



COMMONWEALTH OF KENTUCKY
DEPARTMENT OF TRANSPORTATION
FRANKFORT, KENTUCKY 40601

ELIJAH M. HOGGE
SECRETARY

WENDELL H. FORD
GOVERNOR

BUREAU OF HIGHWAYS
JAMES E. GRAY
COMMISSIONER

May 10, 1973

H.3.21

MEMORANDUM TO: J. R. Harbison
State Highway Engineer
Chairman, Research Committee

SUBJECT: Research Report No. 366; "Tartan Surfacing for an Equestrian Overpass;"
KYP-69-21; HPR-1(8), Part III.

By letter, February 14, 1968, the Bureau of Public Roads, requested that the Tartan surfacing specified on the subject project be considered an experimental feature under the terms of PPM 60-2. This action was intended to assure reporting of performance. The contract had been awarded December 20, 1967. PPM 60-2 was supplanted by PPM 20-6.3; the project was approved under Category 2.

The report submitted herewith encompasses installation of the Tartan surface and short-term performance -- long-term performance being relegated to some undefined time in the future.

No specific test has been made to determine the adhesion of the surfacing to the concrete deck; surely any loosening will eventually reveal itself.

The Cor-Ten steel has stained the concrete masonry rather badly; and the bridge appears somewhat defiled because of it.

One of the photos shows a severe crack in the concrete plinth.

Although the traffic on the bridge is low, we have not heard any complaints of horses balking on the bridge or of any kind of accident there.

Respectfully submitted,

A handwritten signature in cursive script, reading "Jas. H. Havens".

Jas. H. Havens
Director of Research

JHH:dw
Attachment
cc's: Research Committee

Research Report
366

**TARTAN SURFACING FOR AN
EQUESTRIAN OVERPASS**

I 64-2(67)8, Jefferson County

KYP-69-21, HPR-1(8), Part III

by

D. C. Newberry, Jr.
Research Engineer Senior

Division of Research
Bureau of Highways
DEPARTMENT OF TRANSPORTATION
Commonwealth of Kentucky

The contents of this report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Bureau of Highways.

This report does not constitute a standard, specification, or regulation.

May 1973

INTRODUCTION

The location of I 64 in Jefferson County traverses Seneca Park, noted for its scenic beauty and superior recreational facilities. A bridle path in Seneca Park necessitated construction of an overpass for equine traffic. A non-slip and sound-deadening, resilient surface was essential for aesthetics and safety. Tartan, a rubbery mat developed primarily for race course and paddock surfaces, was specified and installed on the overpass.

MATERIAL AND PROCEDURES

Tartan, manufactured by the New Products Division of Minnesota Mining and Manufacturing Company, was used on the bridge. Location of the project is shown in Figure 1. Project Identification is: Jefferson County; I 64-2(67)8, SP 56-273-14L; Seneca Park, Station 30+00. The use of Tartan was proposed by Arnold H. Vollmer Associates, Consulting Engineers.

As a matter of related interest, thoroughbred horsemen have sought resilient surfacings for their paddocks and stalls. Asphalt-bound rubber running-track surfaces (40 percent sand, 40 percent shredded rubber, 20 percent asphalt content) -- such as built at the University of Kentucky in 1959 -- have withstood trackmen using short cleats for 10 years but cannot withstand the twisting action of horses' shod feet. Tartan surfacing was developed specifically for this use.

Detailed construction procedures and material requirements are outlined in the Special Note (see APPENDIX). The plan view and typical section of the bridle path bridge are shown in Figure 2. The contract for Project I 64-2(67)8 was awarded to Greer Bros. and Young on December 20, 1967. Unit bid prices for Tartan surfacing ranged from \$3.00 to \$15.00 per square foot. Based on an estimated quantity of 2020 square feet and a unit bid price of \$15.00 (unit bid price of low bidder for entire project), the total cost of Tartan surfacing was estimated at \$30,300. Actual cost of the Tartan surfacing, due to an adjustment in material cost, was \$14.00 per square foot for a total cost of \$28,280 for the 2020 square feet. The Tartan surfacing was installed during the period July-September 1970. Photographs obtained during construction are shown in Figures 3 and 4.

PERFORMANCE

During inspections made on June 6, 1971 and February 18, 1972, the surface was apparently in as-constructed condition; there was no evidence of wear or tear. Conditions noted February 18, 1972 are shown in Figures 5 and 6. Particular attention was given to the transverse seams of the material. The only flaw was at the fillet curves on the edges of the deck (see Figure 2). The close-up photograph in Figure 6 shows that the difficulty of installation on the fillets may be the cause of apparent looseness at these points.

During an inspection on April 25, 1973, it was possible to observe wetness and edge conditions previously not so apparent. Figures 7 through 14 are photos illustrating significant features found. Figure 7 (foreground) shows muddiness and settlement at the northern end of the bridge. Figure 8 shows horseshoe tracks -- indicating minor usage of the bridge. Figure 9 shows "birdbaths" at mid-span and iron stains on the concrete plinth. Figure 10 shows efflorescence at a crack in the plinth. Figure 11 shows a well-cemented seam in the Tartan surface. Figure 12 shows unbonding of the Tartan material in the raggle and water retained underneath. Figure 13 shows incomplete fit of Tartan material into the raggle and apparent failure of glued seam in Tartan sheeting. Figure 14 shows a plinth joint merging into the raggle below; this provides direct access of water behind the flashing (tucked) section of the Tartan sheets.

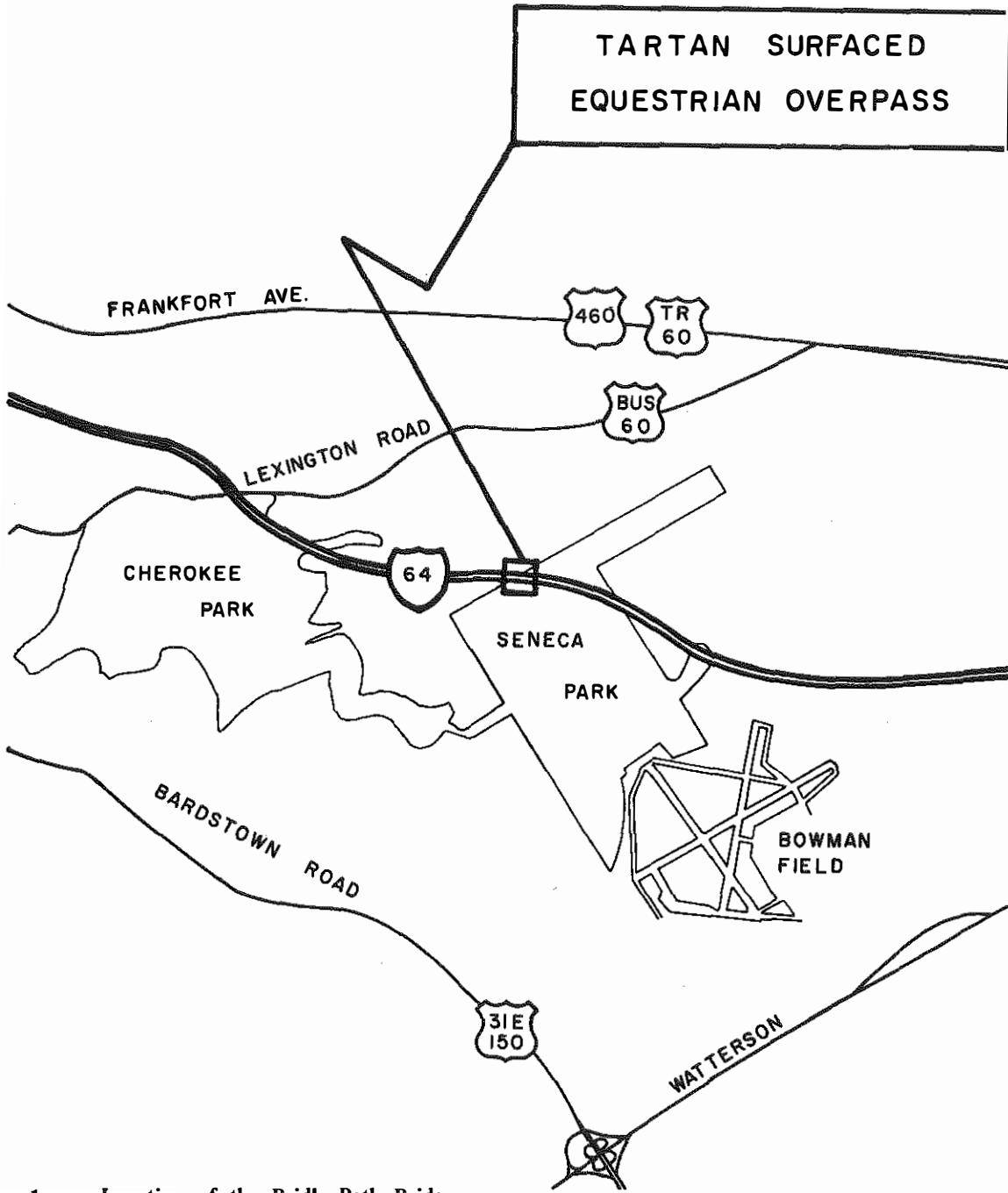


Figure 1. Location of the Bridle Path Bridge.

1. 1000

2.

3. 1000

4.

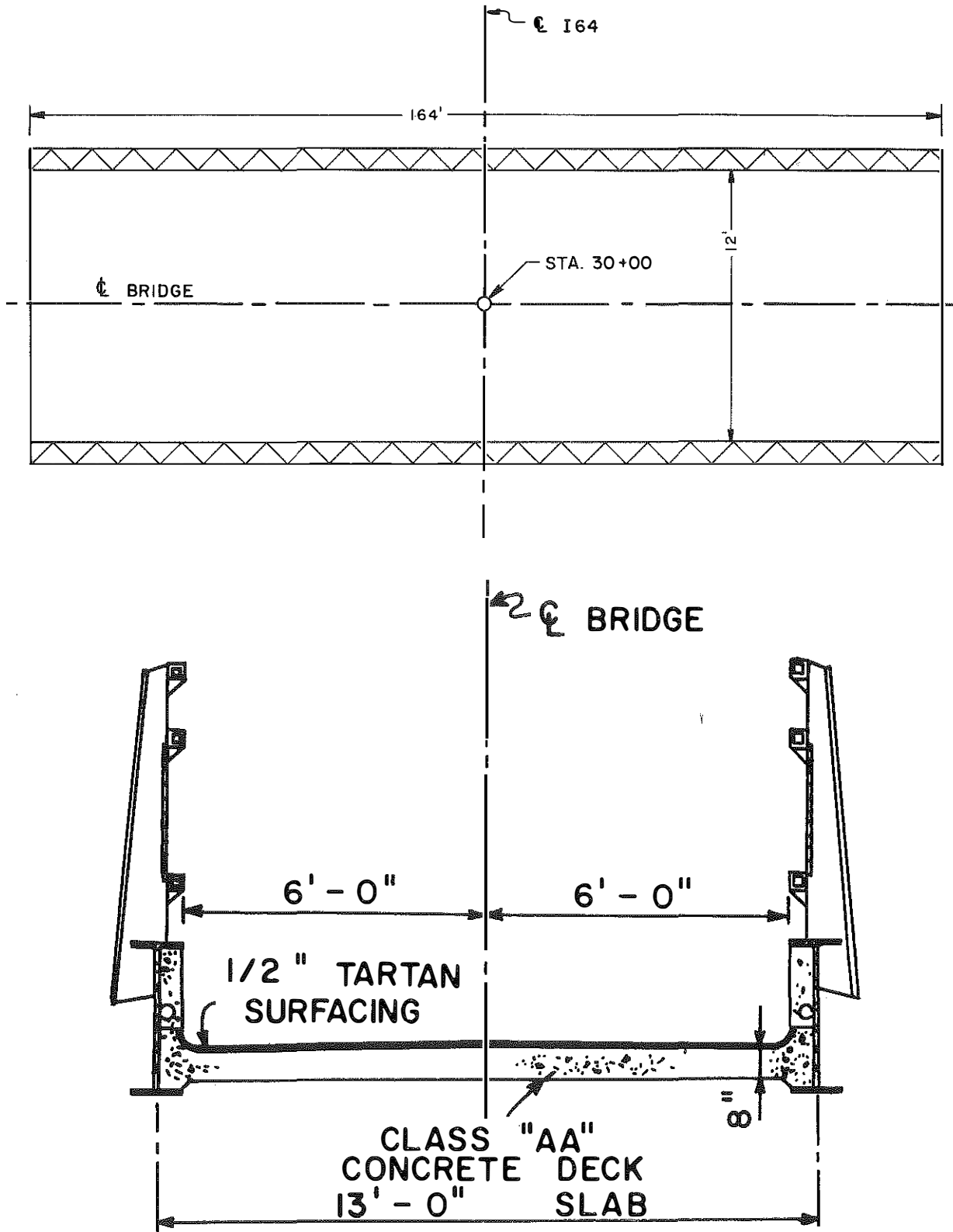


Figure 2. Plan View and Typical Section of the Bridle Path Bridge.



Figure 3. Laying Tartan Surfacing on the Bridge Deck.



Figure 4. Anchoring Tartan Surfacing during Curing of the Mastic. Note Compression Roller in Foreground.



Figure 5. View of Completed Tartan Surface.



Figure 6. Close-up Showing Joint at Fillet of Curb. Note Slight Unevenness of Installation.

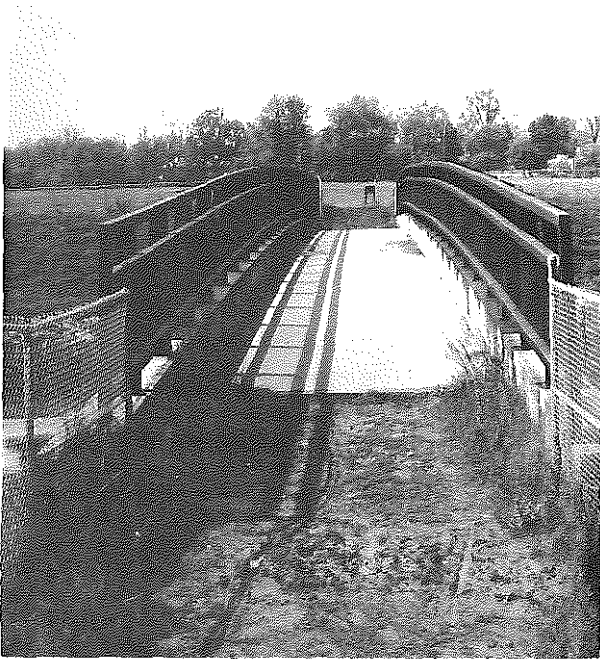


Figure 7. View of Bridge from North Approach (4-25-73).

Figure 8. Horseshoe Tracks on Tartan Surface (4-25-73).





Figure 9. Standing Water near Middle of Span (4-25-73).

Figure 10. Crack in Concrete Plinth (4-25-73).

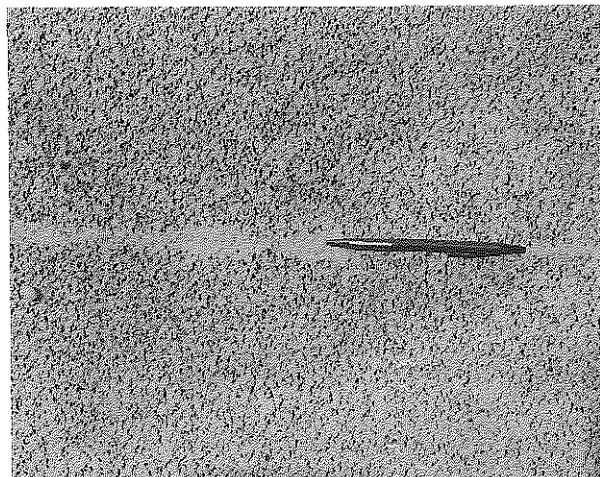


Figure 11. Glued Joint in Tartan Sheeting (4-25-73).



Figure 12. Unbonded Sheeting where Tucked into Raggle (4-25-73).

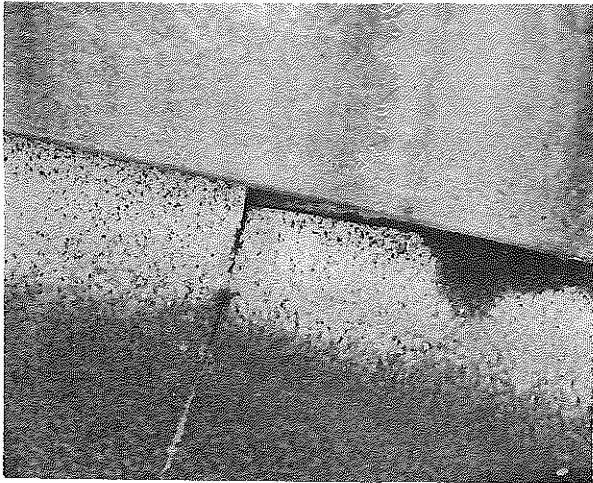
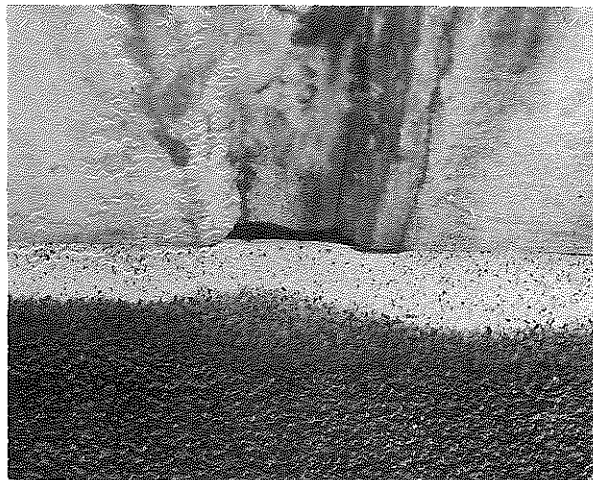
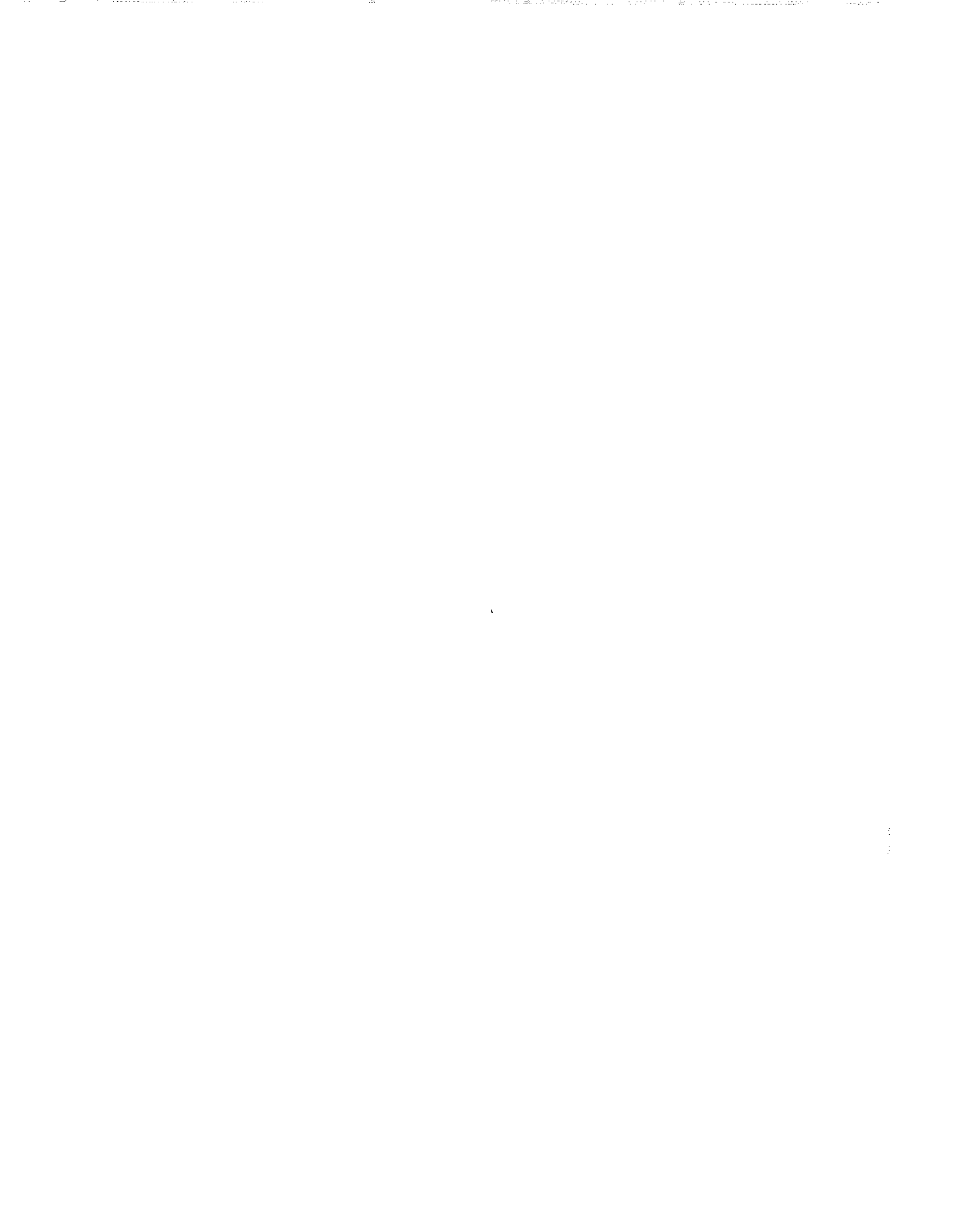


Figure 13. Incomplete Fit into Raggle (4-25-73).

Figure 14. Vertical Recess in Plinth, Not Sealed (4-25-73).





APPENDIX
SPECIAL NOTE
FOR
TARTAN SURFACING



COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

SPECIAL NOTE
FOR
TARTAN SURFACING

DESCRIPTION:

This item shall consist of furnishing and installing Class A "Tartan" surfacing material as manufactured by the New Products Division of Minnesota Mining and Manufacturing Company on the bridge deck within the limits shown on the plans.

MATERIALS:

The Tartan material shall be furnished in pre-cut rolls and shall retain its properties when subject to weathering and shall be resistant to mildew and all forms of biological attack. The edges shall be trimmed to snugly fit into the recesses at the bridge curb. The finished surface shall present a uniform appearance and shall be non-slip and skid-proof, both in wet and dry weather.

Samples of the finished product shall be furnished the Engineer prior to installation and all material shall conform to any and all applicable sections of the Standard Specifications insofar as specific formulations, tests, laboratory reports etc. are required.

The following indicates ranges of tests results acceptable for this product:

Stress-Strain (A.S.T.M. D-412-61T)

Tensile Strength: 90-300 p.s.i.
Elongation and Break: 60-100%

Compressive Strength (A.S.T.M. D-575-46)

Strain Rate: 20 inches per minute
10% Modulus: 40 psi to 70 psi
50% Modulus: 300 psi to 500 psi

**Coefficient of Restitution (Precision Resilience Tester)
(e)² less than 0.35**

Indentation Hardness (Shore A-2 Durometer A.S.T.M. D-1706-61).

Range: 40 ± 5

Low Temperature Properties (A.S.T.M. D-1053-61)

Scott Brittle Temp. less than -20°F
T₁₀ less than -35°F
T₁₀₀ less than -45°F

Compression Set (A.S.T.M. D-395-61 Method B)

75% to 90% immediate recovery after 72 hours at 50% compression at 72°F temperature.

Oil Resistance (A.S.T.M. D-471)

Less than 5% volume swell after 168 hours immersion at 75°F.

Tartan Brand adhesive #100 and primer #300 shall conform to the manufacturer's formulation and shall be installed as per directions furnished

The surfacing material shall be an approved green color acceptable to the Engineer and have an indented finish.

CONSTRUCTION METHODS:

The surfacing shall be installed the entire length of the bridge deck as soon as the concrete has cured properly to the satisfaction of the Engineer. The deck slab shall receive a wood float finish as per the Standard Specifications and shall be dry and clean of oil, dirt, dust, paint and all substances that might affect the permanent bond. If the concrete requires washing, it shall be allowed to dry a minimum of 24 hours and shall be protected from the elements prior to the installation of the surfacing.

The concrete shall be etched per the manufacturer's directions where any residue remains or the finish is such that a proper bond cannot be obtained.

Primer #300 shall be applied as an even coat to thoroughly saturate the deck and a second coat shall be applied no sooner than two hours after the first coat. A minimum curing time of four (4) hours is required prior to applying the adhesive.

3M Adhesive #100 shall be thoroughly mixed as per the manufacturer's directions and shall be applied when the air temperature is between 60° - 75°F. The adhesive shall be applied with an approved 1/8 inch notched trowel immediately after mixing.

The surfacing shall be furnished in full deck width pieces and in approximately twenty foot lengths and shall be installed as follows:

(1) Lay the surfacing in the area desired. The material is elastic and may have stretched or compressed during unrolling. If the pad is too long, stretch has occurred and shall be relieved by pushing one end of the pad inward to form a ripple, and walking this ripple along the pad. If the pad is short, compression has occurred and may be relieved by pulling on one end of the pad until the proper length is obtained.

(2) Complete cutting and trimming at the edges to insure a snug fit at each side of the deck.

(3) Roll back one half of the pad over the shipping core to expose the floor. Avoid excessive sharp bending.

(4) Spread the adhesive on the floor and roll the pad into the adhesive. Seams should be butted tightly when the pad is rolled out, or adjusted immediately thereafter. The entire pad should then be tamped firmly in place, especially at the edges to insure a tight fit against the concrete deck.

(5) Roll back the other half of the pad and repeat the installation of the remaining half.

(6) The second pad should then be positioned tightly against the first pad, making certain that all seams are properly butted together.

(7) Excess adhesive may be forced up between seam edges and shall be removed immediately.

(8) All seams, gaps and openings in the finished overlay shall be filled by using a Seaming Kit as provided by the manufacturer.

(9) The finished surface shall be cleaned as directed by the Engineer using a mild detergent and water.

METHOD OF MEASUREMENT:

Tartan Surfacing installed complete in place and accepted shall be measured for payment in square feet of exposed area lying between the ends of the bridge and the edges at each curb, including the areas tucked under edge angles on the end of the bridge.

BASIS OF PAYMENT:

The area of Tartan Surfacing thus measured shall be paid for at the contract unit price per square foot which price shall be full compensation for all materials, adhesives, seaming kits, etching, equipment, tools and labor incidental to the satisfactory installation of the surfacing.