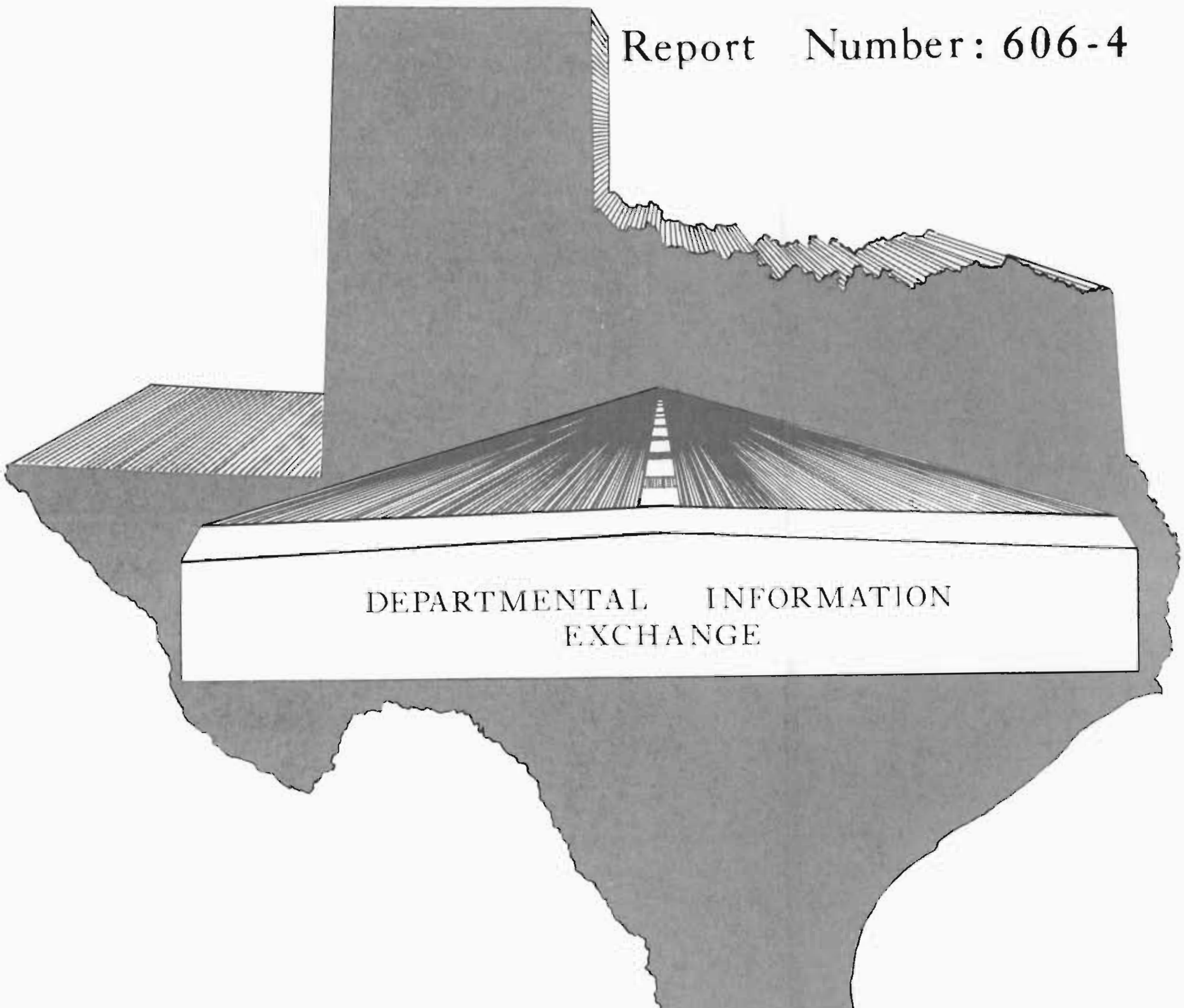
EXPERIMENTAL PROJECTS

EVALUATION OF SURFACE - SEALING SYSTEMS UTILIZING SEAL COATS AND POLY - FAB UNDERSEAL

Report Number: 606-4



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16. Abstract

A major problem encountered in overlaying a distressed pavement with asphaltic concrete pavement concerns the retardation of reflective cracks in the new pavement. The objectives of an experimental project on IH 40 in Potter County was to evaluate the performance of various construction materials and techniques in retarding reflective cracking and develop cost data for these various systems. The systems consisted of a surface-sealing system in conjunction with the asphaltic concrete pavement consisting of an underseal of asphalt and aggregate and a system in conjunction with the asphaltic concrete pavement consisting of an underseal containing a poly-fab underseal at various depths below the surface.

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EVALUATION OF SURFACE-SEALING SYSTEMS UTILIZING SEAL COATS AND POLY-FAB UNDERSEAL

Initial Report
for
Evaluation of Experimental
Construction Project

on

Interstate Highway 40
Oldham and Potter Counties
Texas

Controls: 90-4 & 5
From: 0.3 Mi. West of Potter County Line
To : 2.0 Mi. West of Bushland

Project Supervision

Lewis R. Loyd, Supervising Resident Engineer

Donald D. Day, Senior Resident Engineer

Report Prepared by

Donald D. Day, Senior Resident Engineer

State Department of Highways & Public Transportation
District 4
Amarillo, Texas

in cooperation with

U.S. Department of Transportation
Federal Highway Administration

Dates of Construction:
July 11, 1977 to August 30, 1977

EXPERIMENTAL PROJECT REPORT 606-4

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or policies of the Federal Highway Administration. This report does not constitute a standard specification or regulation.

The material contained in this report is experimental in nature and is published for informational purposes only. Any discrepancies with official views or policies of the DHT should be discussed with the appropriate Austin Division prior to implementation of the procedure or results.

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OBJECTIVES

A major problem encountered in overlaying a distressed pavement with Asphaltic Concrete Pavement concerns the retardation of reflective cracks in the new pavement. The objectives of an experimental project on I.H. 40 in Potter County was to evaluate the performance of various construction materials and techniques in retarding reflective cracking and develop cost data for these various systems. These various systems consisted of:

1. A surface-sealing system in conjunction with the Asphaltic Concrete Pavement consisting of an underseal of asphalt and aggregate.
2. A surface-sealing system in conjunction with the Asphaltic Concrete Pavement consisting of an underseal containing a poly-fab underseal at various depths below the surface.

PROJECT BACKGROUND

The research project is at the location of one of the first sections of U.S. Highway 66 upgraded to full interstate standards in 1959. The project is located approximately 18 miles west of Amarillo. The roadway is at an elevation of 3900 feet, gentle sloping (1 to 3 percent) and oriented West-Northwest to East-Southeast. The soil is a clay loam with a Plastic Index (P.I.) between 17 and 25 and a Triaxial Class of 4.0 to 5.0.

The average rainfall is 18.23 inches with an average of 13 inches of snow. The mean annual temperature is 59° Fahrenheit with an average minimum temperature of 20.9° Fahrenheit in January. The lowest recorded temperature is -8° Fahrenheit and daily variations of 30° to 40° are common. Drops of 60° are not uncommon with passages of "Northers" during the winter. Hard freezes for three or four days with rapid thaws are not unusual.

The original main lanes consisted of two 12' lanes, 5' inside shoulders and 10' outside shoulders and were constructed of 18" compacted flexible base with 150#/SY asphaltic pavement on the lanes and a one course surface treatment on the shoulders. The roadway sloped 1/8" per 1'-0" from the edge of the inside shoulder to the outside shoulder.

During the winter of 1968-1969 we received an unusual amount of moisture followed by excessively low temperature for several days. The ground froze to a depth of approximately 18". This deep freeze of the pavement was followed by Southwest winds with temperatures in the low 70's. This very quickly thawed out the surface of the roadway and with the volume of truck traffic (1300 trucks per day), the surface of the thawed areas quickly degenerated.

Samples were taken in seven various locations. The average soil characteristics were Liquid Limit, 30; Plastic Index, 12.5; and passing #40, 31%. Emergency funds were obtained and plans were rushed through for letting. The plans included cement stabilization of the top 6" of the existing base material with 6% Portland Cement. (See Figure I). A level-up course of Type D Asphaltic Concrete Pavement averaging 175 lbs/SY was placed over the stabilized base and an addittional 150#/SY riding surface was placed over the main lanes. The geometrics of the main lanes were not altered.

Approximately one year after the completion of the emergency construction, cracks began to appear in the surface of the roadway. With the 1/8" per 1' slope, water did not drain off the roadway, especially in the wheel paths. With the cracking and standing of the moisture during wet periods, pumping and increasing deterioration of the pavement resulted. (See Picture, 1, 2, 3 & 4)

DESIGN

The design of the roadway incorporated four different concepts so that each could be evaluated as to their success in preventing and/or retarding cracks. The average daily traffic count during construction was 7060 of which 25.6% were trucks. This volume of traffic added to the problems of construction and the sequence of work required detours at each end of the project to be used during actual construction operations. Traffic was carried on the main lanes through the new construction except during actual construction operations.

The same geometrics were used in each of the four designs. This revised design changed the slope in the outside lane from 1/8" per 1' to ¼" per 1'. This gave an average thickness of 3" at the outside shoulder and 4½" average thickness at the centerline. The slope on the inside lane was changed from 1/8" per 1' slope to the outside to 3/16" per 1' slope to the inside. This lane had 4½" average depth at the centerline and 3/4" average thickness at the inside shoulder. This design put the additional thickness where needed in the outside lane and provided a roof-top crown allowing snow to be graded off and not melt and run across the pavement during a day, then freeze again at night (See Figure II).

As previously stated, the experimental portion of this project dealt with the evaluation of a surface-sealing system only and the geometrics were the same for each of the four alternate systems.

System I (See Figure III) consisted of a seal coat using 0.35 gal/SY asphalt and Type A Gr 3 Aggregate applied at the rate of 1 CY per 85 SY applied directly to the existing pavement. This was followed with the level-up and final course of Asphaltic Concrete Pavement.

System II (See Figure IV) consisted of placing Asphalt and Poly-fab underseal directly on the existing pavement. This was covered with a seal coat using 0.25 gal/SY asphalt and Type A Grade 5 Aggregate applied at a rate of 1 CY per 120 SY. This was followed with the level-up and final course of Asphaltic Concrete Pavement.

System III (See Figure V) consisted of placing the level-up course of Asphaltic Concrete Pavement, then placing Asphalt and Poly-fab underseal over the level-up and then placing a final course over the poly-fab. The final course averaged 75#/SY.

System IV (See Figure VI) consisted of placing Asphalt and Poly-fab underseal directly to the existing pavement. This was blotted with sand and overlayed with the level-up and final course of Asphaltic Concrete Pavement.

CONSTRUCTION PHASE

The placing of poly-fab underseal fabric was the only construction procedure that varied from the normal construction practices. Therefore, for this report this construction procedure will be the only construction discussed. The poly-fab underseal used for this project was Petromat.

Petromat is the trade name for a nonwoven fabric developed by Phillips Fibers Corporation, a subsidiary of Phillips Petroleum Company. It is a specially engineered reinforcing material to be used to increase fatigue life of an overlay and to help keep cracks from reflecting through to the new surface. Petromat fabric, made with polypropylene fiber, is designed to resist chemicals, rot, and when combined with asphalt, form a barrier to moisture.

Phillips Fiber Corporation furnished a machine and operator to aid in placing of the Petromat. This machine was especially designed for the placing of this fabric (See Picture 5). The machine was a converted small front-end loader adapted as a placement vehicle for the Petromat. The overall performance of the machine was satisfactory.

The Petromat on this project was supplied in 6'3" or 12'6" by 300' strips rolled on a cardboard tube. The weight was about 60 pounds for the short roll and 120 pounds for the long roll.

The transverse joints were lapped 6 to 14 inches and additional asphalt was applied, then the joints were nailed down for protection from damage by the traffic. The joints were lapped with the traffic to lessen damage and wear (See Pictures 6 and 7).

The longitudinal joints were a different problem. The edge of the Petromat previously placed curled if the asphalt underseal for the strip adjacent was applied at temperatures above 260° Fahrenheit. When temperature of the underseal asphalt was applied within the 225° to 240° Fahrenheit range, the curling action did not occur. A change in the grade of asphalt did not change the observed reaction at the edge of the material.

The section (Section II) receiving the seal coat on the Petromat developed more wrinkles than the other sections. The material expanded when the hot asphalt was applied (See Picture 8). There were some wrinkles present in all sections (See Picture 9). There has been no apparent ill-effect in the succeeding layers of material placed above these wrinkles, as of this report.

The air temperature varied from the 60's to 90's during the placing operations. As the temperature rose, the material needed to remain in contact longer before it would bond to the raw asphalt. A small pneumatic roller was used to aid in bonding the asphalt and Petromat.

The Petromat absorbed about 0.21 gallons of asphalt per square yard. The application rate on this project was approximately 0.25 gallons of asphalt per square yard. The surface would become sticky or tacky, after the bonding had taken place. The asphalt not absorbed was blotted by the addition of sand before the surface was opened to through traffic.

The wind was a problem during the placing of the Petromat. The wind velocity varied from 15 to 30 miles per hour during most of the placement operation. Interstate 40, at the location of this project, has an east-west orientation with the prevailing wind from the southwest. The wind would cause the most trouble where there was a break in the cross slope of the section near the edge of the material. To keep the Petromat in place, the edge on the windward side was nailed with concrete nails and roofing washers. The spacing of the nails was 5 feet more or less along the edge of the material.

The traffic was carried on the main lanes through the new construction except during actual construction operations. The traffic was carried on the Petromat without difficulty and without damage to the surface. The longest period the traffic was on the Petromat surface was four days. Rain did not adversely effect the Petromat that was carrying traffic.

Care in the operations of construction equipment was necessary during placing of successive construction activities. The tracks of the laydown machine and loaded truck could cause damage to the Petromat by turning, starting and stopping.

EVALUATION

The purpose of this experimental project was primarily to evaluate the performance of various surface sealing systems and develop cost data for these systems.

The performance of the roadway will be watched regularly by the Maintenance Foreman and any unusual changes in the surface along this project will be called to the attention of the District Engineer. The midpoint of each section is clearly marked with guardposts for easy identification. The ends of each section can readily be identified by a construction joint.

A point was selected in each of the four sections which has been marked for future relocation. Photos were taken before and after construction at each of these reference points. A total of eight photos were taken at each reference point. Additional photos were taken and referenced at points in existing pavement that indicated structural weakness.

Additional photos will be taken at each of these points each year for five years for evaluation of each system. These photographs are marked and retained at the office of the Resident Engineer, Lewis R. Loyd, in Canyon, Texas.

A Bar Graph (Figure VII) indicates the difference in cost per square yard for the four different typical sections. The petromat and underseal was a significant factor in the total cost per square yard.

SUMMARY

The evaluation of the performance of the various surface-sealing systems is initiated with this report. The various sections have been closely examined numerous times since the original construction. This winter has been very cold (coldest February since 1907) and we have had more than average moisture in the form of rain, sleet and snow. To this date, no cracks have been observed in any of the sections and there is no evidence of failure in the pavement structure.

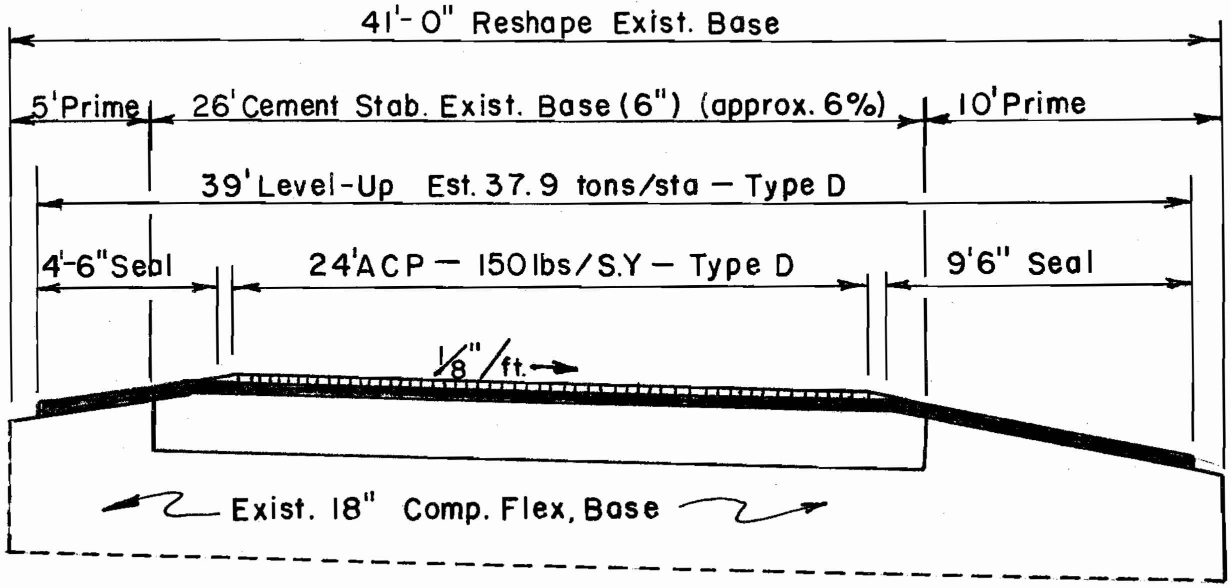


FIGURE I

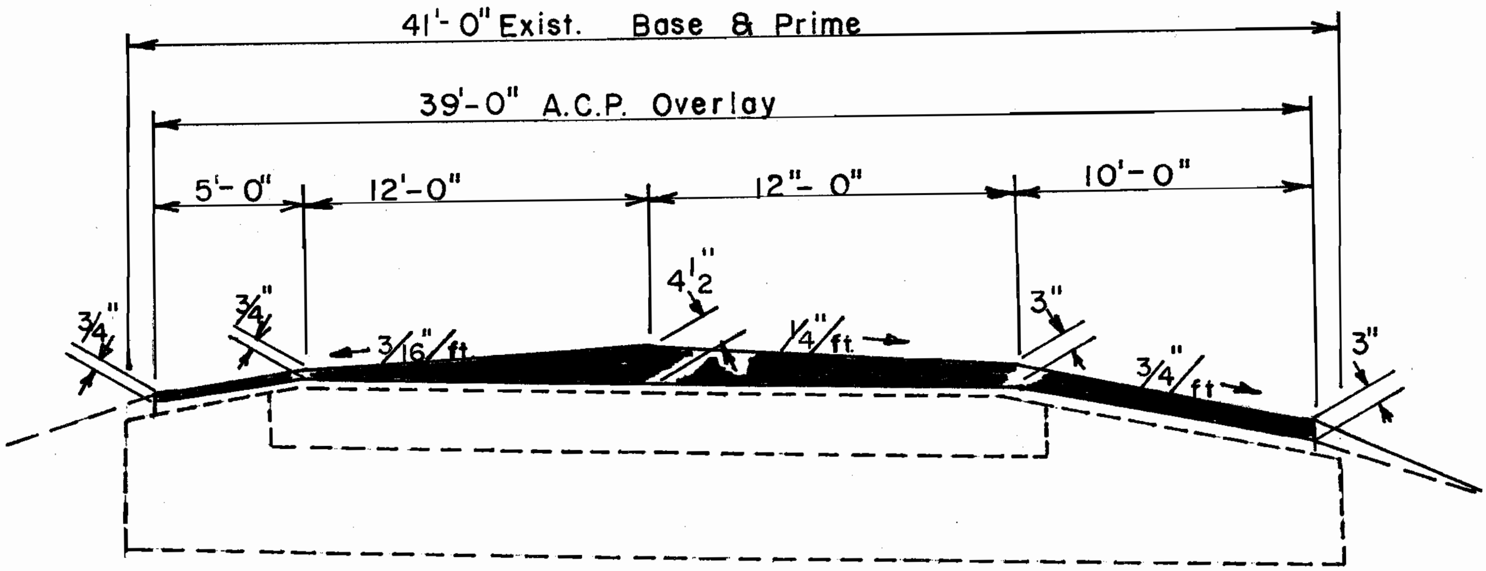


FIGURE II

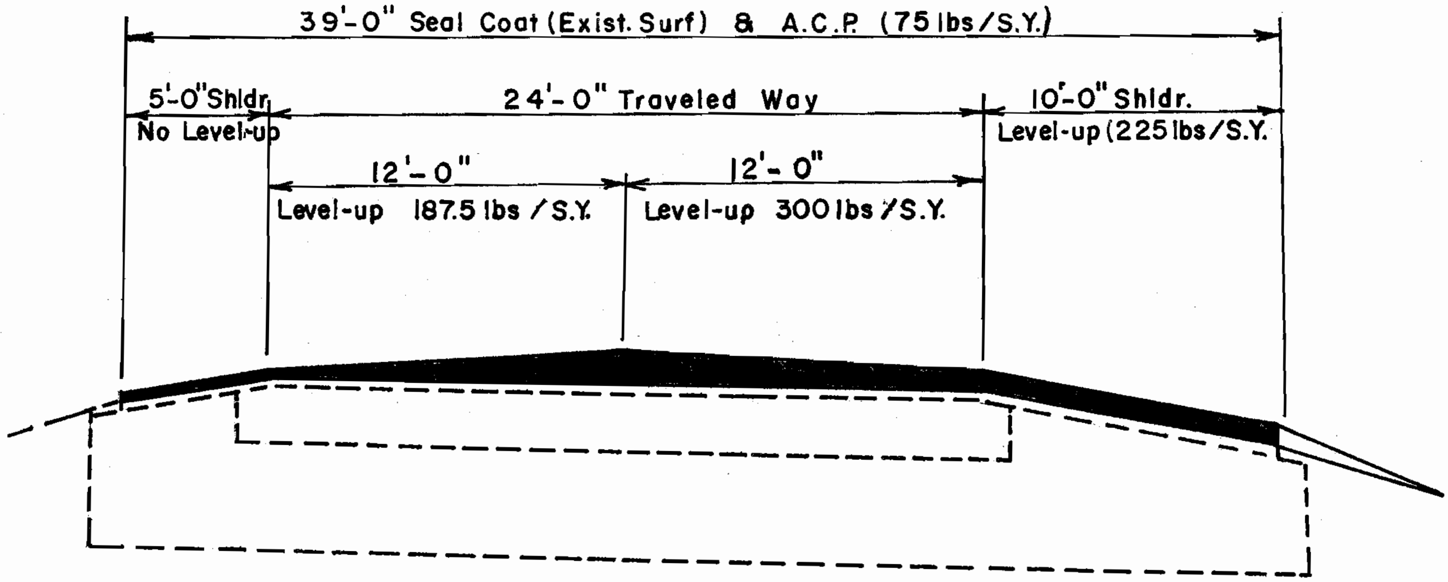


FIGURE III

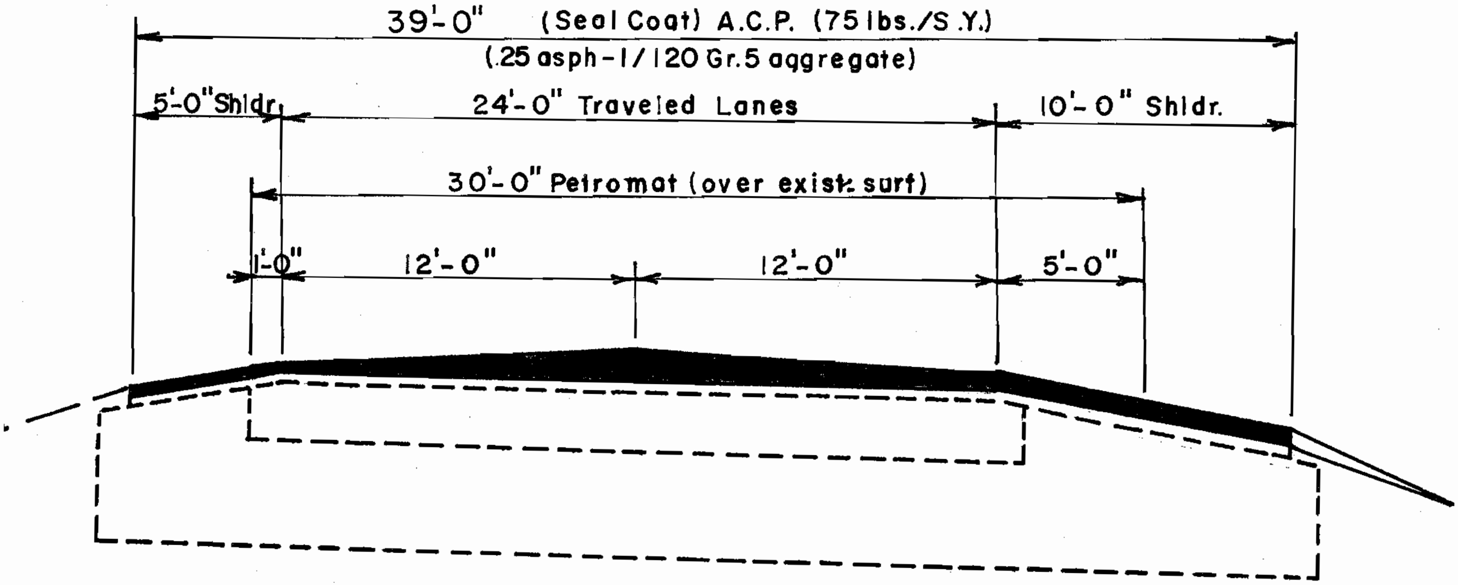


FIGURE IV

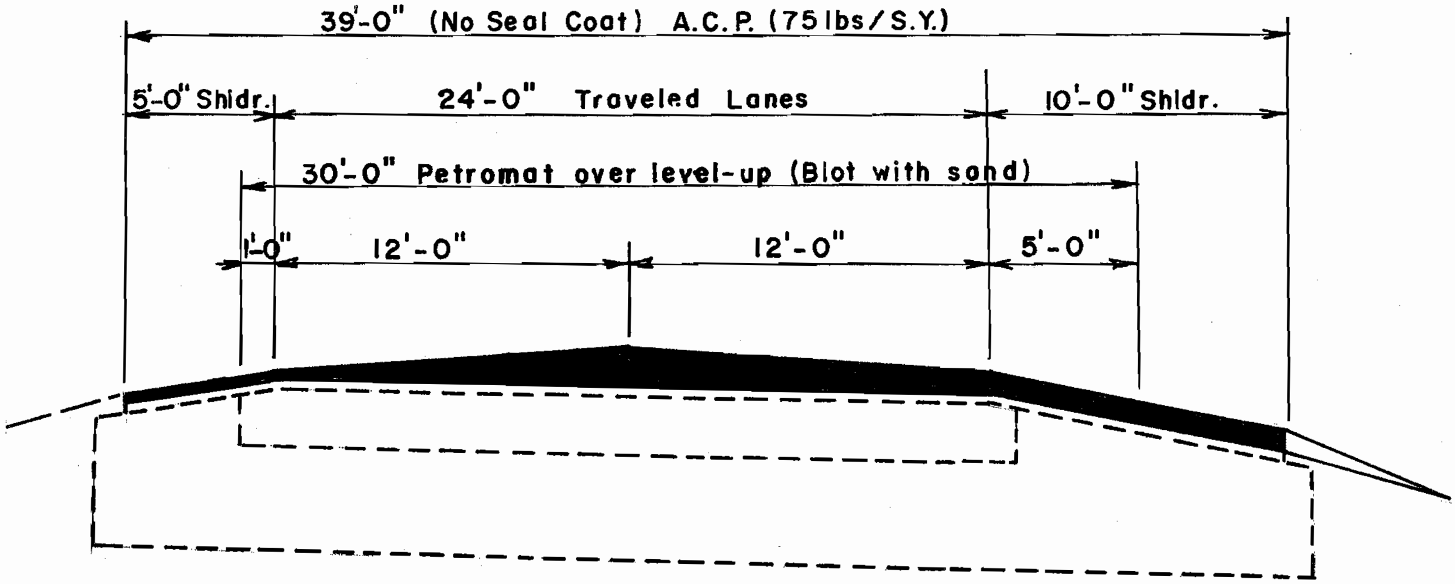


FIGURE V

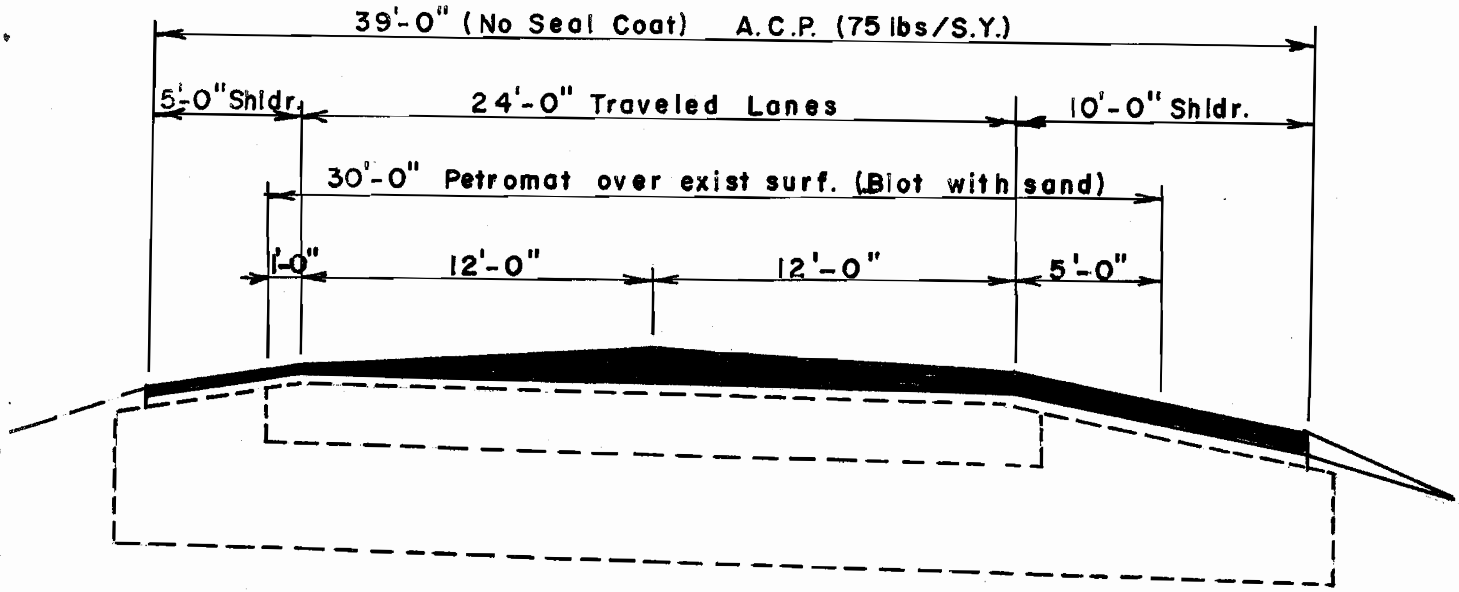


FIGURE VI

CONTRACT COSTS
COST PER SQUARE YARD

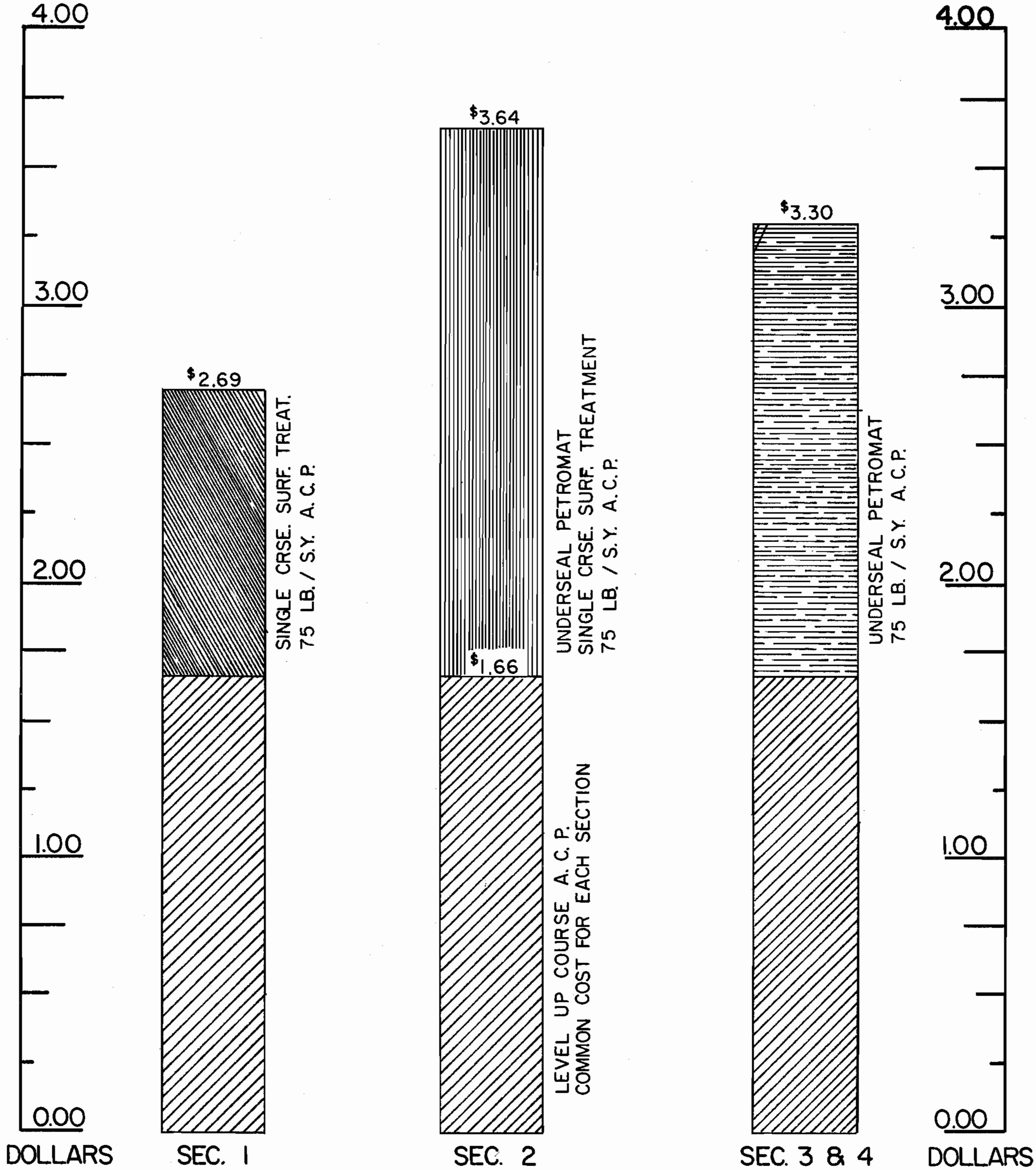
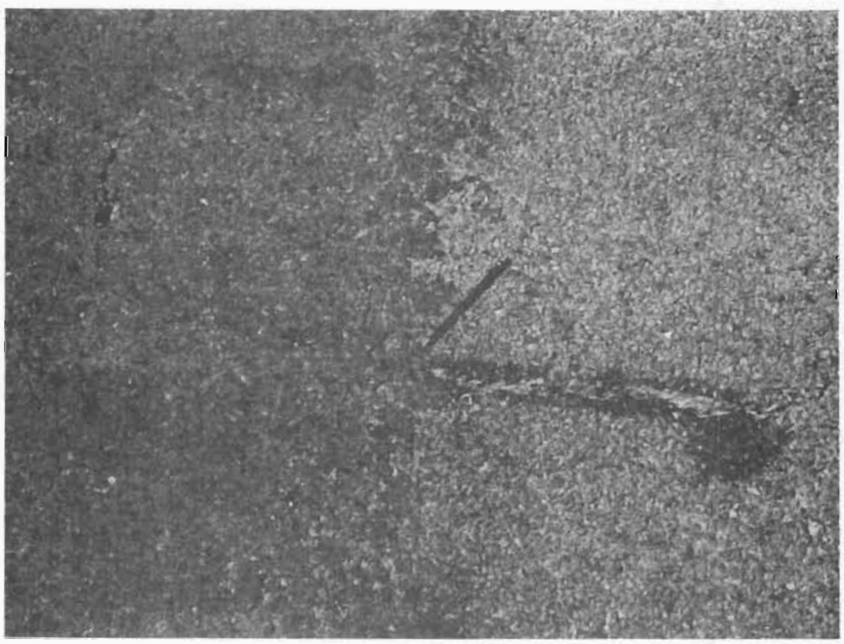


FIGURE VII

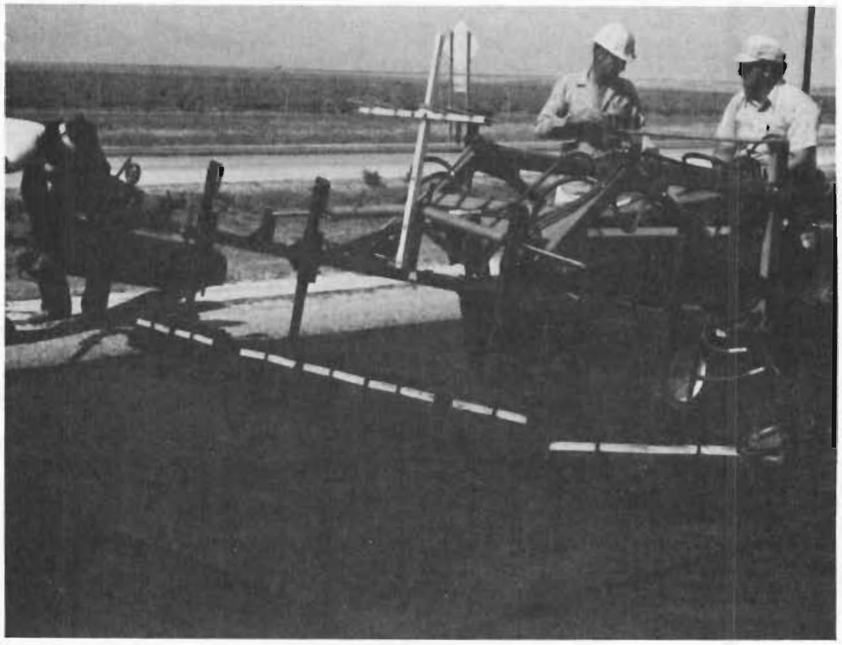
Picture 1

Picture 2

Picture 3



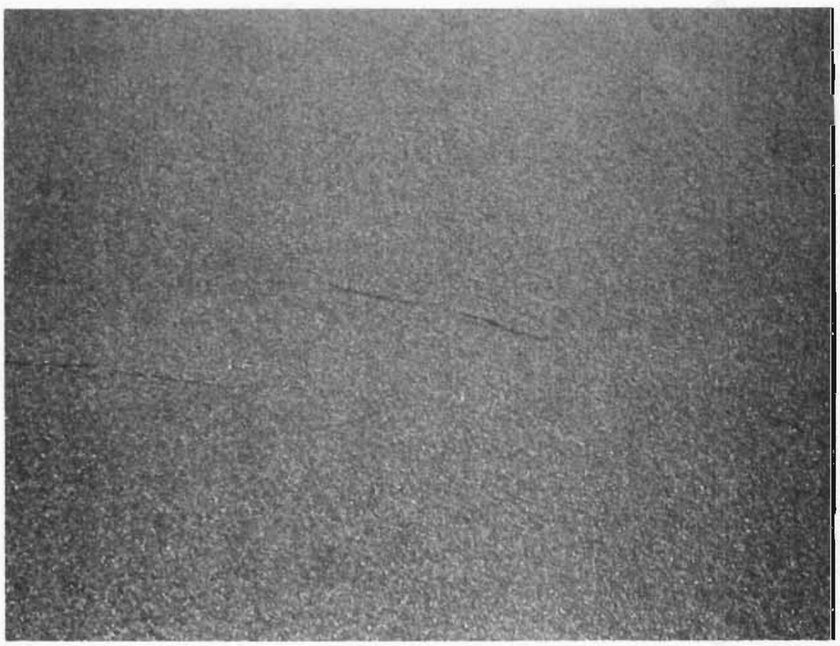
Picture 4



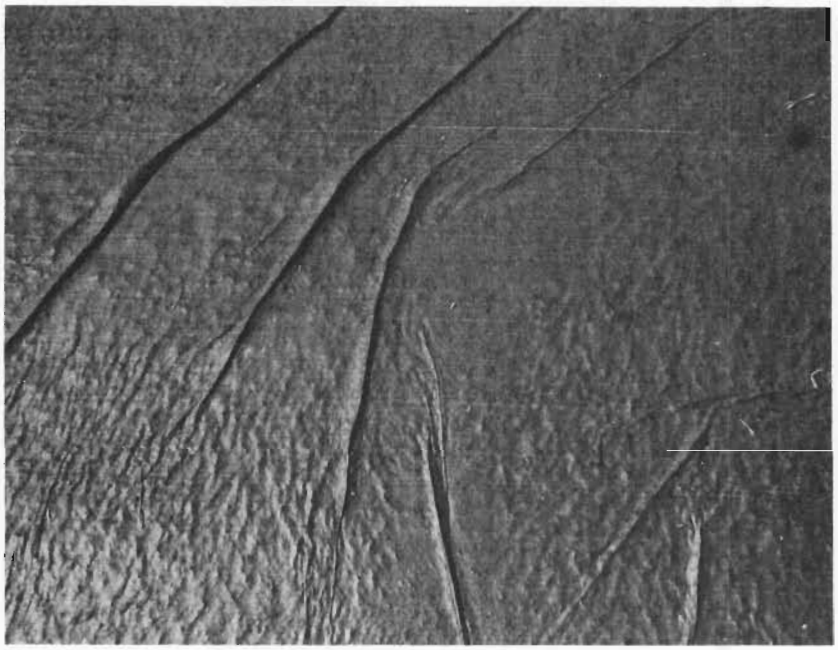
Picture 5

Picture 6

Picture 7



Picture 8



Picture 9