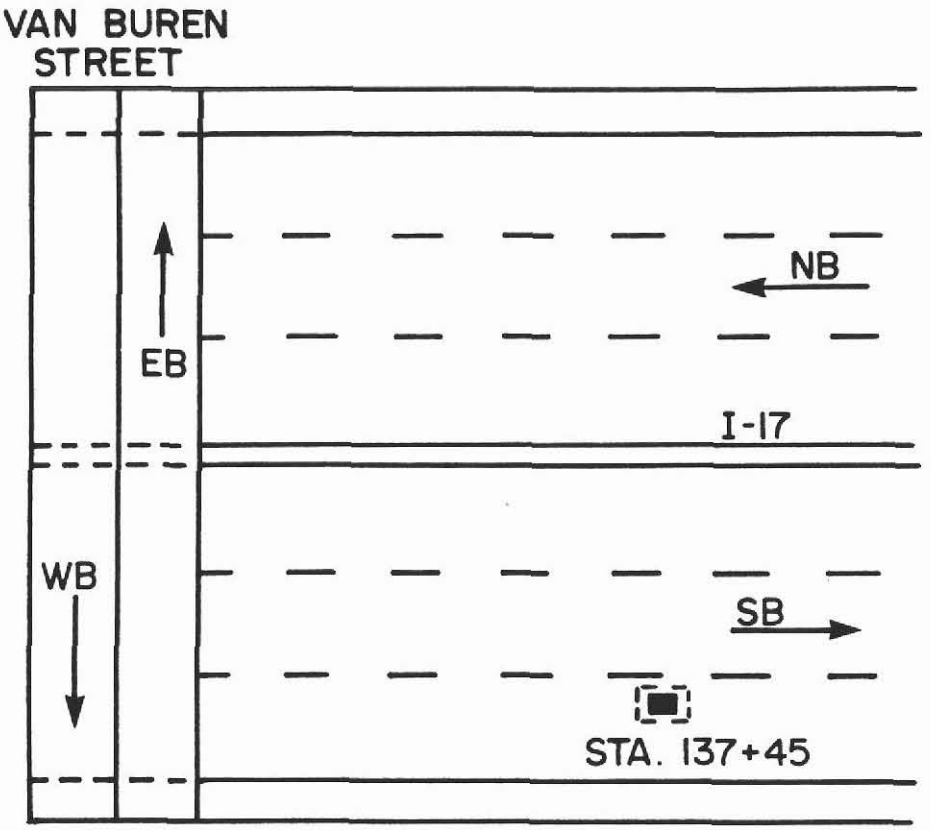

FIGURE 1 - LOCATION OF ROADPATCH TEST SECTION

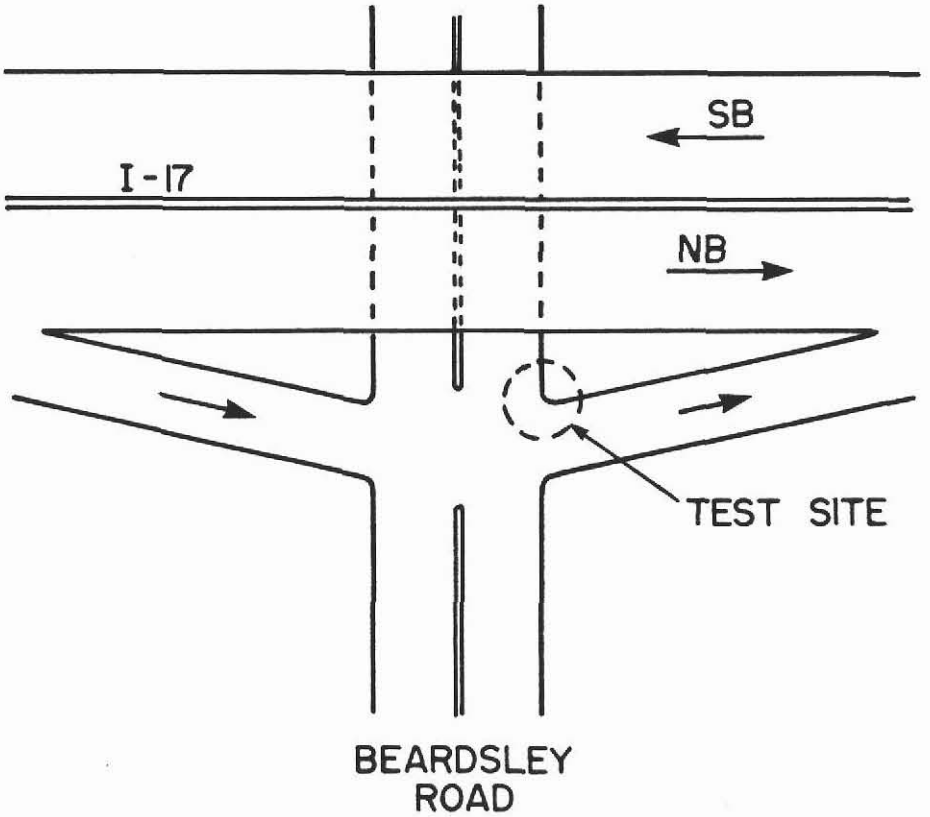

FIGURE 2 - LOCATION OF THORITE TEST SITE

AT BEARDSLEY ROAD AND I-17

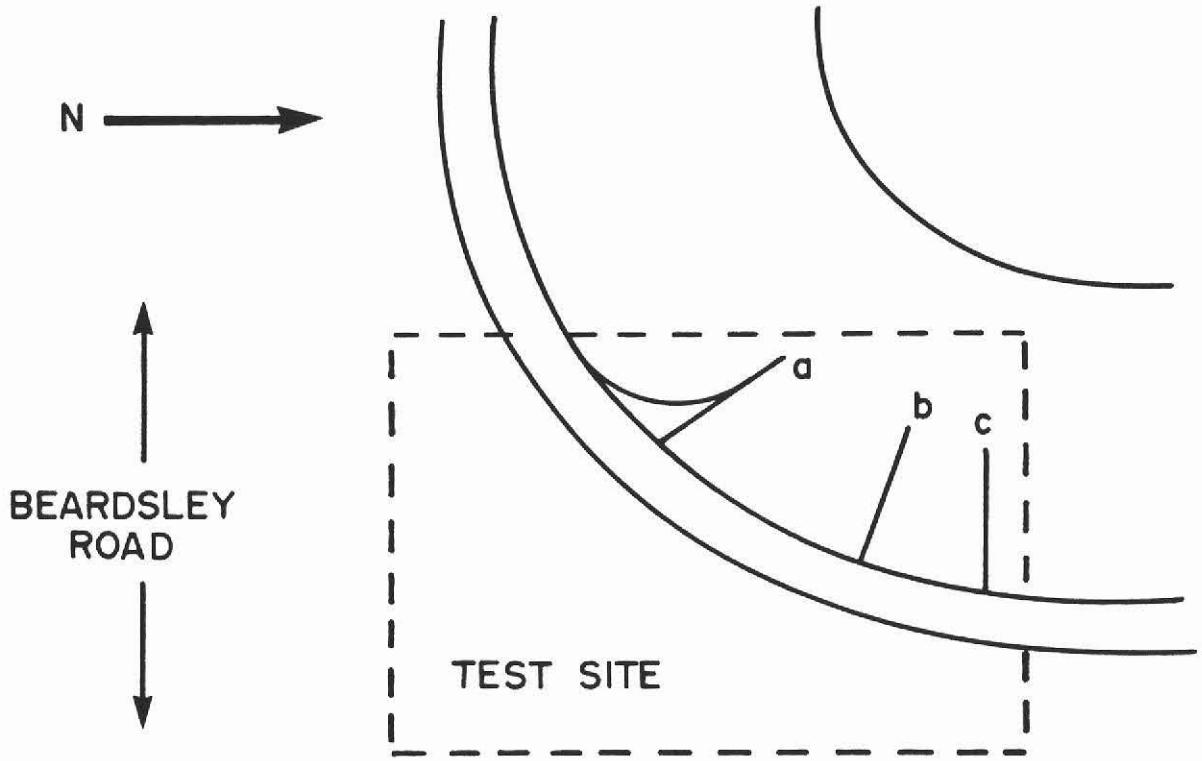

FIGURE 3 - MARKINGS ON THORITE TEST SITE

III. TEST CONDITIONS AND PROCEDURES

a) Roadpatch

The I-70 Roadpatch test site was placed at about 11:30 a.m. The ambient air temperature was approximately 70°F. District I maintenance provided traffic control and performed the pothole preparatory work. The preparatory work consisted of removing deteriorated concrete, (Figure 4) brooming the debris, and air blasting the cavity. The prepared cavity measured 16"x32"x2" (Figure 5).

Representatives from Thoro Products placed the patching material. First, a slurry coat of the Roadpatch was brushed on. (Figure 6) and then the patch mix was placed over the slurry coat (Figure 7). The patch mix was prepared by mixing Roadpatch with a liquid containing 1 part Acryl-60 to 3 parts clean water. Mixing

FIGURE 4 - REMOVING DETERIORATED CONCRETE

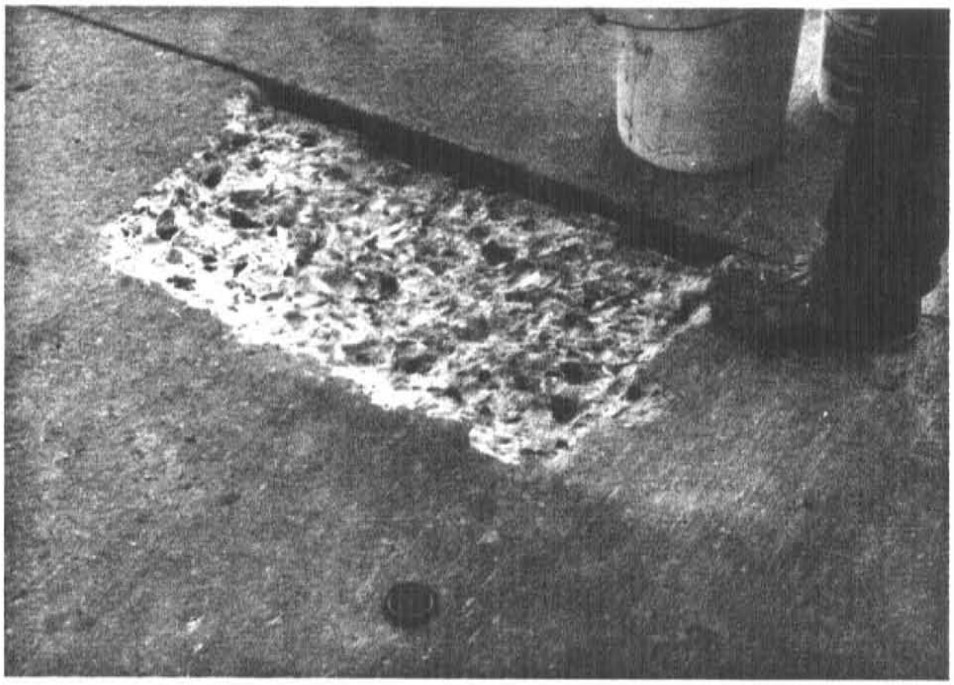

FIGURE 5 - POTHOLE IMMEDIATELY BEFORE PATCHING

FIGURE 6 - BRUSHING ON SLURRY COAT

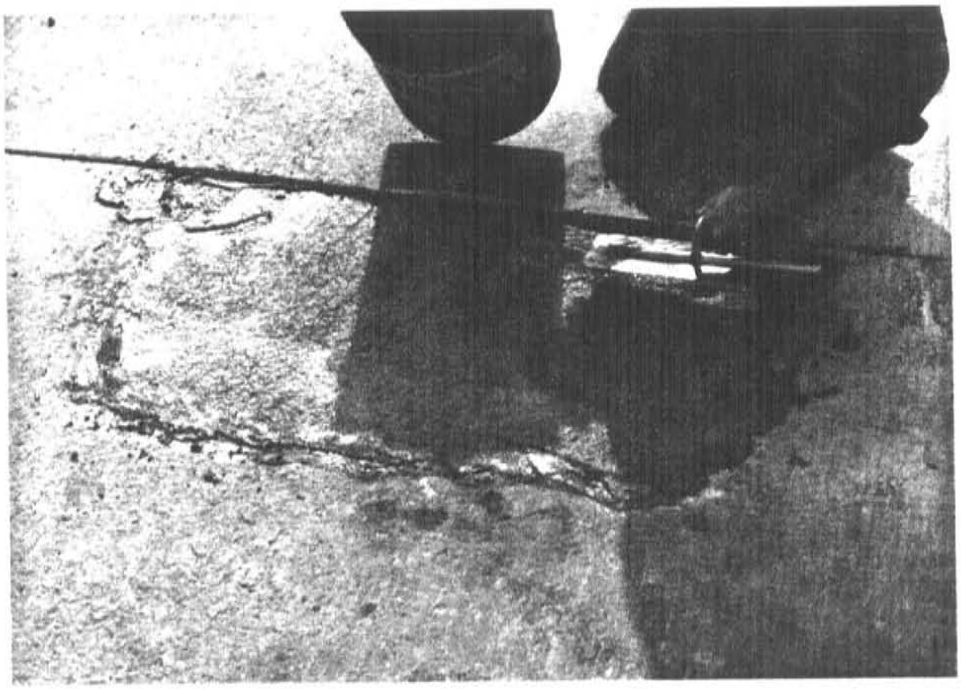

FIGURE 7 - PLACING ROADPATCH

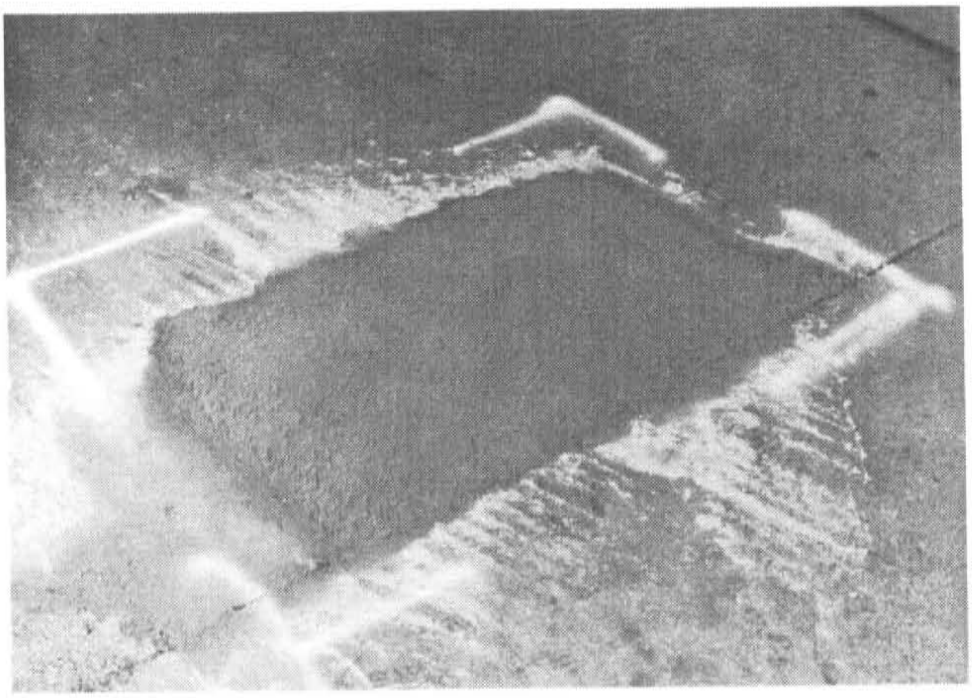

FIGURE 8 - COMPLETED PATCH

took 1-2 minutes in a mechanical mixer. The patch work was completed in about 10 minutes (Figure 8).

Approximately two 50 pound bags of Roadpatch mix were used at a cost of $11.47 per bag. The Acryl 60 liquid cost approximately $45.56 per 5 gallon bottle.

b) Thorite

The Thorite test was placed at about 9:00 a.m. The ambient temperature was approximately 60-70°F. The northwest curb was arbitrarily chosen for reconstruction. The curb was 5-6 inches high and about 3-4 feet in length.

The curb area was cleaned and all loose particles were removed (Figure 9). Although a wire brush was used to clean the area, the Thoro representative stated that a water blaster could have been used. The surfaces of the area to be patched were

dampened and coated with a slush coat of Thorite, making sure all pores and voids were filled (Figure 10). Consecutive layers of Thorite were applied in 1-2 inch lifts (Figure 11). The surfaces were scratched before addition of successive lifts. No form work was used to construct the curb. The finished curb is shown in Figure 12.

The materials incorporated into the patch consisted of a white liquid mix (Acryl 60) added to water and the Thorite patch mix. The Acryl 60 bonding agent was used because of the large size of the patch and because no gravel was utilized in the patch. One and one-half cans were used at a cost of $21.00 per can. Each can contained about 60 pounds of material.

Only half of the curb was finished during the demonstration. To save time and material, the remainder of the curb was reconstructed a week later by Thoro Products personnel using pea gravel mix. The beginning and ends of both test sites were marked with white spray paint.

IV. ANALYSIS

a) Roadpatch

The Roadpatch repair was completed in about 10 minutes with no problems. This system would seem to have potential due to its short maintenance time and quick setting time. Although two hours is recommended for setting, the Thoro representative stated that at higher temperatures, 3/4 - 1 hour would be sufficient. The shorter setting time could be advantageous in emergency situations. Another advantage of roadpatch is that the patch can be placed flush with the pavement surface because there is very little densification. Finally, from an aesthetic standpoint white

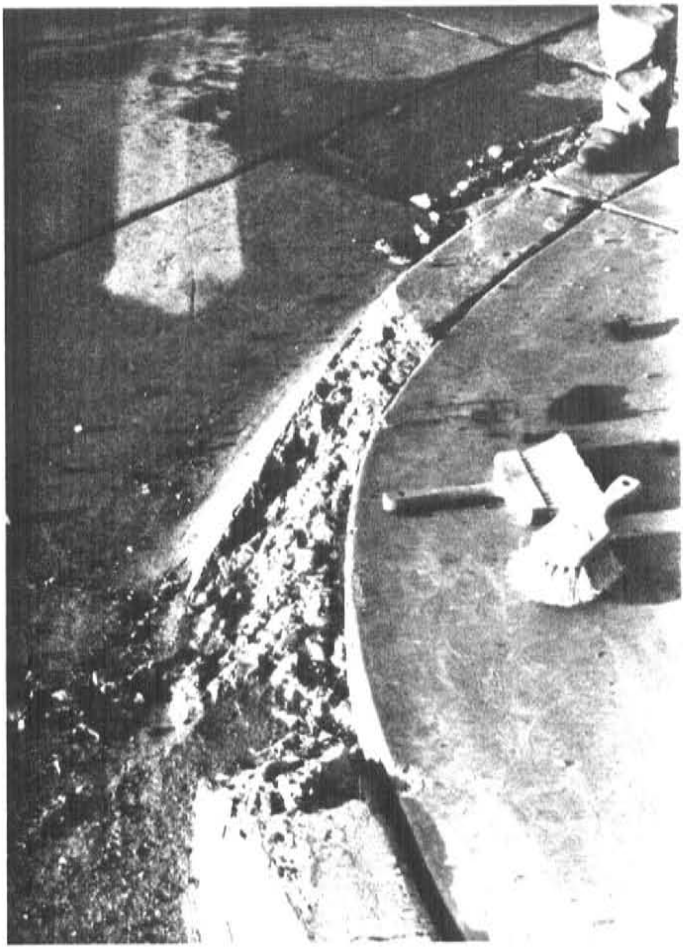

FIGURE 9 - REMOVING LOOSE DEBRIS AND PREPARING CURB

FIGURE 10 - INITIAL COAT OF THORITE CURB PATCHING MATERIAL

FIGURE 11 - PLACING 1-2 INCH LIFTS OF THORITE

FIGURE 12 - DECEMBER 6 PATCH COMPLETED

patches are desirable over black patches on concrete.

b) Thorite

The Thorite patch was completed in approximately 75 minutes. This long period of time was due to the number of thin layers used in reconstructing the curb. Normally, pea gravel would be used in the mix so that larger lifts could be formed. This patching system is advantageous in that no formwork is required and the set-time is quick.

V. EVALUATION

a) Roadpatch

On February 12, 1985, the first inspection of the "roadpatch" section was made by the ATRC. The product was holding up well with no sign of fatigue.

A final evaluation was performed on April 2, 1986. The patch was still performing well (Figure 13) with no sign of spalling or cracking. The patch appeared the same as in the original construction photos.

b) Thorite

On February 12, 1985, the first evaluation was made by the research center. Shrinkage cracks were apparent throughout the curb. The section was again evaluated on June 20, 1985. The condition of the curb can be seen in Figures 14 and 15. Several stress cracks had developed due to the contact between vehicle tires and the curb. The stress caused by the vehicle tire had begun to spall the ends of the curb.

On April 2, 1986 a final evaluation was performed by Research. The curb patch had completely failed. Figure 16 shows a photo of the curb and piece that had been knocked out by traffic.

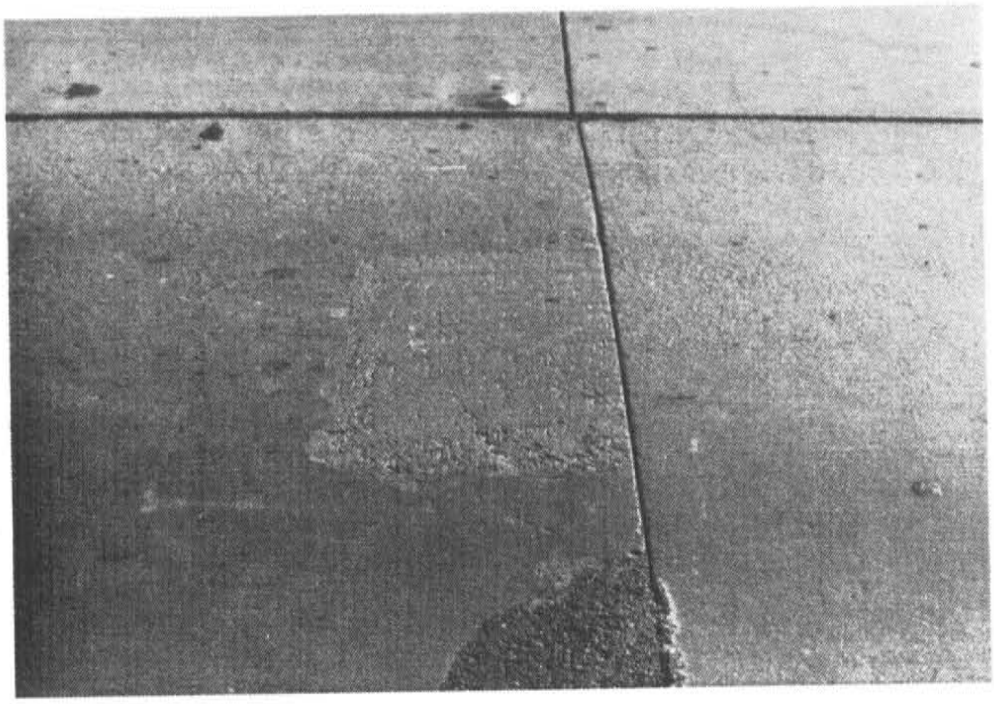

FIGURE 13 - THORO ROADPATCH NEXT TO UPM PATCH

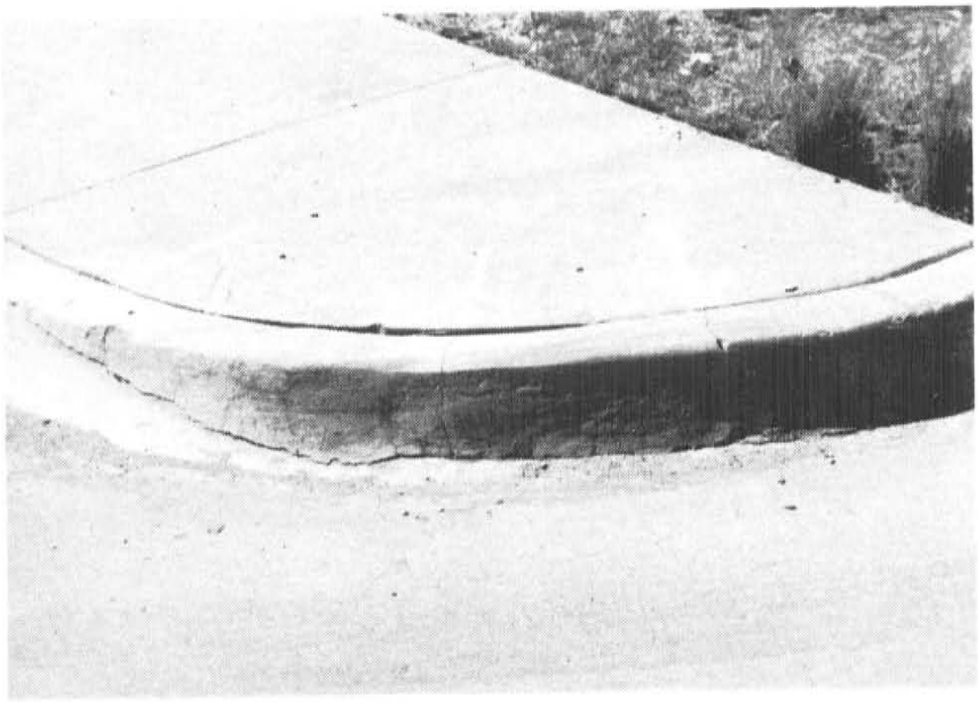

FIGURE 14 -CRACKING IN THORITE

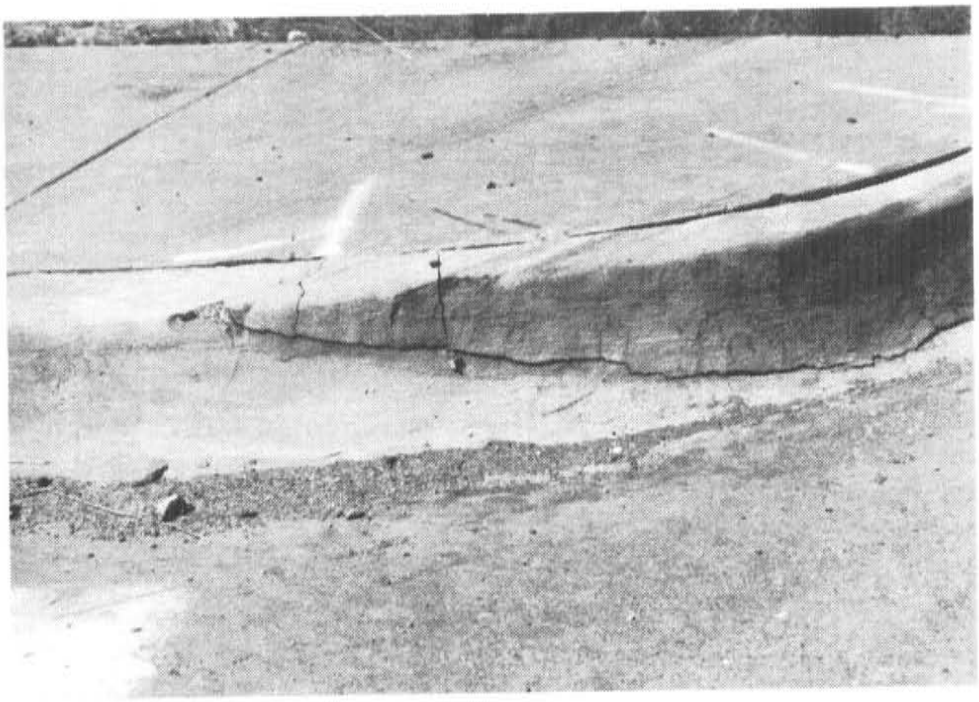

FIGURE 15 - CRACKING IN THORITE

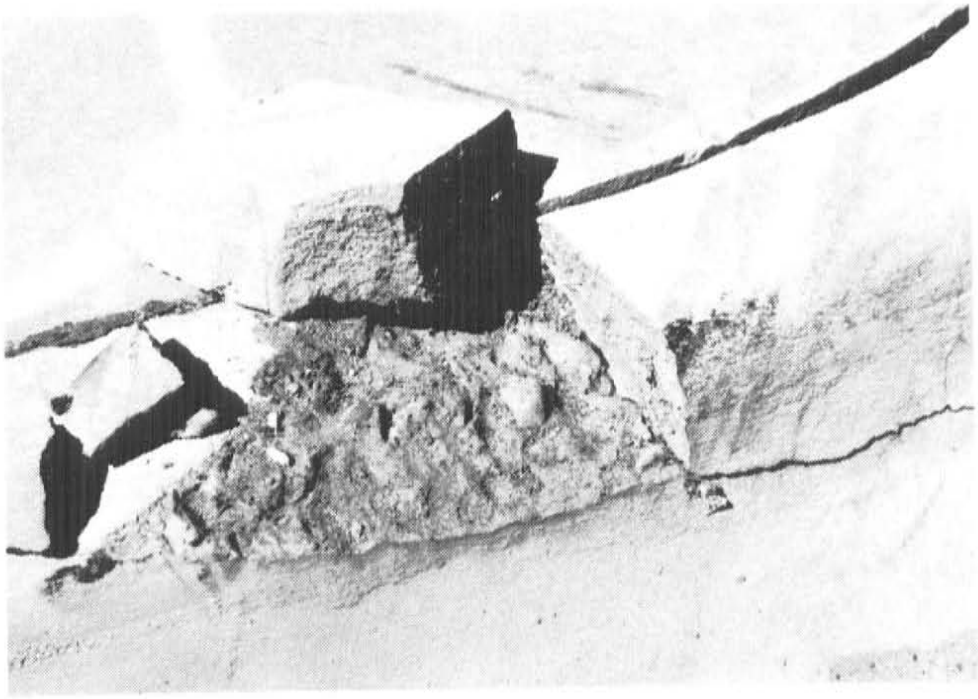

FIGURE 16 - SPALLING OF THORITE CURB PATCH

VI. RECOMMENDATIONS

The Roadpatch product is performing well. It appears to be a viable product for repair of PCCP spalls based on its limited use per the above mentioned test section. The ATRC recommends that maintenance consider the use of Roadpatch for the repair of PCCP spalls in their maintenance operations.

Economically, Roadpatch compares favorably with other conventional concrete patching materials from the standpoint of initial costs, i.e., materials costs, required equipment, manpower, and time constraints are similar to those of Econo-crete. Long term performance will many times determine true cost of the product. Insufficient data is available at the writing of this report (August 86) to ascertain true life costs of the Roadpatch material. Initial performance looks promising.

The Thorite product did not perform as well. Within one year the patch had failed. Based on its poor performance at the Beardsley Road T. I., the ATRC recommends that the product not be considered for use of PCCP repair by ADOT maintenance forces.

APPENDIX

Phoenix and Vicinity
Miles
0 1/2 1 2 3
McKINLEY
VILLA ST.
PIERCE
FILLMORE
POLK
TAYLOR
MELVIN
VAN BUREN ST.
Memory Lawn Memorial Park Cemetery
Memorial Park Cemetery
BLACK CANYON
INTERSTATE 17
MONROE
ADAMS
WASHINGTON
JEFFERSON
MADISON
JACKSON ST.
27TH AVE.
24TH AVE.
JANE WAYLAND CHILDREN'S HOME
JACKSON
HARRISON
LINCOLN
GRANT
SHERMAN
HADLEY
TONTO
S.P. R.R.
HAPPY VALLEY RD
THUNDERBIRD PARK
DEER VALLEY RD
BEARDSLEY
UNION HILLS
BELL RD
GREENWAY
THUNDERBIRD
CACTUS
PEORIA AVE
GLENDALE
BETHANY HOME
CAMELBACK
INDIAN
THOMAS
McDOWELL
VAN BUREN
BUCKEYE
BROADWAY
SOUTHERN
BASELINE
DOBBINS
ELLIOT
ESTRELLA DR
SUN CITY
YOUNGTOWN
TOLLESON
CASHION
GLENDALE
PHOENIX
PARADISE VALLEY
SCOTTSDALE
TEMPE
MESA
GUADALUPE
SHEA BLVD
DOUBLE TREE RANCH RD
INDIAN BEND RD
McDONALD DR
CHAPARRAL RD
SALT RIVER
Scottsdale Community College
Scottsdale Municipal Airport
Sky Harbor International Airport
Arizona State University
Mesa Community College
Mormon Temple
Desert Botanical Garden
Phoenix Zoo
Phoenix Civic Center
Phoenix Mun. Bldg
Pueblo Grande
Municipal Stadium
TEMPE PARK
PAPAGO PARK
Phoenix Country Club
Phoenix College
Phoenix Indian School
VA Hospital
Heard Museum
Public Library
County Hospital
State Hospital
State Fair Grounds
Arizona Mus.
Glendale Community College
Glendale Municipal Airport
Grand Canyon College
Municipal Golf Course
American Graduate School of International Management
Southwest Indian School
Fort Paradise Race Track
NORTH MOUNTAIN PARK
SQUAW PEAK CITY PARK
PARADISE VALLEY PARK
THUNDERBIRD PARK
Deer Valley Airport
Aqueduct
Arizona Canal
Grand Canal
Salt River
Roosevelt Canal
Western Canal
Highline Canal
Granite Creek
Shunk River
Cave Creek
Cave Creek
Crosscut Canal
Beeline Hwy
Lake Pleasant Rd
Dry Webb
Boswell
Country Club Dr
Rural Rd
Tatum Blvd
Pima Rd
Hayden Rd
Dobson Rd
Alma School Rd
Scottsdale Rd
Priest Dr
Mill Ave
Stapley Dr
Lehi Rd
Center St
Apache Blvd
Main St
Broadway Rd
Southern Ave
Baseline Rd
Guadalupe Rd
Elliot Rd
Warner Rd
Rural Rd
Tatum Blvd
Cave Creek Rd
Scottsdale Rd
Hayden Rd
Dobson Rd
Alma School Rd
Priest Dr
Mill Ave
Stapley Dr
Country Club Dr
Central Ave
Black Canyon Hwy
Grand Ave
Pleasant Rd
Beeline Hwy
17
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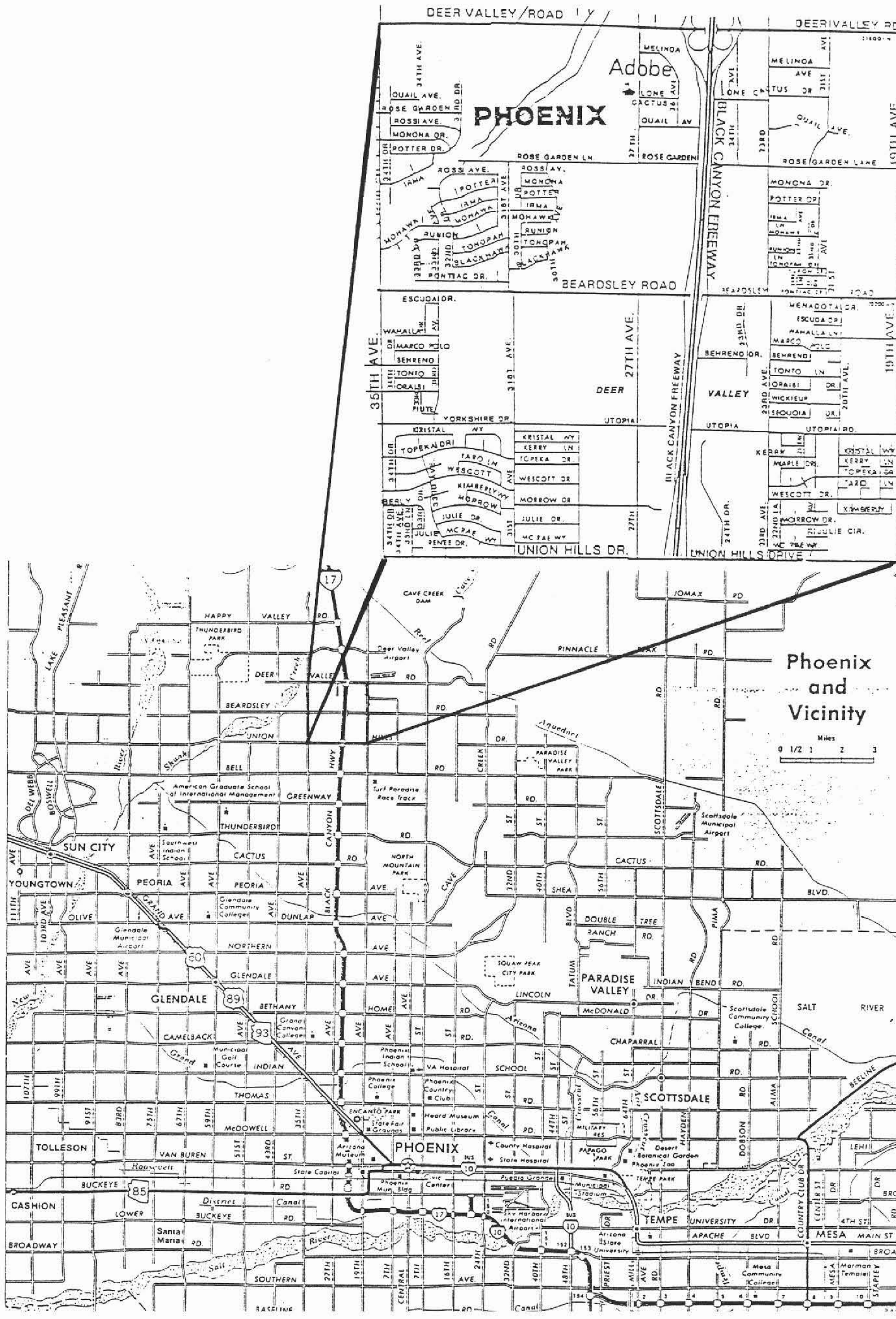
187



Phoenix
and
Vicinity
Miles
0 1/2 1 2 3
DEER VALLEY ROAD
DEER VALLEY RD
PHOENIX
Adobe
BLACK CANYON FREEWAY
BEARDSLEY ROAD
35TH AVE.
27TH AVE.
19TH AVE.
DEER
VALLEY
UTOPIA
UNION HILLS DR.
UNION HILLS DRIVE
JOMAX RD
HAPPY VALLEY RD
PINNACLE PEAK RD.
THUNDERBIRD PARK
Deer Valley Airport
BEARDSLEY RD.
UNION HILLS DR.
BELL RD
GREENWAY RD.
American Graduate School of International Management
Turf Paradise Race Track
THUNDERBIRD RD.
SUN CITY
YOUNGTOWN
PEORIA
CACTUS RD
PEORIA AVE.
NORTH MOUNTAIN PARK
SHEA BLVD.
OLIVE
GRAND AVE
DUNLAP AVE
Glendale Community College
Glendale Municipal Airport
NORTHERN AVE
SQUAW PEAK CITY PARK
GLENDALE AVE
PARADISE VALLEY
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Phoenix Indian School
SCHOOL
Phoenix College
Phoenix Country Club
THOMAS RD
SCOTTSDALE
ENCANTO PARK
State Fair Grounds
Heard Museum
Public Library
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Arizona Museum
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Phoenix Zoo
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Civic Center
Phoenix Mun. Bldg
TEMPE PARK
Municipal Stadium
BUCKEYE RD
CASHION
LOWER BUCKEYE RD.
Sky Harbor International Airport
TEMPE
UNIVERSITY DR
LEHI
BROADWAY
Santa Maria RD.
Arizona State University
APACHE BLVD
MESA MAIN ST
Salt River
Mesa Community College
Mormon Temple
SOUTHERN AVE.
BASELINE RD.
Canal
Arizona Canal
Grand Canal
Crosscut Canal
Aqueduct
Skunk Creek
New River
Cave Creek
CAVE CREEK DAM
DEL WEBB
BOSWELL
LAKE PLEASANT
SCOTTSDALE
TATUM BLVD
PIMA RD
HAYDEN
DOBSON RD
ALMA SCHOOL
COUNTRY CLUB DR
CENTER ST
PRIEST
CENTRAL

Cement-base, fast-setting patching material for concrete bridge decks, expressways.

ROADPATCH®

DESCRIPTION

A cement-base, fast-setting patching material that develops high compressive strengths and will allow traffic bearing patches to be put back in service in 2 hours from time of placement. Roadpatch is fortified with special alkali resistant glass fibers that improve appreciably the impact, flexural and tensile strengths. The use of these special fibers contributes substantially to the ability of the product to resist cracking and the abrasion resistance. These improved properties, the high compression strength, and the overall capabilities make Roadpatch a superior patching material for highway departments, municipalities, and industry throughout the world.

USES

To patch bridge decks, curbs, expressways and other areas where partial depth patching is required.

ADVANTAGES

- Excellent impact resistance.
- High compressive strength.
- Very resistant to cracking.
- Excellent flexural and tensile strengths.
- Freeze-thaw resistant.
- Fast-setting.
- Traffic bearing 2 hours.
- Can be applied to a damp surface.
- Longer working time.
- Contains no calcium chloride.
- Good storage stability.
- Will not burn itself out.

SURFACE PREPARATION

Area to be patched must be clean, structurally sound and free of all loose, dirty, oily and scaly material before applying Roadpatch. Do not feather edge patches, either cut or chip to a depth of approximately 3/8" to 1/2" (.95 to 1.27 cm) around edge of patch.

MIXING

Thoroughly mix Roadpatch with a mixing liquid consisting of 1 part Acryl 60 to 3 parts clean, potable water. Mix until material has been thoroughly blended and has achieved cement mortar consistency (2-3" [5-7.6 cm] slump). This can be achieved in approximately 1-2 minutes if blending by hand. In a mixer approximately 60 seconds is sufficient.

When mixing in rotary mixer, rubber tip blades are desirable. Add dry material to mixing liquid for better blending. Note: 25 lbs. (11.3 kg) of 1/4" to 3/8" (6.3-9.5 mm) or less of dry, clean aggregate, stone or pea gravel may be added to 50 lbs. (22.7 kg) of Roadpatch for patches in excess of 1" (2.5 cm).

Small amount of Roadpatch may be mixed by hand; just maintain same consistency as described above.

APPLICATION

Before applying Roadpatch, dampen area with water. Leave no standing water. Then apply Roadpatch, forcing the material against the sides and bottom of the patch area. Trowel material level, allow to take initial set. Roadpatch can be troweled or broom finished. Preferred curing of Roadpatch is at 70°F., 50° relative humidity and air cured.

LIMITATIONS

Do not re-temper Roadpatch.

Do not apply on frozen or frost-filled surfaces or if the temperature is below 40°F (4.4°C).

THORO SYSTEM PRODUCTS®

PROPERTIES

Set — approximately 10 - 15 minutes at normal temperatures.

Heat of hydration — Minimum heat of hydration

Percentage of calcium chloride — NONE

Bondability — Bonds to all clean and sound concrete, masonry and stone.

PACKAGING

50 lb. (22.7 kg) bags.

COVERAGE

50 lbs. (22.7 kg) will cover approximately 12 sq. ft. (1.1 m^2) @ ½" (1.27 cm) thick.

TEST DATA

All tests were conducted by Pittsburgh Testing Laboratory following ASTM procedures.

Compressive Strength (psi) — ASTM C109-80			
3 Hours	1 Day	7 Days	28 Days @ 70° F - 50% R.H.
1060	2210	5000	6080

Flexural Strength (psi) — ASTM C-348-80	
7 Days	28 Days @ 70° F - 50% R.H.
720	1320

Tensile Strength (psi) — ASTM C-190-77		
1 Day	7 Days	28 Days @ 70° F - 50% R.H.
,209	304	381

Shrinkage (psi) — ASTM C-490-77/C 596-75	
7 Days	28 Days @ 70° F - 50% R.H.
-0.04%	-0.07%

THORO SYSTEM PRODUCTS

Centerville, IN • Bristol, PA • Newark, CA • Mol, Belgium
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Telephone: (305) 592-2081

A Unit of Beatrice Chemical, Division of Beatrice Foods Co.

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Fast-setting, non-shrink patching material for new and old concrete and masonry.

THORITE®

DESCRIPTION

A fast-setting, non-shrink patching material specially prepared for patching new and old concrete and masonry. Disintegrated areas can be rehabilitated with Thorite without the need of expensive form work.

USES

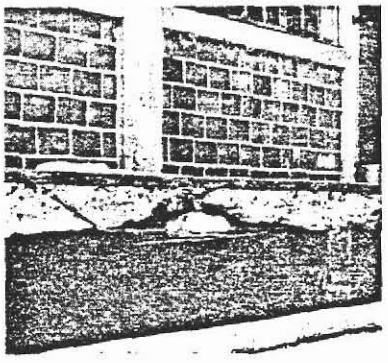
Patching and filling spalled concrete where reinforcing rods are exposed and corroded. Patching honeycomb and construction faults in concrete. Restoring disintegrated surfaces of old concrete and brick masonry. Repairing cracked and broken stucco. Patching concrete pipe and setting stubs. Patching precast concrete.

ADVANTAGES

- Quick-setting.
- Prepared ready to use when mixed with water.
- Does not contain waxes, metallics, tars, or emulsions of any type.
- Does not contain calcium chloride.
- Non-shrink qualities and freedom from oxidation make a durable patch.
- Workman can complete work in one operation.
- Saves labor, forming, excessive scaffolding.
- Does not slump from edge of patch.
- High structural strength.

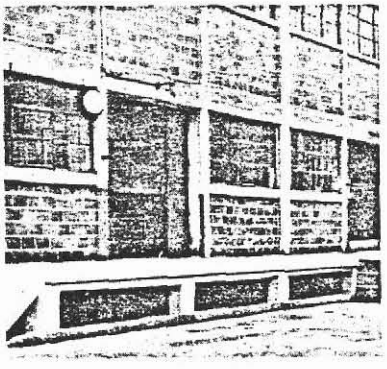
APPLICATION

TO PATCH SPALLED CONCRETE: Concrete found to be cracked, spalled or otherwise showing evidence of disintegration or structural failure should be cut out to sound surface. All surfaces to be patched must be structurally sound. Loose concrete and rust on steel rods should be removed by sandblasting, chisel and hammer or wire brush. Heavy particles of concrete should be removed by air or electric hammer. Wash clean with water from hose before filling with Thorite. Mix Thorite to batter consistency and apply by brush over reinforcing rods and concrete within patching area. Slush mix under rods, between steel rods and over old concrete



1. First remove all loose, spalled concrete. Clean reinforcing rods, then apply slush coat of Thorite over rods and concrete to be patched.

2. Mix Thorite to mortar consistency and force into area to be patched. After Thorite has set, shape to conform to surrounding areas.



3. Now apply a finish coat of Thoroseal over the patched area. This area looks like new, and the building has been given new life. Quick, easy, economical - and durable.

THORO SYSTEM PRODUCTS®

surface. All previously embedded steel should be thoroughly covered and slushed with brush coat before filling patch with heavier, trowel coat of Thorite. Thorite must be in place and leveled within five to ten minutes after mixing water is added. No forms are necessary. Apply in successive ½" (1.27 cm) to 1" (2.5 cm) layers. Scratch first layer, cool with water and apply second layer within 15 to 20 minutes. If patch gets hot and turns light gray, cool by wetting. Keep patch damp 20 to 30 minutes after filling to complete curing. Several patches may be made during one stage of scaffolding and work completed without comeback or additional moving. Apply coat of Thoroseal over Thorite immediately after completion of patch.

TO PATCH CONCRETE FLOORS AND CURBS: Edge of disintegrated surface to be patched should be cut or chiseled at right angle with surrounding surface, or undercut if possible. Thoroughly clean area removing all loose particles. Dampen surface and apply heavy brush or slush coat of Thorite, making sure all pores and voids are filled. Follow this with trowel coat of Thorite, forcing material against edge of patch, all the way around, and work toward center. If area to be patched is greater than 1" (2.5 cm) in depth, material should be applied in 1" (2.5 cm) layers, scratched, then applied in successive 1" (2.5 cm) coats until patch is filled. Dampen first application with water before making second. Screed off and steel trowel Thorite patch to level of floor. After material has hardened, so it is not soft or tacky, place either burlap bags or construction paper over patched area. If burlap is used, saturate with clean water and keep wet for 45 minutes to 1 hour. Thorite generates considerable heat if used in quantities, and it is advisable to keep material cooled with water until heat has been dissipated, after which area can be covered with construction paper after final wetting down. Light traffic can be used over patched area after 1 hour, but the longer it is cured the better.

Due to exceptional fast-setting qualities of Thorite, and to increase the length of setting time during hot weather, we recommend the following:

1. Use cold mixing water.
2. Keep material in cool place.
3. Cool surface to which material is to be applied with clean, cold water.
4. Mix small batches and use quickly.

During cool weather, keep material warm and use lukewarm mixing water to speed set.

LIMITATIONS

Do not retemper; Thorite that has been retempered will never get hard. Do not add other material. Do not stir constantly, just enough to mix water through batch. Do not permit Thorite to get hot in place; sprinkle with cold water after placing. Fog spray from hose or dash on water with brush. Do not apply Thorite on frozen or frost-covered masonry or over frosted steel rods; frost must be removed by heating with blowtorch before making application. Do not apply in large quantities. Thorite is best applied in ½" (1.27 cm) to 1" (2.5 cm) layers; scratch and apply successive coats until patch is filled. Cool first application with water before making second application. Do not neglect to apply coat of Thoroseal over finished patch immediately to assure secure bond for later applications of Thoroseal. Do not apply over dry, dusty surface.

COVERAGE

1 lb. (.45 kg) fills 17 cubic inches (278 cm^3).

PACKAGING

12 lb. (5.4 kg) can; 50 lb. (22.7 kg) sack; 60 lb. (27.2 kg) steel pail.

TEST DATA

COMPRESSIVE STRENGTH PSI (kg/cm^2)		
24 HRS.	7. DAYS	28 DAYS
812 (57)	3910. (274.9)	5743 (403.7)
Conducted by Ambric Testing & Engineering-Laboratory No. 14576		

AUTOCLAVE TEST . . . 0.0285% EXPANSION Conducted by Pittsburgh Testing Laboratory No. 460020

THORO SYSTEM PRODUCTS

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