# PAVETECH BRIDGE JOINT SYSTEM

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JAN 1990

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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16. Abstract

A "Pave Tech Bridge Joint System" was installed on a bridge deck on US Route 2 in the town of Waterbury, Vermont, on December 18, 1989. The 3 span deck had been rehabilitated in 1986 and a sheet membrane applied. The joint replaced by the Pave Tech installation had failed and was leaking through a 5/8" gap between the joint sealer and the face of the asphalt.

The experimental installation of a proprietary system was quickly and satisfactorily completed under adverse weather conditions. Post installation testing of the binder material produced a 260% elongation indicating that the system may be able to withstand the severe environment and resulting movement at the installation site.

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## INTRODUCTION

In early summer of 1989 the proponents of a British bridge joint system, PAVETECH, expressed a desire to introduce the system to US markets and were willing, through their US lisencee, to perform a joint installation without charge. This initial report briefly describes the installation of a PAVETECH Bridge Joint System at a location where the standard sawed and sealed joint had failed shortly after construction.

## PROJECT DESCRIPTION AND BRIDGE CONDITION

The test location is a joint in Bridge #44 on US Rte 2 in Waterbury Vt. This is a 3 span WF Beam, composite bridge with a reinforced concrete deck, over the Little River, built in 1961. This two lane (34'x229') bridge was rehabilitated in 1986 under project IR Deck (3). The repair included the installation of a preformed sheet membrane waterproofing system and a 2" bituminous concrete overlay. The joints are 34' long with a 26 degree skew angle.

The joint to be rehabilitated had failed and was open for its entire length. The original 3/4" wide joint had opened to a maximum of 1-3/4" with an average of 5/8" gap between the sealant and the pavement faces.

Figure 1 illustrates a typical joint of the type which failed.

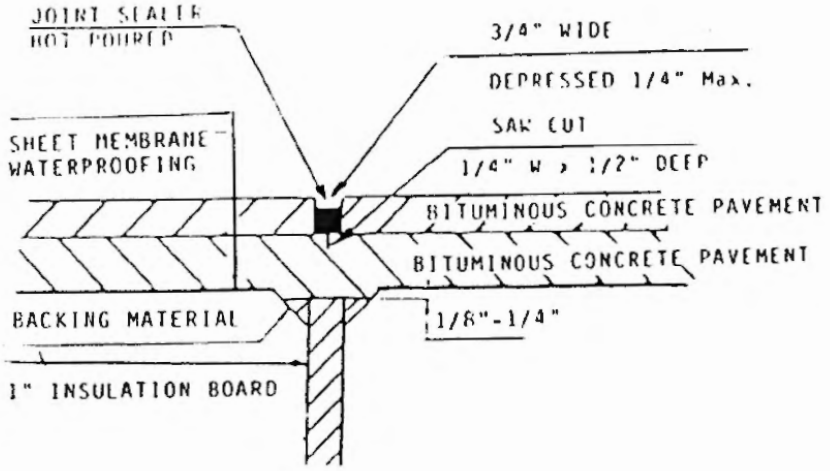


FIGURE 1

## EXPERIMENTAL SYSTEM DESCRIPTION

The PAVETECH Bridge joint system is a British proprietary product and procedure manufactured in the United States by Pavement Technology Systems Limited, 8800 Governors Hill Drive, Suite 244, Cincinnati, Ohio 45249 (ph 513 683-7102), and marketed and installed exclusively by licensed applicators. The applicator for this installation was Davis & Swanson, P.O. box 293, West Main St. Tilton N.H. 03276 (ph 603 286-8955).

The product literature indicates a service life of 6+ years with a warranty of 24 months and promises it to be completely waterproof.

For details and complete application instructions see APPENDIX A, manufacturer's specifications for installation procedures. These specifications include a series of descriptive drawings of the application procedure. Figure 2 illustrates a completed PAVETECH joint.

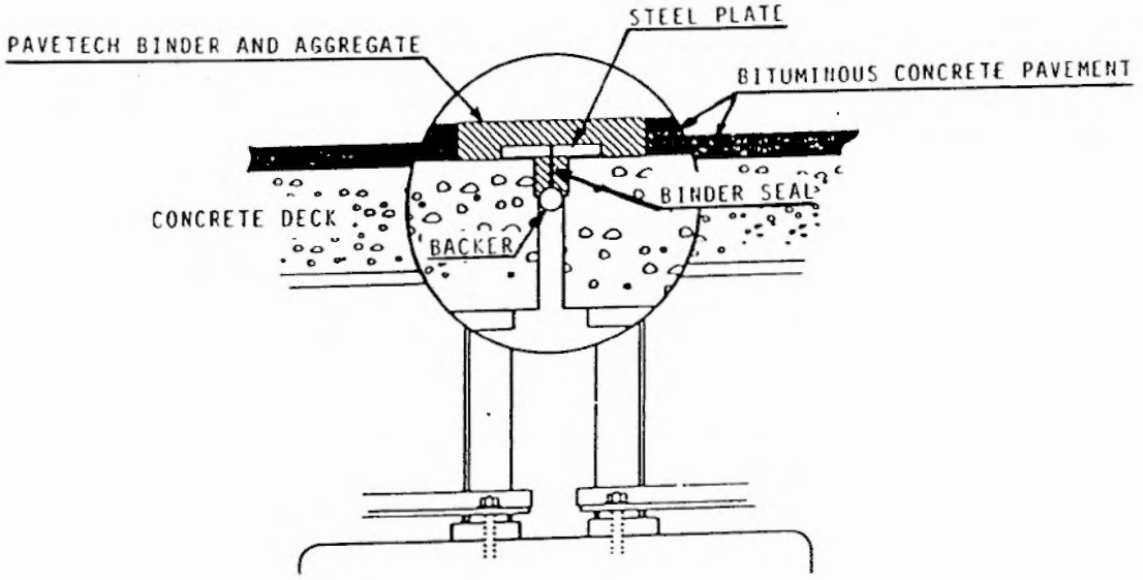


FIGURE 2

## COST

Although this installation was done at no charge for demonstration purpose, the stated cost for a completed joint is $200.00 per LF for 100 LF or less and varies from $120.00 to 180.00 per LF for more than 100 LF.

## INSTALLATION

The initial saw cutting was performed on December 15, 1989 by Vt. A.O.T. District 6 personnel. Two parallel saw cuts were made 10" from the center of the joint, to a depth of 1-3/4".

On December 18, 1989 the joint installation was accomplished. Air temperature at 7:30 AM was -8 degrees F. with partly cloudy skies. By 8:15 AM the removal of the pavement was completed on the westbound lane of the bridge. By 9:20 am the heating, drying and cleaning of all surfaces using a 3000 degree hot compressed air lance was completed. The backer material was inserted in the gap at a depth 1" below the surface of the concrete deck. The gap width ranged from 1-5/8" to 1-3/4". The rubberized asphalt mastic binder which had been heated to 335 +/- degrees F in a double walled, oil bath melting kettle was then poured into the gap by hand using coal hods. This seal was brought up to the level of the top of the slab. As it cooled it contracted slightly and left a slight depression. Steel plates 6" wide and 1/4" thick were then installed to bridge the gap. Nails were inserted through predrilled holes in the plate into the sealing material. More hot binder was then poured atop and allowed to flow under the plate as well as being squeegeed on the adjacent concrete surface to form a flat surface slightly higher than the steel plates. Binder was also squeegeed up the faces of the asphalt to seal the entire working trough.

The specially selected aggregate was being heated in a drum mixer. Heat was being applied through use of the hot lance directly into the drum. Hot binder was then added to the heated aggregate and mixed. After mixing the material was poured into the trough and raked level. Two courses were applied with a hot binder seal coat after each one. At 10:30 AM the surface course was applied. This course uses a smaller size aggregate and is compacted with a sidewalk roller. Following rolling the surface was coated with a squeegeed coat of binder. When the surface was firm a grit was broadcast to prevent tires from sticking to the surface.

By 11:30 am all equipment had been moved to the eastbound lane and traffic was permitted on the new joint. By noon the air temperature had risen to 20 degrees F and a 20 MPH +/- wind was blowing. Installation of the eastbound side joint was completed by 2:15 PM using the same procedure as in the morning. A light intermittent snowfall occurred in the afternoon but it was not heavy enough to hinder the installation.

The applicator stated that the only deviation from standard procedure was that the aggregate was heated to the maximum allowable temperature in order to slow the cooling of the mix which might occur while raking and placing, at the cold ambient temperatures.

## POST INSTALLATION TESTING AND OBSERVATION

During the installation a small sample patch of binder was poured onto a snow covered area of the deck and allowed to cool. This sample was taken to the Materials & Research Laboratory where it was cut into 1" wide strips and stored in a freezer at 0 degrees F. On December 29, 1989, one of the strips was removed and stretched at an air temperature of 10 degrees F. When elongated the 7/16" thick material stretched from 6" in length to 16" in length before breaking, an elongation of 260%.

After testing it was noticed that the material was still slightly tacky at the break and the ends tended to rebond when stuck together, although with no real strength. After several days at room temperature the bond at the break point had developed significant strength. This rebonding would probably not occur in the field due to contamination with dirt and moisture.

On January 18,1990, one month after installation, there was a heavy rainfall. Approximately 1/2 hour after the rain stopped it was observed that water was dripping from a plastic trough which had previously been installed beneath the joint to protect the pier cap. Because of the trough, the bottom of the joint could not be seen.

When the PAVETECH joint was installed the joint in the curbs were not sealed. This is to be done in the early spring. The water dripping from the trough may have come from the curb joint at the lower side of the bridge deck.

Some deterioration of the binder/grit wearing/seal course was also noted. This deterioration which is likely due to snowplow damage had exposed the aggregate/binder course. The damage is minor, limited to two areas. One area at centerline is about 2" wide and one foot long along the easterly sawcut. The other area is located in the westbound lane along the easterly sawcut and is also about 2" wide but about 3' long. Neither area is expected to degrade the seal.

## SUMMARY

The installation was quickly and satisfactorily completed under adverse weather conditions. All observers were impressed with the procedure and material used. The cold elongation properties of the binder suggest that the system may be able to withstand the severe environment and resulting movements at the installation site.

## FOLLOW UP

This joint will be observed and evaluated for as long as it takes to determine its effectiveness and service life.

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*Applicators of Protective Coatings*
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# PAVETECH BRIDGE JOINT SYSTEM

## SPECIFICATION FOR INSTALLATION PROCEDURES

### I. SCOPE

This work shall consist of the removal of asphalt paving at bridge expansion and abutment joints, and the furnishing and installation of a combination of specially blended polymer-modified asphalt and selected aggregate, which is flexible and waterproof. Overall horizontal movement characteristics must not exceed 1-1/2" per joint.

### II. DEFINITION OF TERMS

Abutment Joint - The interface of the abutment wall and the asphalt pavement

Expansion Joint - The construction joint between adjacent bridge deck slabs

Movement Gap - The gap between adjacent bridge deck slabs

### III. MATERIALS

A. Binder

| | |
|---|---|
| Type | PAVETECH BJS Binder |
| Softening Point | 180°F |
| Flow | 3 mm. max. @ 140°F |
| Penetration | 9 mm. max. @ 77°F |
| Extension | 50% @ -20°F (3 cycles) |
| Resilience | 60% min. @ 77°F |
| Tensile Adhesion | 700% min. |
| Specific Gravity | 1.1 +/- 0.05 |
| Pouring Temperature | 320°F - 350°F |
| Max. Safe Heating Temp. | 365°F |

B. Aggregate

| | |
|---|---|
| Type | Processed, dried granite |
| Gradation | 95 - 100% passing 7/8" |
| | 30 - 50% passing 5/8" |
| | 10 - 25% passing 1/2" |
| | 0 - 10% passing 3/8" |
| Specific Gravity | 2.65 |
| CaO Content | Less than 5% |
| Packaging | 100 pound bags |

C. Backer Rod

| Property | Nominal Value | Test Method |
|---|---|---|
| Density, lbs/ft$^3$ | 2.0 | ASTM D 1622 |
| Tensile Strength, psi | 25 | ASTM D 1623 |
| Water Absorption by Volume % | 0.5 | ASTM C 509 |
| Compression Deflection @ 8 psi, % | 25 | ASTM D 1621 |
| Temperature Resistance, °F | -45 to +450 | " |

D. Bond Breaker

| Movement Gap, Inches | Materail | Width/ Inches | Gauge |
|---|---|---|---|
| 2 1/2 | Aluminum | 4 | |
| 2 1/2 | Mild Steel | 6 | 1/4" |

E. Safety Provisions

Personnel shall be thoroughly trained in the safe handling of materials in accordance with the manufacturers instructions. Protective clothing shall be required to prevent accidental contact of heated materials with exposed skin. All materials shall be used in such a manner as to minimize personal and environmental hazards as approved by the Engineer.

IV. INSTALLATION METHODS

A. Removal of Asphalt Paving and/or Existing Joint Materials

Saw cut to full depth of existing materials parallel to expansion joint center and at 6-12 inches on either side. For abutment joint, one saw cut shall be made 12-24 inches from joint interface, parallel with interface. Remove asphalt or joint material between saw cuts or between saw cut and joint interface.

B. Preparation of Surfaces

All exposed horizontal and vertical surfaces of the joint and movement gap shall be thoroughly cleaned and dried using a hot compressed air (H.C.A.) Lance, Model 63. H.C.A. Lance shall produce a flame-retarded air stream temperature of 3000°F, at a velocity of 3000 feet per second at 15 psig chamber pressure.

Repairs to damaged concrete arrisses shall be made as directed by the Engineer, using epoxy patching materials in strict accordance with the manufacturers instructions.

C. Caulking and Sealing Movement Gap

The movement gap shall be caulked with a backer rod of suitable diameter placed at a depth to ensure a correct width/depth ratio of BJS Binder placed in the movement gap, according to the dimensions of the gap.

D. Bond Breaker

The bond breaker plate shall be fixed to the base of the joint, centered over the movement gap and secured by nails or spikes through the caulking throughout the length of the joint. Plates shall be lapped as necessary to accomodate different joint lengths.

E. Sealing Exposed Surfaces

All prepared, exposed surfaces of the joint shall be sealed with PAVETECH BJS Binder.

F. Preparation of Aggregate

Granite aggregate shall be heated to a temperature of 200°F to 250°F in a suitable rotating drum blending unit with heat source attached or using the H.C.A. Lance, Model 63.

G. Placement of Prepared Materials

Heated aggregate and PAVETECH BJS Binder shall be combined in the joint in layers not exceeding 2 inches thick at a ratio of 74% aggregate/26% binder by weight. Layers shall be raked to level and allowed to cool before placement of subsequent layers. The final layer shall overfill the joint and after cooling to a stable mass, shall be compacted to the level of adjacent surfaces using a hand roller or vibrating screed. The finished joint shall be dusted with a fine, dry aggregate to prevent tackiness.

V. METHOD OF MEASUREMENT

Epoxy Repair of exposed concrete surfaces, if required, will be measured in cubic inches installed based on field dimensions and will be paid for as EPOXY REPAIR.

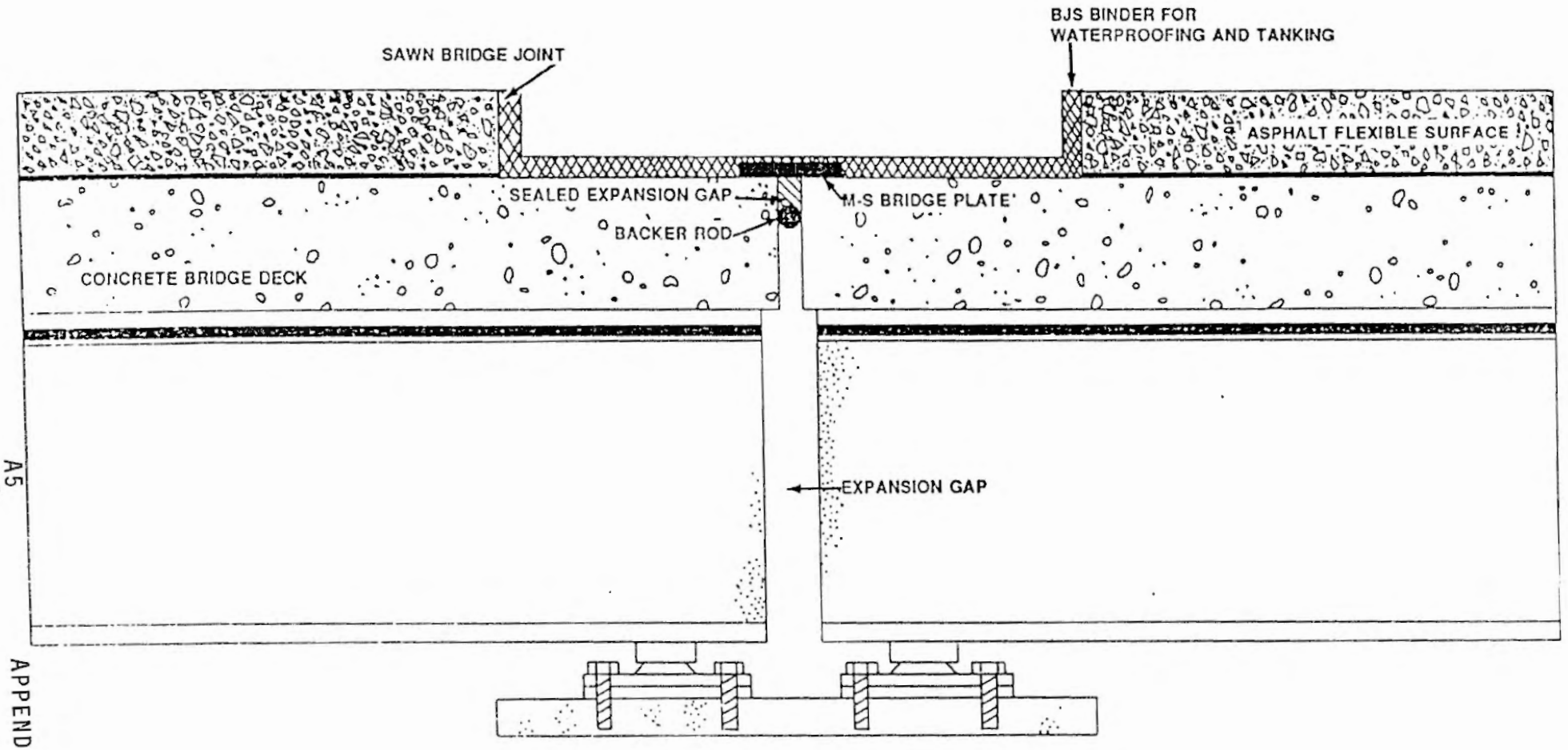
Installation of the PAVETECH BRIDGE JOINT SYSTEM will be measured in cubic feet of joint installed based on field dimensions and will be paid for as INSTALL BRIDGE JOINT.

VI. BASIS OF PAYMENT

The contract price paid per cubic inch for EPOXY REPAIR shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary, and for doing all the work involved in preparing and repairing exposed concrete surfaces as directed by the Engineer after removal of asphalt paving.

The contract price paid per cubic foot for INSTALL BRIDGE JOINT shall include full compensation for furnishing all labor, materials, tools and equipment and incidentals, and for doing all the work involved in preparing and installing the materials as shown on the plans, as specified in the Specifications and as directed by the Engineer.

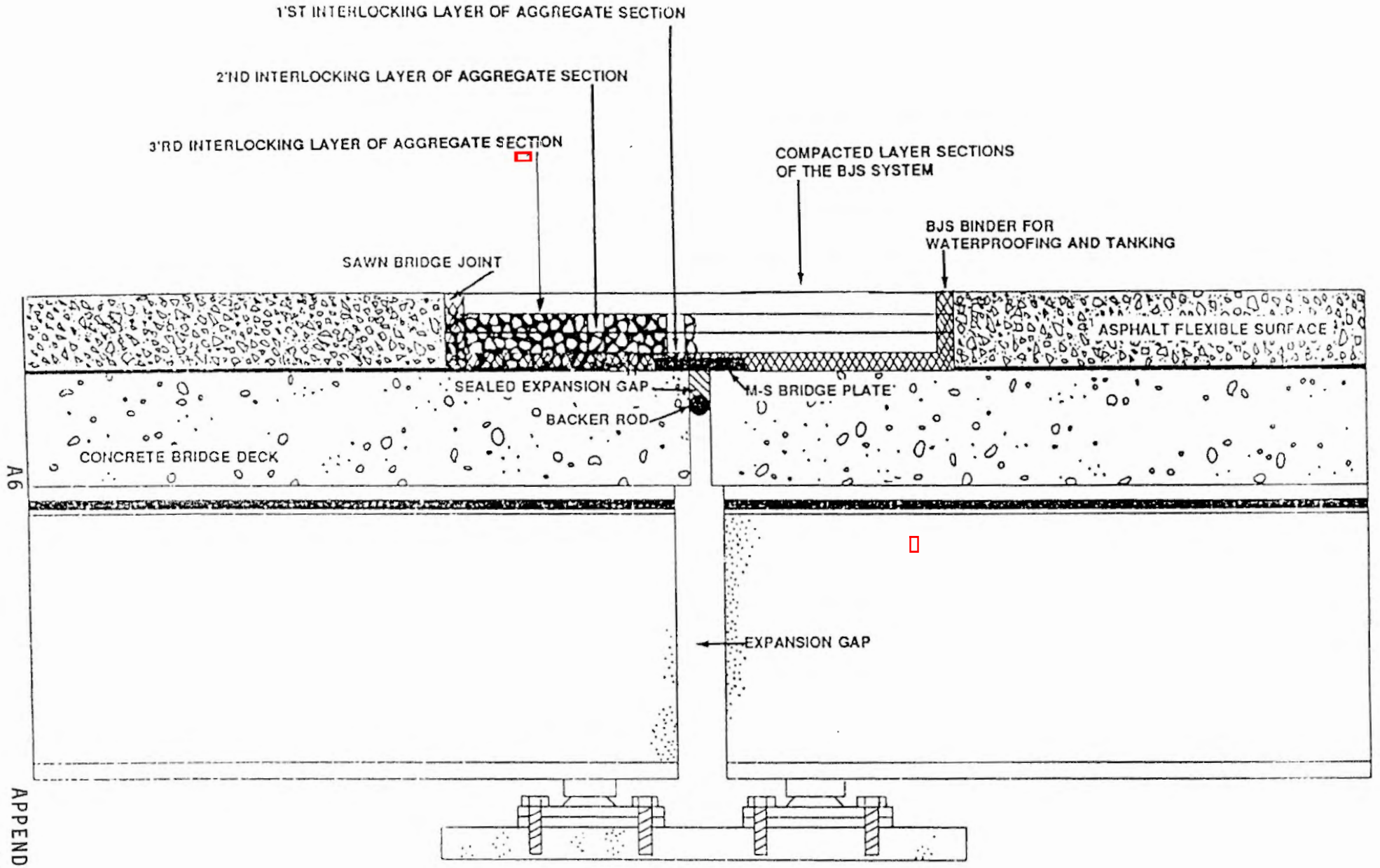
| PAY ITEM | PAY UNIT |
|---|---|
| Epoxy Repair | Cubic Inch |
| Install Bridge Joint | Cubic Foot |






**PAVETECH** BRIDGE JOINT SYSTEM®

Drawing 3

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APPENDIX A

**PAVETECH** BRIDGE JOINT SYSTEM®

Drawing 4