RUBBERIZED ACP CLASS "D"

SR-520, Evergreen Point Bridge to SR-908

WA-RD 330.1

Post-Construction and Yearly Evaluation Report
March 1994

Washington State Department of Transportation

Washington State Transportation Commission
Transit, Research, and Intermodal Planning (TRIP) Division
in cooperation with the U.S. Department of Transportation
Federal Highway Administration

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
WA-RD 330.1		

4. TITLE AND SUBTITLE	5. REPORT DATE
Rubberized ACP Class "D" SR-520, Evergreen Point Bridge to SR-908	March 1994
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) John Livingston and Ron Schultz	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Washington State Department of Transportation Materials Laboratory 1655 South Second Tumwater, Washington 98504-7365	10. WORK UNIT NO.
	11. CONTRACT OR GRANT NO. Contract 2324
12. SPONSORING AGENCY NAME AND ADDRESS Washington State Department of Transportation Transportation Building PO Box 47370 Olympia, Washington 98504-7370	13. TYPE OF REPORT AND PERIOD COVERED Post-Construction and Yearly Evaluation Report
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

This study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. ABSTRACT

The construction and performance history are described for a rubberized open-graded pavement placed on SR-520 near Kirkland, Washington. The section has lasted longer than the average conventional open-graded pavement, but it is not clear that the addition of the rubber was the only contributing factor in the increased life of the section.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
rubber-asphalt, open-graded pavement, service life	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22616

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
None	None	15	

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SR-520, Contract 2324
Evergreen Point Bridge to SR-908

by

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Post-Construction
and
Yearly Evaluation
Report

Prepared For
Washington State Department of Transportation
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Federal Highway Administration

March 1994

DISCLAIMER

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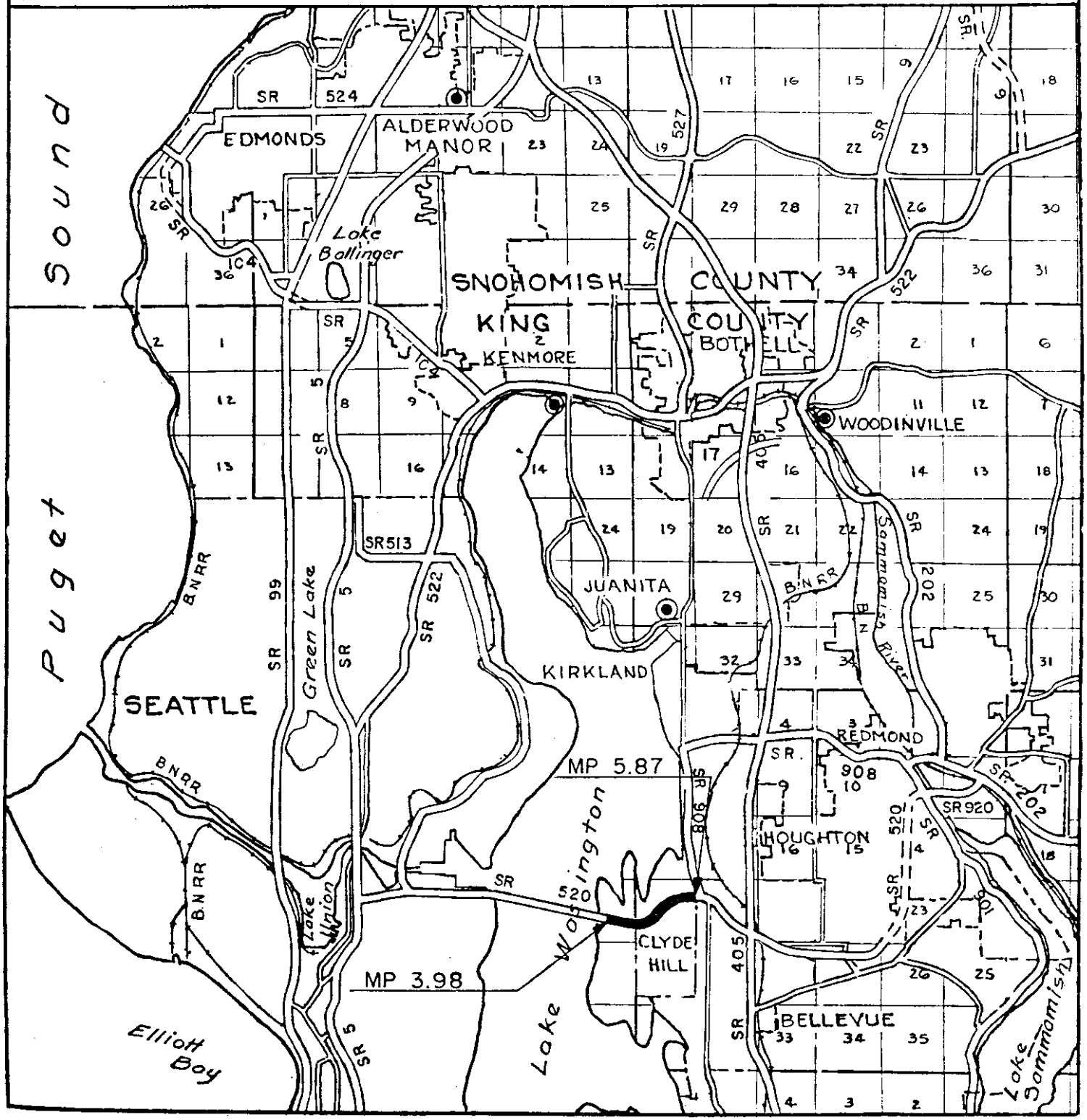
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

OLYMPIA, WASHINGTON

MAP OF STATE HIGHWAYS

KING & SNOHOMISH COUNTIES



INTRODUCTION

This report describes the construction of an experimental rubberized asphalt open-graded friction course (Class D) overlay on SR 520. The section overlaid was located just east of the Evergreen Point Floating Bridge. The rubberized asphalt overlay was selected for this high traffic area because of its reported ability to resist ravelling as compared with a conventional Class D pavement. A short section of conventional Class D pavement was placed at the eastern end of the project to serve as a control.

STUDY SITE

The project boundaries were the east pavement seat of the Evergreen Point Floating Bridge and the SR 908 Interchange as shown on the vicinity map located in Appendix A. The ADT for this section at the time of construction in 1982 was 79,000 with a projected growth rate of 2.5% per year, however the current ADT is 102,000 with a growth rate of 6.5% per year. Pertainent facts concerning the construction contract are tabulated below.

Contract Number: 2324
Contract Name: Evergreen Point Bridge to SR 908
Route Number: SR 520
Milepost Limits: 3.98 to 5.87
Number of Lanes: 4 lanes plus HOV lane westbound
Overlay Thickness: 0.08 ft. Class G leveling,
0.06 ft. Class D wearing
Project Engineer: Tom Brown
Contractor: Lakeside Industries
Start of Paving: August 14, 1982
End of Paving: August 15, 1982

The roadway section called for removal of 0.08 ft. of the existing asphalt and replacing this with a leveling course of Class G ACP equivalent in depth to the section removed, followed by the 0.06 ft. wearing course of the rubberized asphalt concrete Class D. A short control section of Open Graded Class D, with conventional binder, was placed on the outside lanes and ramps of the 108th Avenue N.E. interchange.

CONSTRUCTION SUMMARY

The paving of both the rubberized asphalt and the open graded asphalt concrete Class D was performed by Lakeside Industries of Issaquah. Arizona Refining Company provided technical expertise on the project, while Sealant Systems performed the asphalt rubber reaction process. The job mix design recommended by Arizona Refining Company is listed below along with the extraction results from the actual mix placed on the project.

CLASS D

Sieve Size	Specs. % Passing	Control #1 % Passing		Control #2 % Passing	
		Lab	Field	Lab	Field
3/8"	97 - 100	99	100	99	100
#4	30 - 50	36	45	45	44
#8	5 - 15	10	14	16	14
#200	2 - 5	1.3	3.7	2.0	2.8
Stabilometer		26		28	
Voids		12		10	
Wt/Cu. Ft.		136.6		139.3	
Max. Density		155.3		154.6	
%Asphalt 5.5-8.5(spec.)		6.2	7.5	6.6	7.6

Except for the addition of the rubber, the specifications for this mix are identical to conventional Class D mix. The complete contract specifications can be found in Appendix B.

The vulcanized and devulcanized rubber additive were mixed with the AR 4000 in a portable recirculating distributor and then transferred into the regular storage tank. This tank was connected to a Barber Greene 9000 pound batch plant. The batch plant produced the rubberized mixture at 340^0 F which was transported to the job site by conventional 10-wheel end dump trucks. A Barber Greene paver with vibratory rollers was used to place and compact the mix.

Paving of the project was conducted August 14 and 15, 1982. The weather was broken clouds with ambient temperatures ranged from 48^0 to 60^0 F. The only construction difficulty was that a cloud of white smoke or vapor formed around the paving machine. This caused visibility problems for the traffic having to negotiate the construction zone. The cloud could have been water vapor caused by the contrast between the high temperature of the mix and lower ambient temperatures or by the mix itself. It could also have been a smoke cloud from the rubber in the asphalt. A white cloud of smoke has been observed distributors which are spraying the rubber-asphalt binder for stress absorbing chip seals.

COST

The unit contract bid price for the Rubberized Asphalt Concrete Pavement Class D was $ 27.00/ton.

PERFORMANCE EVALUATIONS

Friction Resistance

The initial friction tests were done December 1, 1982, 4 months after the completion of the paving. These initial values ranged from 41 to 47 with an average of 44. Friction test values were also collected three additional times during the course of the evaluation. The table on the next page summarizes the results of all four sets of measurements.

Friction Test Results

	LOW	HIGH	AVERAGE	MONTH
1982	41	47	44	December
1984	39	46	43	April
1991	47	54	50	January
1992	37	47	44	April

Roughness

Pavement roughness was also monitored on this project. Measurements taken in 1982, prior to the overlay, indicated a value of 2.08 counts per mile while readings taken after paving showed 1.34 counts per mile. Measurements have been taken at three different times since the initial testing. These were taken in January 1984, January 1991, and September 1992 with readings of 1.16, 1.38, and 1.95 bumps per mile, respectively. These values indicate that the roughness has increased with time to almost the same level as the original pavement after 10 years of traffic.

Rutting

Recent acquisition of a South Dakota Profilometer enabled the measurement of rutting for the entire length of each lane of the project in September of 1992. The results are as follows:

Eastbound Inside Lane	0.48 inches
Eastbound Outside Lane	0.33 inches
Westbound Inside Lane	0.50 inches
Westbound Outside Lane	0.46 inches

Visual Observations

The project, as of September 1992, appeared to be in fair shape. Rutting is a problem as noted above, and several locations were noted where maintenance patches have been placed in the wheel paths. A new maintenance overlay was also noted between MP 4.00 and 4.25 in both travel directions. This was placed due to excessive ravelling and rutting. Moderate ravelling was observed throughout the project length in all lanes. Another maintenance overlay was noted in the vicinity of MP 5.00 WB. This repair seems to have been initiated by a problem in the subgrade not in the rubber-asphalt pavement. Visual inspection of the conventional Class "D" control section showed the same signs of raveling and rutting noted in the rubber-asphalt section.

As an added note, the Evergreen Point Bridge, which is located just west of this project, was paved with Class "D" a few months prior to this project. It is showing considerable rutting, 1/8 - 1/4 inch, through its entire length. The primary cause of this rutting is believed to be the use of studded tires during winter months and the concentration of wheel loads caused by the narrow width of the structure. The bridge was overlaid in late 1991 to correct this problem.

CONCLUSIONS

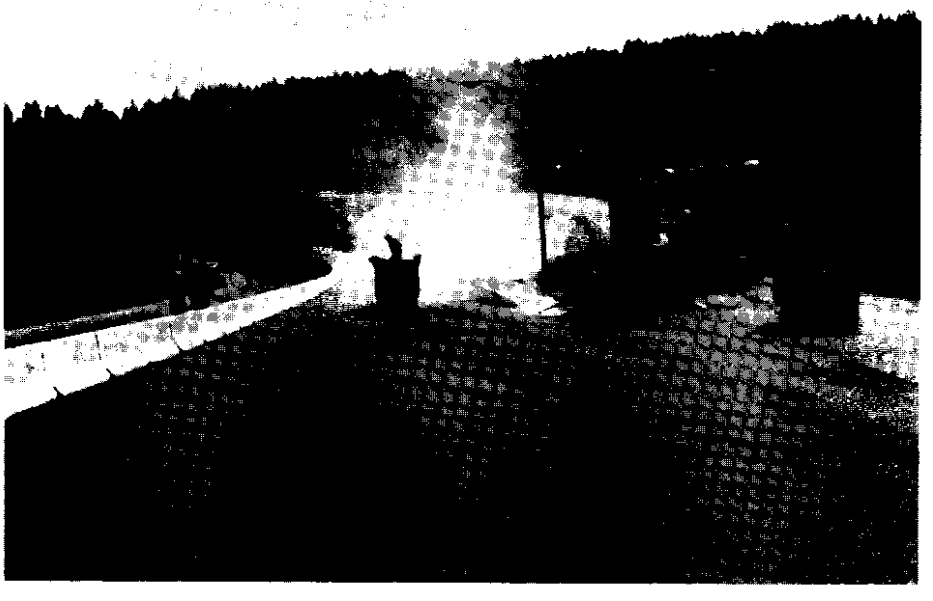
The experimental rubberized friction course is experiencing the sames forms of deterioration experienced by other open graded pavements in the state, namely ravelling and rutting. The typical service life of Class D pavements is 7 - 9 years before severe rutting (1/2 to 3/4 inches) mandates rehabilitation. Therefore, this project has survived considerably longer than the average open graded pavement. Taking into consideration the control section, which has shown performance equivalent to the rubberized mix, it leads to the conclusion that the addition of rubber may have not been the

only factor which contributed to the longer pavement life of this section.

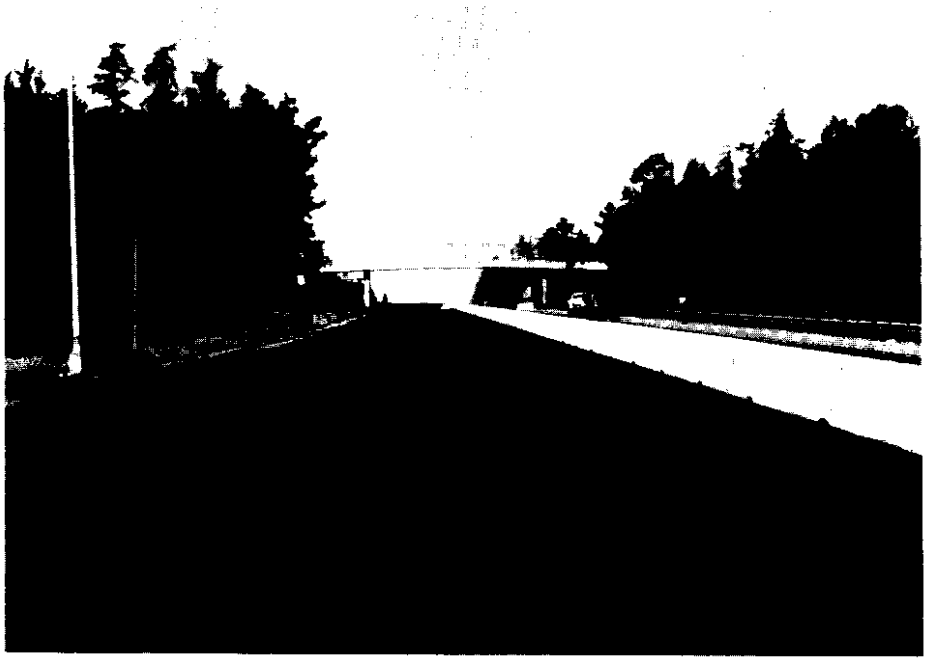
APPENDIX A

Photographs

Paving operation with the rubberized Class D ACP mix showing cloud which formed behind the paver.



Rolling operations on the rubberized Class D ACP mix.



View of finished rubberized Class D ACP pavement.

APPENDIX B

Specifications

RUBBERIZED ASPHALT CONCRETE CLASS D

This special provision covers the modification of the standard specifications for Class D asphalt concrete to include granulated rubber in the binder phase of the mixture.

The standard specifications for asphalt concrete Class D shall be applicable except for the following changes:

Section 9-02 of the standard specifications is supplemented by the following:

Asphalt
Asphalt shall be AR-4000W conforming to section 9-02.1(4) of the standard specifications.

Granulated Rubber
Granulated rubber shall be free from fabric, wire, or other contaminated materials except that up to four percent of calcium carbonate may be included to prevent particles from sticking together. The rubber shall meet one of the following gradations and shall be at the option of the Contractor:

1. 100% ground vulcanized rubber:

Sieve	Percent Passing
No. 16	95-100
No. 25	0-10

All percentages are by weight.

2. 40% powdered reclaimed devulcanized rubber and 60% ground vulcanized rubber scrap:

Sieve	Percent Passing
No. 8	100
No. 30	60-80
No. 50	15-40
No. 100	0-15

All percentages are by weight.

Section 5-04.3 of the standard specifications is supplemented by the following:

Mixing Asphalt and Rubber
The asphalt and rubber shall be combined as rapidly as possible in the proportions of a minimum of two pounds of rubber to one gallon of asphalt (standard @ 400 degrees F), then held for such a time and

temperature that the consistency of the mix approaches that of a semi-fluid material. The temperature of the asphalt shall be between 400 degrees F and 450 degrees F prior to mixing. The use of up to nine percent diluent to assist in the mixing of rubber will be permitted. If a diluent is used, it shall have a boiling point of at least 350 degrees F. After reaching the proper consistency, the use of the material shall proceed immediately, and in no case shall the material be held at temperatures in excess of 350 degrees F for more than one hour after reaching that point.

The method and equipment for combining the rubber and asphalt shall be so designed and accessible that the Engineer can readily determine the percentages, by weight, of each of the two materials being incorporated into the mixture.

For the rubberized asphalt concrete Class D only, the first sentence in the third paragraph of section 5-04.3(8) of the standard specifications is deleted and replaced by the following:

When discharged, the temperature of the mix shall not exceed 325 degrees F.

Section 5-04.5 of the standard specifications is supplemented by the following:

Rubberized asphalt will be measured by the ton in accordance with section 1-09 of the standard specifications and shall include the rubber and the diluent. Any conversions from volume to weight shall be calculated on the basis of 7.5 pounds per gallon at 60 degrees F of asphalt rubber material.

Rubberized asphalt concrete will be measured by the ton with no deduction being made for the weight of liquid asphalt, rubber, diluent, blend sand, mineral filler, or any other component of the mixture.

Section 5-04.5 of the standard specifications is supplemented by the following:

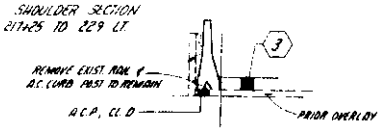
16. "Rubberized Asphalt Concrete Pavement Class D", per ton.

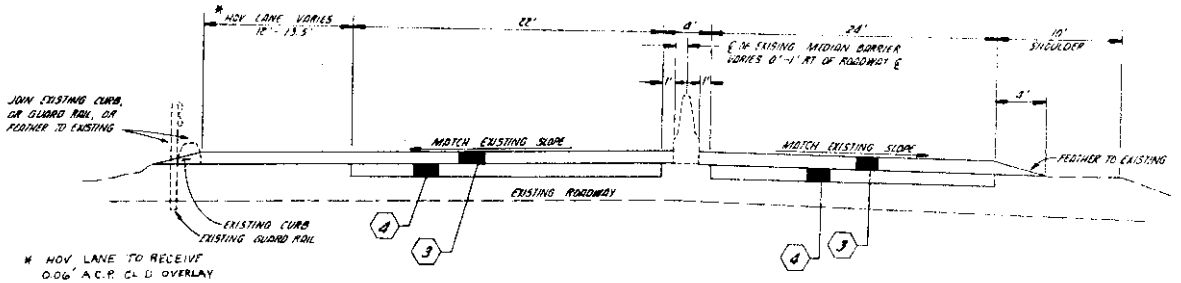
The unit contract price per ton for "Rubberized Asphalt Concrete Pavement Class D" shall be full compensation for furnishing all labor, tools, materials, and equipment necessary to complete the work as specified.

APPENDIX C

Roadway Sections

SHOULDER SECTION
217+25 TO 229 LT

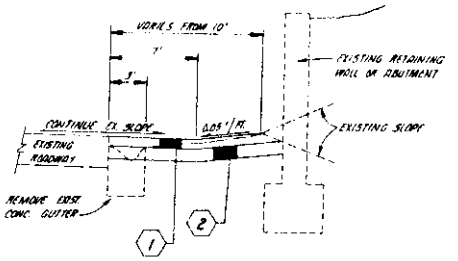




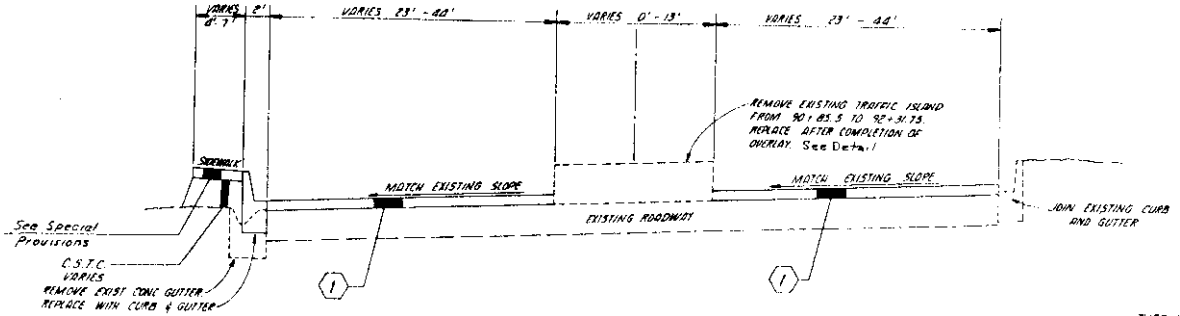
* HOV LANE TO RECEIVE 0.06' A.C.P. CL. D OVERLAY TO MATCH SHOULDER (BROKEN BACK)

S.R. 520
201+98.79 TO 302+00.00

1. ASPHALT CONCRETE PAVEMENT, CLASS B 0.15' COMPACTED DEPTH
2. CRUSHED SURFACING TOP COURSE 0.20' COMPACTED DEPTH
3. A.C.P., CL. D RUBBERIZED OPEN GRADE ASPHALT 0.06' MIN. COMPT. DEPTH (WEARING COURSE)
4. ASPHALT CONCRETE PAVEMENT CLASS G 0.08' COMPT. DEPTH (LEVELING COURSE), BITUMINOUS PLANING DEPTH
5. GRAVEL BORROW VARIABLE DEPTH



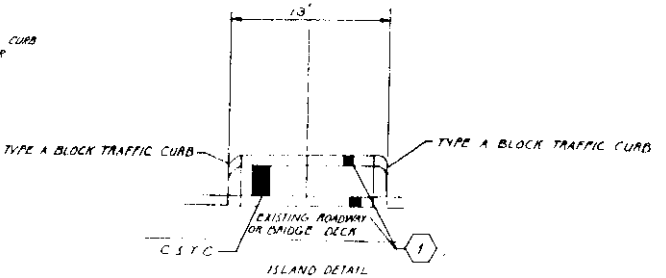
S.R. 520
302+00 TO 309+80
RIGHT SHOULDER



104TH AVENUE N.E.
SR 908
85+00 TO 95+88

MEMBRANE WATERPROOFING (DECK SEAL) 104TH AVE. 91+00.5 TO 104TH 92+16.35 FULL WIDTH TO BE INSTALLED BEFORE A.C.P. CL. B OVERLAY.

NOTE: SOIL HERBICIDE TO BE APPLIED TO ALL AREAS WHERE 0.15' OF A.C.P. CLASS "B" IS TO BE PLACED OVER C.S.T.C.



ISLAND DETAIL
104TH AVE. 90+85.5 TO 92+31.75