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SQUEEGEE SEAL AND CRUMB RUBBER CHIP SEAL SAPINERO - EAST

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Prepared in cooperation with the
U.S. Department of Transportation
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16. Abstract

A severely cracked section of asphalt pavement located in South Central Colorado was overlayed with materials intended to prevent reflection cracking. Construction features included a squeegee seal, plant mix leveling course and a rubber asphalt chip seal.

Five years of performance were evaluated as part of this study with recommendations for treatment of reflection cracking.

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SAPINERO-EAST

Background

This report documents the performance of an experimental construction project designed to evaluate the success of a squeegee seal and crumb rubber chip seal as crack filling and crack reduction treatment. These prodecures were incorporated into Project FC 050-2(10), Sapinero-East. Construction on this project included a Squeegee Seal on the old mat for crack filling, 1 1/2 - 2 inches of plant mix leveling course, and a crumb rubber chip seal.

The squeegee seal procedure has been used by maintenance forces in Colorado for many years as a crack filling procedure. It has been used with good success in keeping badly cracked roads from raveling apart for two or three years under traffic. This project offered an opportunity for a evaluation of this process not only as a crack reduction treatment but also as a crack filling material.

The project also evaluated a crumb rubber chip seal. At the time of construction, crumb rubber used with a chip seal was new in Colorado, and this research project helped to evaluate the effectiveness and durability of this material.

The objectives of this study were to quantatively evaluate the Squeegee Seal process as a crack filler and/or reflective cracking treatment in combination with the Crumb Rubber chip seal and the overlay material. Additionally, the performance of crumb rubber asphalt was evaluated as a chip seal material.

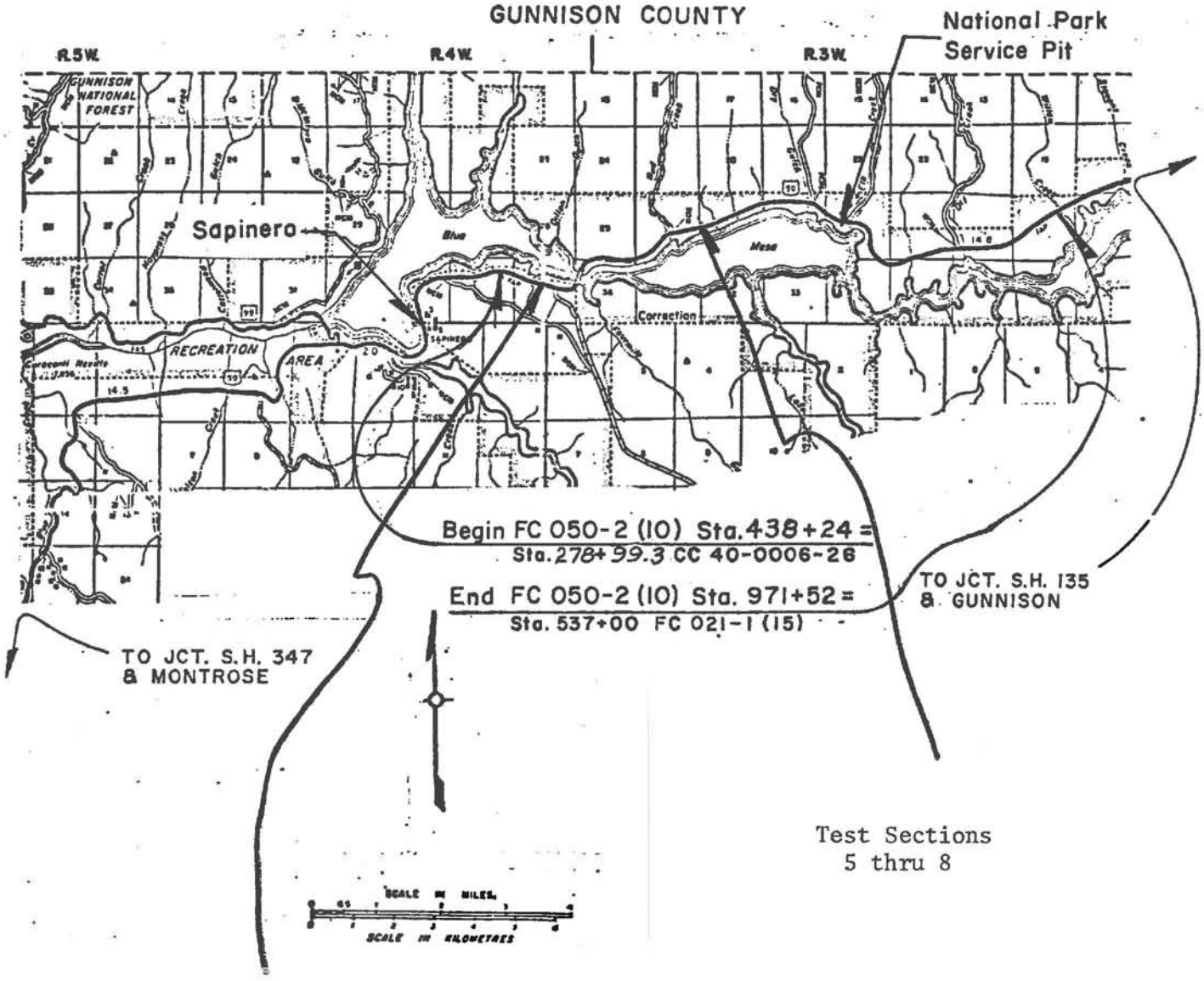
Project Description

Sapinero-East, Project No. FC 050-2(10), is located on U.S. 50 approximately 20 miles west of Gunnison, Colorado. The roadway is adjacent to Blue Mesa Reservoir with an elevation of 7,600 feet above sea level (See Figure 1). The average annual precipitation in this area is 12.2 inches, and temperatures range from -35^{o}F in winter to 85-90^{o}F in the summer. U.S. 50 is on the Federal Aid Primary highway system with an average daily traffic volume of 2,150 vehicles with 14% heavy trucks.

Overlay design using the deflection method showed the need for a 1 1/2-inch overlay on the majority of the project with a 2-inch overlay at the east end. The final project plans called for a squeegee seal for crack

FIGURE 1

FEDERAL AID PROJECT NO. FC 050-2(10)
STATE HIGHWAY NO. 50
PROJECT LOCATION MAP



Test Sections
5 thru 8

Test Sections
J and 1 thru 4

filling, a 1 1/2" or 2" HBP overlay, and a crumb rubber chip seal surface treatment. Two sets of four test sections were included in the plans so that the various features could be evaluated. Figure 2 is a typical layout of the test sections showing the treatment used for each section. The location of the test sections is also shown on the map in Figure 1.

Both sets of test sections were located in areas receiving a 1 1/2" overlay and by adding and subtracting features on various sections, it was hoped to evaluate the individual effectiveness of each treatment.

During the last week in April 1978, a preconstruction evaluation was performed on the test sections. Testing performed included cracking and rutting surveys, CHLOE PSI's, deflections using the Dynaflect, and moisture and density samples of the base and subgrade.

Table A contains a summary of the deflections, PSI's, and cracking and rut depth data. As can be seen from a review of Table A, the existing roadway was in poor condition. Photograph Number 1 shows the typical roadway condition prior to construction.

Sections J and 1-4 are located near the west end of the project. The soils in this area are alluvial in nature containing a large amount of fractured rock. Sections J, 1 and 2 are located in a cut, and Sections 3 and 4 are on rock fills. Sections 5-8 are located near the center of the project in mountainous terrain. Sections 5-7 are located in rock cuts, and Section 8 is located in a high rock fill. Dynaflect readings and base and subbase soil samples show no structural problems in any of the test section areas.

The large amount of cracking is attributed primarily to aging of the pavement and the extreme thermal conditions in the project area. Transverse cracks had approximately a 12-foot spacing with numerous connecting longitudinal cracks located primarily at the center line or between wheel paths.

Construction

A. Squeegee Seal and Overlay

Because of the severe cracking on the old roadway, a squeegee seal was applied to fill the cracks and hopefully prevent reflective cracking through the new overlay and chip seal.

The squeegee seal was applied by Maintenance forces during the week of May 8, 1978. The method used to apply the squeegee seal was originally developed in northeastern Colorado where the method is commonly used to

FIGURE 2

JULY 1978

SAPINERO-EAST

PROJECT FC-050-2(10)

TEST SECTIONS AS CONSTRUCTED

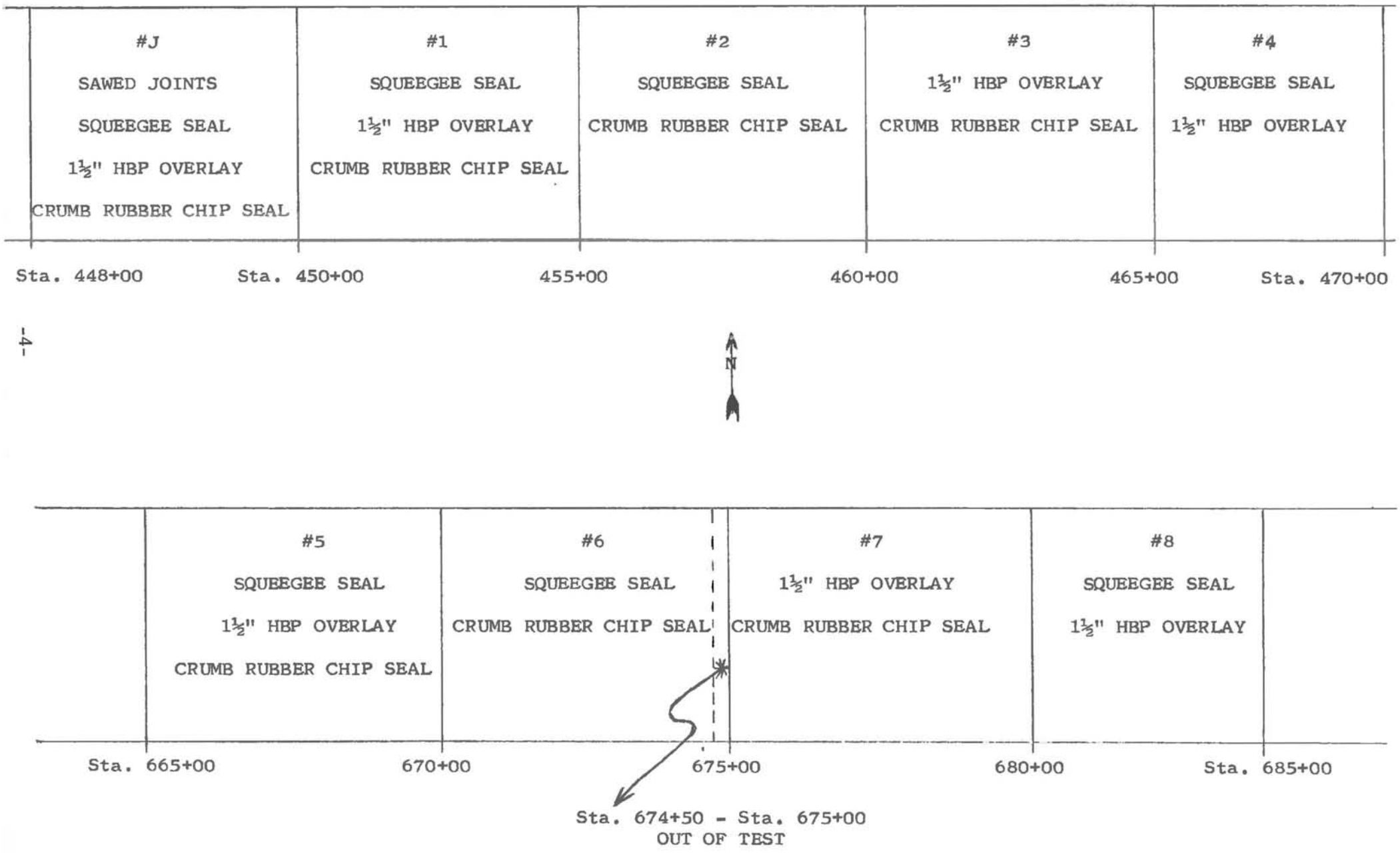


TABLE A

Crumb Rubber Chip Seal

Sapinero - East

Project FC 050-2(10)

Preconstruction Roadway Condition

Sec. No.	CHLOE PSI	Dynaflect* Deflection (mils)	Cracking Lin. Ft.	Average Rut. Depth (in)
1	2.5	1.96	1820	0.2
2	2.6	1.70	1800	0.2
3	2.2	1.62	2200	0.2
4	2.5	1.72	1980	0.3
5	2.5	1.63	1740	0.2
6	2.3	1.51	1780	0.2
7	1.9	1.17	2360	0.4
8	2.1	1.49	1740	0.2

*Maximum deflection of Sensor #1 corrected to 70^{o}F.

maintain badly cracked roadways. Few squeegee seals have been used in mountainous areas such as this or in areas which suffer the extreme weather conditions found here.

First the roadway is shot with MC-70 for one lane width, then the loose MC-70 is squeegeed back and forth using two maintainers with rubber blades. This forces the loose cutback asphalt into the cracks all the way across the pavement with excess cutback pushed onto the shoulder. Following this, a blotter sand is applied using a Flaherty spreader. This sand absorbs the excess asphalt cement on the surface, and also is worked into the cracks by traffic action. In northeastern Colorado, this has shown to perform well as a bandaid treatment to hold a badly cracked pavement together for two to three years.

On the Sapinero-East project, the driving lanes were shot with MC-70 at a rate of 0.16 gal/yd^2 with the shoulders treated at 0.13 gal/yd^2. The shoulders received a lower rate because the excess liquid asphalt from the driving lanes had pushed onto the shoulders.

Two maintainers were used to squeegee the asphalt back and forth into the cracks followed by a sand application at a rate of 9.6 lbs/yd^2. The photographic section contains pictures documenting the squeegee seal application.

The highway was then left open to traffic for 4 to 5 weeks so that traffic could work the sand into the cracks, and the MC-70 would completely cure prior to placement of the overlay.

During late May and June 1978, a 1 1/2-inch overlay was placed over the full width of the roadway, driving lanes and six foot outside shoulders. The HBP used for the overlay was a Grading E using AC-5 as a mix binder. Colorado's Grading E is a minus 3/4 inch crushed rock, dense graded mix commonly used throughout the state where acceptable aggregate is available.

B. Chip Seal Application

Special distributor trucks for handling the asphalt rubber mixture were supplied by the scrap rubber supplier, Sahuaro Petroleum & Asphalt Co. These trucks have internal agitators to mix the crumb rubber with the asphalt cement, and also spray nozzles to apply the mixture.

The trucks were charged with asphalt cement (AC-10), the rubber was added, and then the mixture was heated to over 350^{o}F for 45 minutes to one hour. The heating is to obtain a reaction between the scrap rubber and asphalt cement. Once the reaction has taken place, kerosene is added as a wetting

agent for the chips and the material is ready to apply to the roadway.

On this project, the contractor was given the option of washing and drying the chips or precoating them with 0.8% AC. The chips used on this project conformed to the Colorado Department of Highways specification for Type I chips. These chips have 100% passing the 3/4" sieve with 95% retained on the #4 sieve. The plan specifications for scrap rubber and cover coat material (chips) are contained in Appendix A and B reespectively.

The Sahuaro Crumb Rubber Chip Seal was started on Wednesday morning, July 12, 1978. The prewashed chips were dried using the drum dryer of the contractor's asphalt plant and immediately loaded on trucks resulting in the use of heated chips. The seal was started at the east end of the project in the eastbound lanes with the distributor and Flaherty chip spreader operating against the flow of traffic. These were followed by the haul trucks and three rubber tired rollers. At least three roller passes were made over the entire seal.

A 12-foot section was sealed along the eastbound shoulder for about half the length of the project on the first day. Traffic was handled using flagmen and a pilot car leading one direction through at a time. On the first day, there was approximately a 20% overrun on the chip application rate (38.83#/yd^2). This overapplication was a result of problems with the chip spreader. These problems were fixed Wednesday night, and on Thursday and Friday, fewer chips were wasted and a fairly uniform chip rate of 33.4#/yd^2 was used for the remainder of the project. There were no major problems with the Sahuaro distributor trucks or the crumb rubber asphalt application.

Samples of the chips, crumb rubber, and asphalt cement were taken throughout the project and no quality control problems were encountered. At locations of starts and stops, the contractor used tar paper to obtain a clean edge and prevent rich spots on the restart. The seal coat operation is further documented in the photographic section of the report.

The project was revisited approximately four weeks after completion of the chip seal. Visual observations of the project showed good chip retention with an estimated 75-80% of the chips retained in the rubber-asphalt binder. Only one section of the project appeared to have insufficient chips: the westbound lanes near Test Sections 5-7. After discussion with the project engineer, it was found that this area did not lose chips, but here, the distributor truck got ahead of the Flaherty spreader, and in trying to catch up, an insufficient number of chips was applied. Skid tests showed that the average skid number

for the project at this time was 54, with the lean area having an average skid number of 46.

Post Construction Evaluations

During the week of August 21, 1978, the first post-construction evaluation of the project was performed. Measurements taken included PSIs using the CHLOE profilometer and the skid truck profilometer. Additionally, skid testing and texture measurements were taken to document the "as constructed" condition of the project. These measurements along with cracking and rutting were to be taken annually to determine the performance of this project over the next four years.

Table B shows the data summary of PSI's and skid testing for the test sections. A review of the data in Table B shows an average improvement in PSI of 0.8; from 2.3 at preconstruction to 3.1 following. This is considered good since the rough texture of the chip seal caused a great deal of vibration in the CHLOE profilometer.

The skid truck profilometer is less affected by texture and in this case is a better estimate of the roadway smoothness. The texture meter measurements give an indication of the surface roughness when comparing sections 4 and 8 without the chip seal to the other test sections. The texture measurements over the period from 1978 to 1980 show that the texture has held up well.

The skid tests show good skid resistance throughout the evaluation period even in the westbound lanes of Sections 5-7 where the chip application was light. The pavement texture can be seen in the photographic section.

Table C lists the cracking and rutting history of the project. A review of the rut depth measurements shows that no significant rutting problems have occurred and that the worst rutting, which was only moderate, occurred in Sections 2 and 6 which received a squeegee seal and chip seal only.

A review of the cracking table allows a comparison of the various treatments used on this project. Sections 2 and 6 received a Squeegee Seal and Chip Seal only. From a cracking standpoint, by the end of the second winter these two sections were in the same or worse condition than prior to construction. The treatments were not adequate for long-term correction of the roadway problems in these two sections. Chip retention will be discussed later.

Sections 1 and 5 received the standard treatment for the project; Squeegee Seal, 1 1/2 inch HBP leveling course, and a crumb rubber chip seal. By

TABLE B
Crumb Rubber Chip Seal
Sapinero - East
Project FC 050-2(10)

Skid Testing and Smoothness History

Section	CHLOE PSI* 8/22/78	4/25/79	5/7/80	Skid Truck PSI 8/22/78	Pavement Texture** 8/22/78	4/25/79	5/7/80	8/22/78	Skid Tests 6/21/79	7/15/81
1EB	3.1	3.4	3.1	3.7	29	24	31	55	56	-
1WB	3.1	3.2	3.3	3.5	29	18	23	53	57	59
2EB	2.7	3.1	2.6	3.7	29	33	25	55	55	-
2WB	2.9	2.8	2.8	3.8	27	16	15	53	54	60
3EB	2.9	3.4	3.0	4.2	26	33	27	56	56	-
3WB	2.9	3.2	3.1	3.8	23	16	21	53	55	61
4EB	3.7	3.8	3.6	4.4	6	7	6	51	59	-
4WB	3.3	3.4	3.2	4.6	5	8	8	53	55	57
5EB	3.1	3.3	3.2	4.3	19	15	12			
5WB	2.9	3.4	3.2	3.6	21	27	15	46	49	51
6EB	2.6	2.6	2.7	3.2	18	19	20	54	41	-
6WB	2.6	2.5	2.3	2.8	21	19	13	45	49	61
7EB	3.1	3.3	3.1	4.3	14	17	9	54	39	-
7WB	3.2	3.1	3.0	4.0	18	13	7	47	55	55
8EB	3.1	3.1	2.9	3.8	4	5	4	50	39	-
8WB	3.0	3.0	2.8	3.3	6	6	5	46	54	49
JEB	3.4	3.4	3.3	4.2	25	18	30	54	-	-
JWB	3.1	3.2	2.9	3.1	25	21	17	55	-	-

*Readings corrected for cracking and rutting.
**Rainhart Text-ur-Meter

Test Section Treatment

Section 1 & 5 Squeegee Seal
1 1/2" HBP
Crumb Rubber Chip Seal

Section 2 & 6 Squeegee Seal
Crumb Rubber Chip Seal

Section 3 & 7 1 1/2" HBP
Crumb Rubber Chip Seal

Section 4 & 8 Squeegee Seal
1 1/2" HBP

Section J - Squeegee Seal
1 1/2" HBP
Crumb Rubber Chip Seal
Sawed Joints

TABLE C
Crumb Rubber Chip Seal
Sapinero - East
Project FC 050-2(10)

Cracking and Rut Depth History

Section	Rut Depths (in.) 5/7/80	4/28/81	5/4/82	Cracking Pre-Const. 4/25/78	4/25/79 Lin. Ft	%	5/7/80 Lin. Ft	%	4/28/81 Lin. Ft	%	5/4/82 Lin. Ft	%
1 EB	0.0	0.0	0.1	1820	643	35.3	849	46.6	876	48.1	903	49.6
1 WB	0.0	0.0	0.1									
2 EB	0.1	0.0	0.3	1800	1226	68.1	2154	119.7	2636 54*	146.4	2701 61*	119.7
2 WB	0.0	0.1	0.2									
3 EB	0.1	0.0	0.0	2220	433	19.5	590	26.8	639	28.8	824	37.1
3 WB	0.0	0.0	0.1									
4 EB	0.1	0.1	0.1	1980	579	29.2	698	35.3	735	37.1	838	42.3
4 WB	0.1	0.1	0.1									
5 EB	0.0	0.0	0.1	1740	619	35.6	719	41.3	764	43.9	808	46.4
5 WB	0.0	0.0	0.1									
6 EB	0.2	0.2	0.2	1780	1449	81.4	1984 10*	111.5	3028 102*	170.1	3463 128*	194.6
6 WB	0.2	0.3	0.3									
7 EB	0.1	0.1	0.1	2360	331	14.0	417	17.7	461	19.5	552	23.4
7 WB	0.1	0.1	0.1									
8 EB	0.0	0.0	0.1	1740	828	47.6	1041	59.8	1146 18*	65.9	1282 18*	73.7
8 WB	0.0	0.0	0.2									
JEB	0.1	0.0	0.1	780	274	35.1	286	36.7	322	41.3	339	43.5
JWB	0.1	0.0	0.1		24	3.1	36	4.6	72	9.2	89	11.4

Section J contains 10 sawed joints which constitute 250' of the cracking in the top listing. The second listing documents the cracking other than joints.

*Square feet of alligator cracking.

May 1982, four years after construction, an average of 48% of the original linear cracking had reflected through the overlay and chip seal; 49.6% in Section 1 and 46.4% in Section 5. From visual observations and comparisons, this is typical of reflection cracking for the project.

Sections 3 and 7 averaged 30.3% of original linear cracking reflected through the new pavement; 37.1% in Section 3 and 23.4% in Section 7. While this is somewhat less than the cracking in the standard sections, it should be noted that these two sections contained 20% to 30% more cracking before construction and the cracking rate comparison for the two treatments is: 47.5 ft/1000 ft^2 in the standard sections combined versus 38.2 ft/1000 ft^2 in Sections 3 & 7 without the squeegee seal. Either method indicates that under the environmental conditions in the project area, the squeegee seal is not particularly effective in preventing reflective cracking.

Comparing the cracking in the Standard Sections (1 & 4) with the cracking in Sections 4 & 8 which received a squeegee seal and leveling course without the chip seal shows that the standard section was only slightly better than the sections without the chip seal. When consideration is given to the alligator cracking because of base failures in Section 8 and only Section 4 is compared with the two standard sections the amount of cracking is similar. This would indicate that the crumb rubber chip seal also had little effect on reflection cracking in this area.

Section J was installed because it was felt that under the severe temperature extremes in the project area, thermal transverse cracking would occur. Ten joints were cut through the leveling course and old pavement prior to application of the chip seal in this 250-foot section. The joints were staggered with intervals varying from 15 to 19 feet in a random fashion and cut at a diagonal. As it turned out, random transverse cracking is the most prevalent type of cracking that occurred on the project and the joints prevented transverse cracking in Section J. At the end of four years, the total length of joints plus random cracks in Section J is similar to the standard treatment but should be much easier to fill with crack filler by maintenance forces. The photographic section of this report contains pictures of the joints.

One area of project performance not related to any particular test section is the snow plow damage to the chip seal. The chip seal suffered extensive damage from snow plows during the first winter following construction. Damage was especially bad in the test section areas. Sections 2 and 6 which received

no leveling course had the seal removed on all of the high spots in the pavement. Another area of extensive damage was on either side of test sections 4 and 8. The transition from pavement without a seal to a chip sealed area allowed the snowplow blades to more easily dig into the crumb rubber chip seal. The bulk of the project received less damage than the test sections. From conversations with local maintenance forces most of the damage occurred during times of extremely cold weather when packed ice had to be removed from the roadway. The chips seemed to pop off the surface during plowing. As seen by the photographs, more than just chips were removed by the snowplows; in many areas the entire asphalt-rubber seal was removed.

Conclusions

The construction phase of this project went very smoothly with a minimum of problems or delays. The leveling course and seal coat made a significant improvement in the riding qualities of the pavement and in spite of the snowplow damage the chip seal has provided excellent skid resistance on this roadway. The chip seal and squeegee seal only were not sufficient to rehabilitate this roadway.

From a comparison of the various treatments on the test sections neither the Squeegee Seal or the asphalt-rubber chip seal were particularly effective in preventing reflection cracking. The lack of effectiveness of these treatments is probably attributable to the extremes in temperature common to this area and its effect on thermal transverse cracking.

The sawed joints replaced random transverse cracks in test section J; however, the total length of the joints plus the random cracks was almost equal to the amount of cracking in the standard sections.

Recommendations

From the findings of this research project and the performance of other crumb rubber chip seals in mountainous areas, the use of crumb rubber chip seals is not recommended for areas where packed ice has to be removed by snowplows. This project and two other projects in mountain terrain suffered severe snow plow damage during the removal of packed ice especially in areas with even minor rutting where high spots existed in the pavement. This project performed the best of the three because of the leveling course evening the pavement prior to chip seal application. Squeegee seals have performed well in other areas of the state including mountain areas, when the major problem was alligator cracking. As demonstrated here, the squeegee seal is not very effective in preventing reflection cracking of thermal transverse

cracks and would not be recommended for pavements where thermal related transverse cracking is the major problem.

The sawed joints in Section J did replace the random transverse cracks which occurred in other sections, however, as noted earlier, the total length of joints plus other random cracks was almost equal to the amount of cracking in the other sections. Because the amount of crack filling material required would be the same in either the sawed or random cracked areas, it is doubtful that enough time would be saved in crack filling to off-set the initial cost of sawing the joints in a new pavement. Therefore, unless it can be shown that sawing joints would result in considerably less total cracking, their use is not recommended.

CRUMB RUBBER CHIP SEAL
PROJECT FC 050-2(10)
SAPINERO EAST

Photograph No. 1

Typical roadway condition prior to construction.

Photograph No. 2

Squeegee Seal
Driving lane shot with MC-70 at 0.16 gal/yd2. The shoulder was shot at 0.13 gal/yd2, but received the excess MC-70 from the driving lane.

CRUMB RUBBER CHIP SEAL
PROJECT FC 050-2(10)
SAPINERO- EAST

Photograph No. 3
Squeegee Seal

Two motor graders with rubber tipped blades squeegee the MC-70 back and forth to fill the cracks.

Photograph No. 4
Squeegee Seal

Following several passes with the two motor graders, excess MC-70 is squeegeed on to the shoulder.

CRUMB RUBBER CHIP SEAL
PROJECT FC 050-2(10)
SAPINERO - EAST

Photograph No. 5
Squeegee Seal

After completion of the squeegee process, a sand blotter was applied at a rate of 9.6 lbs/yd2.

The roadway was then opened to traffic for four to five weeks so the MC-70 would fully cure, and traffic would work sand into the cracks.

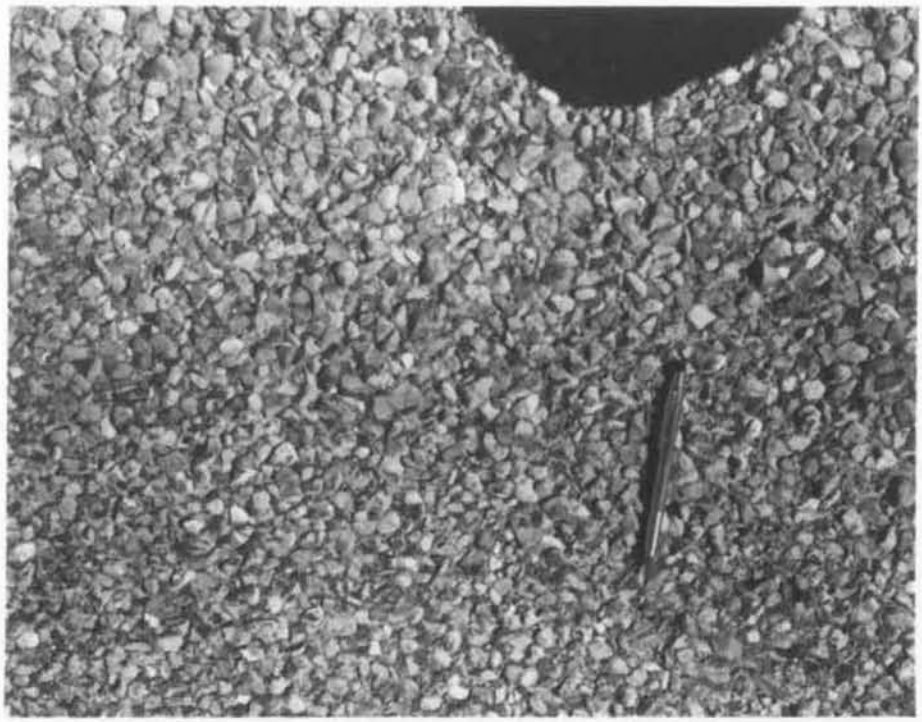
Photograph No. 6

Crumb Rubber distributor truck. These trucks contain aggitators to mix the asphalt cement with the scrap rubber and keep the rubber suspended during application.

CRUMB RUBBER CHIP SEAL
PROJECT FC 050-2(10)
SAPINERO- EAST

Photograph No. 7

A Flaherty chip spreader was used to apply the hot chips. Traffic was kept off the new seal using a pilot car.



Photograph No. 8

Closeup of fractured chips shorty after placement. Note: Coarse surface texture.

Photograph No. 9

In Section J, 10 joints were sawed through the leveling coarse prior to the application of the chip seal.

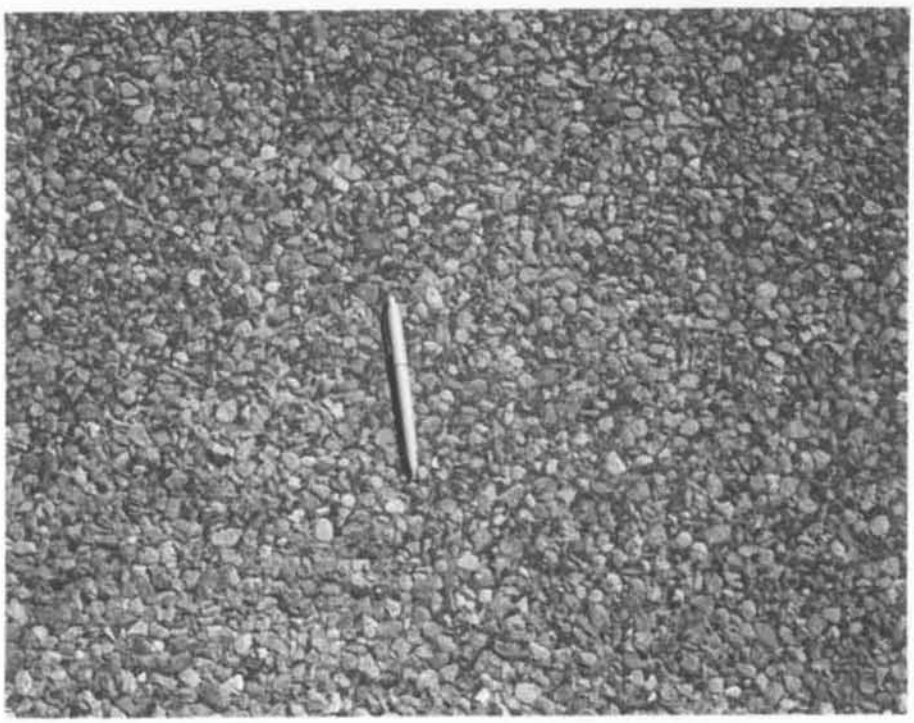
Photograph No. 10

By May 1982, 4 years after construction, the joints are clearly visible, and essentially replaced any transverse cracking in Section J.

CRUMB RUBBER CHIP SEAL
PROJECT FC 050-2(10)
SAPINERO-EAST

Photograph No. 11

Test Section No. 7 in April 1979. This photograph shows typical snowplow damage for the majority of the project with only slight damage at the centerline.



Photograph No. 12

Section No. 1
April 1979.

Typical wheel path texture one winter after construction.

CRUMB RUBBER CHIP SEAL
PROJECT FC 050-2(10)
SAPINERO-EAST

Photograph No. 13

Section 3
April 1979

Typical snowplow damage at a transition from smooth pavement to a chip sealed area.

Photograph No. 14

Section 5
May 1980

Typical transverse crack through the leveling course and chip seal.

Photograph No. 15

Section 4
May 1982

Typical transverse cracking on the project. Cracks are quite visable on this section which did not receive a chip seal. Cracking is similar to the preconstruction condition (see photo. No. 1).

Photograph No. 16

Section J
May 1982

The sawed joints replaced any transverse cracking in this section. Snowplow damage at the centerline and outside shoulders is typical for the project.

Photograph No. 17

Section 2
May 1982

This section did not receive a leveling course and snowplows have removed the chip seal from all of the high spots in the pavement. This is some of the worst snowplow damage on the project.

Photograph No. 18

Section No. 5
May 1982

This section is the standard for the project and shows the typical conditions with snowplow damage at the center line, and outside shoulders and prevalent transverse cracking.

APPENDIX A

REVISION OF SECTION 411
ASPHALT CEMENT (SCRAP RUBBER)
COLORADO PROJECT NO. FC 050-2(10)

MIXING

The material shall be rapidly combined and thoroughly mixed to obtain the desired consistency for application.

After the required reaction has occurred, the mix may be cut back with kerosene or other approved petroleum solvent, as required, for adjusting the viscosity for spraying or better wetting of the cover coat material. The maximum amount of solvent shall not exceed 7-1/2 percent by volume, of the hot asphalt-rubber composition.

The solvent shall have a boiling point of not less than 350°F.

The solvent and asphalt-rubber mixture shall be thoroughly mixed, brought back to spreading temperature and then may be spread immediately.

The completed mixture shall not be reheated after it has cooled to below 325°F once the solvent has been added.

Subsection 411.04 shall include the following:

The pay quantity for Asphalt Cement (Scrap Rubber) will be determined as follows:

1. Asphalt Cement will be measured by the ton prior to the addition of scrap rubber, extender oil, or solvent, and

2. The total number of tons measured will be multiplied by a factor of 1.33 in order to compensate for the 25 percent scrap rubber added.

Subsection 411.05 shall include the following:

Extender oil, solvent and all other materials required to produce the pay item will not be paid for separately but shall be included in the work.

REVISION OF SECTION 409
SEAL COAT (ASPHALT CEMENT) (SCRAP RUBBER)
COLORADO PROJECT NO. FC 050-2(10)

Section 409 of the Standard Specifications is hereby revised for this project as follows:

MATERIALS

Subsection 409.03 shall include the following:

Cover Coat Material shall conform to the requirements of 703.05 except that limestone or sandstone shall not be used. The type to be designated on the plans.

Delete subsection 409.05 and replace with the following:

409.05 Equipment.

The following equipment shall be furnished:

a. A self-powered pressure distributor equipped for heating and applying bituminous material (with rubber added). It shall be so designed that the bituminous-rubber material may be applied uniformly on variable widths up to 12 ft. The distributor shall be equipped with a separately powered distributing pump capable of pumping the bituminous-rubber material at the specified rate through the distributor tips and the circulatory and mixing system. The distributor shall be a full circulating type with nipples and valves so constructed that they are in intimate contact with the circulating asphaltic material in order to prevent any plugging with cooled or congealed material.

The equipment shall include a tachometer, pressure gauge, volume measuring devices, and a thermometer for reading the temperature of tank contents.

b. A self-propelled power pick-up broom for cleaning the existing pavement surface, and removing excess cover coat material.

c. A self-propelled aggregate spreader capable of spreading the specified cover coat material quantity uniformly and accurately over the full width of the asphaltic material.

Delete subsection 409.07 and replace with the following:

409.07 Application of Asphalt Rubber Material

Asphalt rubber material shall be applied by means of a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range specified. The quantity of asphalt rubber material to be used per square yard shall be as directed. A strip of building paper, at least 3 feet in width and with a length equal to that of the spray bar of the distributor plus one foot, shall be used at the beginning of each spread. If the cut-off is not positive, the use of paper may be required at the end of each spread. The paper shall be removed and disposed of in a satisfactory manner. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. Any skipped areas or deficiencies shall be corrected.

The length of spread of asphalt rubber material shall not be in excess of that which trucks loaded with cover coat material can immediately cover.

The spread of asphalt rubber material shall not be more than 6 inches wider than the width covered by the cover coat material from the spreading device.

The distributor, when not spreading, shall be parked so that the spray bar or mechanism will not drip bituminous rubber materials on the surface of the traveled way.

After reaching the proper consistency, application of the material shall proceed immediately and in no case shall the material be placed when a uniform application is not being achieved.

The hot asphalt-rubber mixture shall be applied at a rate of 0.60 ± 0.05 gallons per square yard (based on 7-1/2 pounds per hot gallon).

APPLICATION OF COVER COAT MATERIAL

Subsection 409.08 shall include the following:

At the time of application to the roadway, cover coat material shall be surface dry.

ROLLING

The cover coat material shall be rolled with pneumatic tired rollers carrying a minimum of 5,000 lbs. on each wheel and a minimum air pressure of 100 lbs. per square inch in each tire.

Sufficient rollers shall be furnished to cover the width of the spread with one pass. It is imperative that the first pass be made immediately behind the spreader; and if the spreading is stopped for any reason, the spreader shall be moved ahead so that all cover coat material spread may be immediately rolled. The rolling shall be completed within two hours after application of the cover coat material.

TRAFFIC CONTROL

Except for times when it is necessary that hauling equipment and/or pilot trucks must travel on the newly applied seal coat, traffic of all types shall be kept off the seal coat until it has had time to set properly. The speed of all hauling equipment and pilot trucks shall not exceed 15 miles per hour. The minimum traffic-free period shall not be less than three hours.

REMOVING LOOSE COVER COAT MATERIAL

The power broom used in removing loose material shall be a rotary sweeper type.

The initial sweeping should begin the day following the placement of the cover coat material.

If, because of temperatures or other causes, there is excessive displacement of embedded cover coat material, sweeping should be discontinued until such time as there will be a satisfactory retention of cover coat material. Additional final sweeping should be done and all excess cover coat material removed from three to five days after the roadway has been opened to traffic.

APPENDIX B

REVISION OF SECTION 703
AGGREGATE FOR COVER COAT MATERIAL
COLORADO PROJECT NO. FC 050-2(10)

Section 703 of the Standard Specifications is hereby revised for this project as follows:

Subsection 703.05 shall be revised as follows:

The material shall have 75% fractured faces.

One of the following treatments will be required for Cover Coat Material from the designated Pit:

1. Cover Coat Material shall be washed and mechanically dried and kept dry prior to placing on the roadway.

2. Cover Coat Material shall be precoated with approximately 0.8% AC-5.

All work necessary by these requirements shall be included in the Contract Unit Price for Cover Coat Material.

In subsection 703.05, at the end of the second paragraph, the table of gradation specifications for cover coat aggregate shall not apply. The gradation specifications for Cover Coat Material (Type 1) shall be as follows:

Passing 3/4" Sieve	-	100%
Passing 1/2" Sieve	-	95 - 100%
Passing 3/8" Sieve	-	40 - 70%
Passing # 4 Sieve	-	0 - 5%
Passing # 8 Sieve	-	0 - 3%
Passing #200 Sieve	-	0 - 2%

Section 411 of the Standard Specifications is hereby revised for this project as follows:

Subsection 411.02 shall include the following:

The bituminous material shall be Asphalt Cement (Viscosity Grade AC-10) meeting the applicable requirements of subsection 702.01.

The rubber material shall be ground tire rubber (100 percent vulcanized) meeting the following requirements:

Passing Sieve	Percent
No. 8	100
No. 10	98 - 100
No. 40	0 - 10

The ground rubber, irrespective of diameter, shall not exceed 7 mm in length.

The sieves shall comply with the requirements of AASHTO M 92.

The ground rubber shall have a specific gravity of 1.15±0.02 and shall be free of fabric, wire or other contaminating materials, except that up to four percent of calcium carbonate may be included to prevent the particles from sticking together.

The ground tire rubber may be accepted if accompanied by a Certificate of Compliance from the supplier that the material has been tested during the grinding process and meets the specified requirements.

PROPORTIONS

The proportions of materials by total weight shall be 75±2% asphalt cement and 25±2% scrap rubber.

REACTION TIME

The supplier of the asphalt-scrap rubber mixture shall furnish to the engineer documentation showing the Viscosity-Time-Temperature relationship for each source of asphalt, proposed for use, which establishes the minimum reaction time at the required temperature prior to application.