# EXPERIMENTAL USE OF AN ASPHALT RUBBER STRESS ABSORBING MEMBRANE INTERLAYER

INITIAL REPORT 79-5
OCTOBER 1979

Reporting On
Category II Work Plan 78-R-38

U.S. Rte. 302 - Newbury, Vermont
Newbury F 026-1 (23)

State of Vermont
Agency of Transportation

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A Category II Experimental Project conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. Abstract

An asphalt rubber interlayer was applied on a severely cracked 20 year old bituminous pavement to determine if the material could reduce or eliminate reflective cracking of a new bituminous overlay under Vermont's climatic conditions. The product was spray applied at a temperature of 395° F± and at a rate of 0.58 gallons per square yard. One half inch size cover stone was placed over the material and compacted with a pneumatic roller.

The cost of the experimental treatment was estimated at $1.21 per square yard which was equal to the cost of a one inch course of bituminous pavement.

Field inspections through a nine month period following the application revealed that the treatment did not eliminate reflective cracking although it did promote healing of the cracks with warmer weather.

The performance of a section of the asphalt rubber treatment left exposed to traffic suggests that the product be considered for use as a surface treatment in lieu of rehabilitation with a single 1-1½ inch course of pavement.

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Asphalt Rubber Interlayer<br>Reflective Cracking<br>Asphalt Rubber Surface Treatment | No restrictions |

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# EXPERIMENTAL USE OF AN ASPHALT RUBBER STRESS ABSORBING MEMBRANE INTERLAYER

## Introduction

The search for a method or means of eliminating or reducing reflective cracking in new bituminous pavements has been underway for a number of years. Vermont has experimented with several processes since observations revealed that a high percentage of the cracks in old pavements reflect up through new bituminous overlays, often during the first winter of exposure.

The first process tried in 1973 and repeated in 1974 and 1975 was a strain relieving interlayer (SRI) consisting of vulcanized rubber shreds and fine aggregate in an emulsion slurry placed in a 3/8 inch thickness (1,2). Although initial observations revealed a reduction in reflective cracking, long term evaluations of the SRI led to a recommendation that "the use of rubberized slurry be discontinued in Vermont...based upon initially high first cost and an unpredictable useful life span" (3).

Pulverization of a severely distorted and cracked pavement was carried out in 1974 successfully eliminating potential reflective cracks although the process was considerably slower than certain other methods (2). Recent inspections of the two mile long test site reveal that the two inch overlay has remained free of cracks or significant rutting for a period of nearly five years. This is a noteworthy accomplishment since cracks would be expected to develop in pavements on new construction in the same period of time. It may be speculated

that the performance relates to a flexibility or other property in the pulverized and stabilized base course which is not present in normal subbase materials. Cold recycling was successfully utilized again in 1978 on two Contracts, one of which was a Category III experimental project undertaken as part of Demonstration Project No. 39 (4). The project will remain under evaluation until definite conclusions can be drawn on performance and cost effectiveness.

Four commercially available nonwoven polypropylene or polyester fabrics were also installed as a Category II experimental project in 1978. Following one winter exposure, the products did not appreciably reduce the amount of cracks which appeared in the 1½ inch bituminous overlay when compared with the untreated control section.

This initial report covers the construction phase of a Category II field trial utilizing an asphalt rubber stress absorbing membrane interlayer, a system referred to as a SAMI.

## Background & Product Information

The trial use of the asphalt rubber interlayer came about when the Arizona Refining Company, through their Assistant Sales Manager, Mr. W. E. Hamlin, offered to apply approximately 2500 gallons of their blended material without charge. Their product, known as ARM-R-SHIELD is "a mixture of asphalt cement, rubber extender oil and ground rubber blended together at an elevated temperature, which when hot-spray applied and allowed to cool forms a tough, durable and adhesive membrane suitable for use in the construction of:

a. surface treatments for paved surfaces (chip seals)

b. stress absorbing membrane interlayers (SAMI)

c. bridge deck waterproofing membranes

When hot-poured into pavement joints and cracks, and allowed to cool, it is suitable for use as a joint and crack filler. The system is designed to reduce reflective cracking and prevent surface moisture from penetrating into the pavement being overlaid when used as a SAMI."

Product Composition, Preparation and Application Procedure

ARM-R-SHIELD is composed of 72 to 80% asphalt cement, 2 to 6% rubber extender oil and 20 $\pm$ 2% ground rubber by weight of the total asphalt-rubber blend. The rubber portion of the blend is U.S. Rubber Reclaiming Company designation G274 consisting of 40% powdered reclaimed (i.e. devulcanized) rubber and 60% ground vulcanized rubber scrap selected to have a high natural rubber content.

The preparation of the asphalt rubber mixture is carried out in a pressure distributor truck which is capable of heating, mixing, and applying the completed product. Preparation consists of blending the preheated asphalt cement ($250^{o}$ F-$400^{o}$ F) with sufficient rubber extender oil to reduce the viscosity of the asphalt cement to within the range of 600 to 1800 poises at $140^{o}$ F. The temperature of the asphalt cement-extender oil blend is then increased to within the range of $350^{o}$ F-$425^{o}$ F at which time the ground rubber is added at the specified amount. The mixture is then recirculated for a period of not less than 30 minutes prior to application. Adequate recirculation and/or stirring of the total combined material must be maintained to provide good mixing and dispersion.

If a job delay occurs, the material may be allowed to cool and be reheated just prior to placement.

The application of the 375° F-425° F asphalt rubber is made at a rate of 0.45-0.60 hot gallons per square yard and is closely followed with an application of dry aggregate at a rate of 30 to 40 pounds per square yard. The application of the asphalt rubber cannot be made over an area greater than that which can be immediately covered with aggregate and rolled using pneumatic tired rollers to embed the aggregate particles into the asphalt-rubber membrane. Revolving and drag brooms are used to redistribute and remove excess aggregate.

## Field Trial Location and Roadway Condition

A section of U.S. Rte. 302 in the Town of Newbury, Vermont beginning 1.219 miles west of the intersection with U.S. Rte. 5 was selected as the field trial location. The site selection was based on the condition of the existing surface and on the availability of paving equipment which would be present during the reconstruction of the easterly 1.219 miles of Rte. 302 under Contract F 026-1 (23).

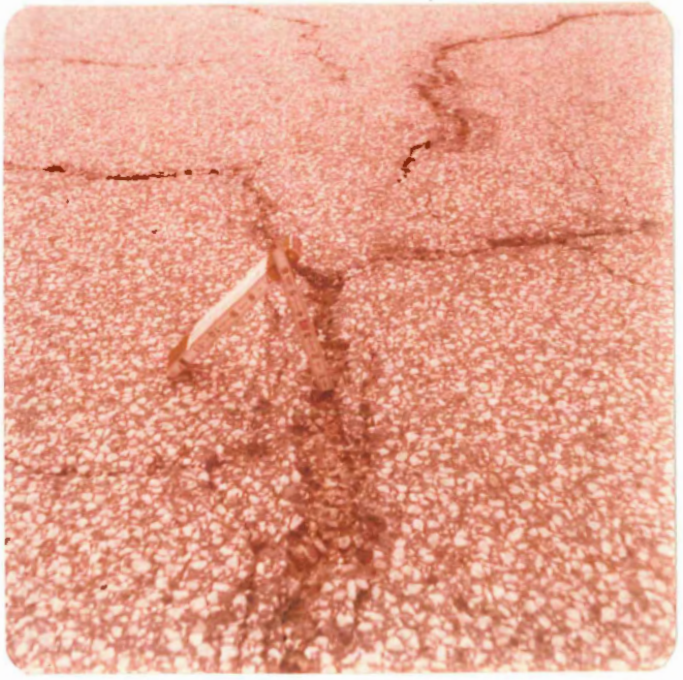
The existing roadway was constructed as a new relocation in 1958 featuring a 24 foot wide roadway with 8 foot shoulders. The sub-base consisted of either 14 or 20 inches of crushed rock which was topped with a 2 1/2 inch bituminous concrete surface course. The pavement had not received any maintenance treatment during the 20 years of service.

A condition survey made at three specific locations within the experimental test section and at one location on the adjoining control area revealed an average of 499 lineal feet of cracks per 100 lineal

feet of roadway. The type of cracks consisted of 43 percent miscellaneous, 30 percent transverse and 27 percent longitudinal. Miscellaneous cracks less than 18 inches in length were not included in the survey. The miscellaneous or pattern type cracks recorded were generally 1/4 inch wide at the surface while the most severe cracks ranged up to 1 inch in width. The transverse and longitudinal cracks varied from 1/2 inch to 1 1/2 inches at the surface by up to 1 measurable inch in depth. The wider cracks were due to a loss of aggregate along each face which resulted in rough sloping shoulders. Although a majority of the cracks were severe enough to warrant routing and crack filling, because the required equipment, and manpower were committed to other projects, only limited patching was carried out in raveled areas.

Maximum rutting values were recorded at 5/8 inch in the left wheel path and 3/4 inch in the right wheel path of both east and west bound lanes. There was little evidence of localized settlement or heaving.

Pavement Condition



Surface raveling along cracks

Climatological data for the area discloses a freezing index of 1207, an average of 96 freeze-thaw cycles and 90 inches of snowfall. Frost penetration within the roadway cross section would be expected to read a depth of 48 to 60 inches.

Average daily traffic volume on the roadway in 1978 was recorded at 3050 vehicles with truck traffic.estimated at six percent.

## Material Application

The AC viscosity grade asphalt, rubber extender oil and ground rubber were mixed and blended in the distributor truck the day before the material was to be applied. The blended material consisted of 79 percent AC 10 viscosity grade asphalt supplied by Exxon, 20 percent rubber and 1 percent extender oil.

The application began on the morning of September 6, 1978. The road surface was dry with the ambient temperature ranging from $60^{o}$ F-$72^{o}$ F during the application period. Weather conditions varied from 100 percent cloud cover to hazy sunshine. The temperature of the blended material ranged between $385^{o}$ F and $405^{o}$ F during the application. Placement was made at a design rate of 0.60 gallons per square yard in two ten foot and one five foot wide pass in order to obtain the proper coverage with stone. The latter was applied by District No. 7 maintenance forces using a chip spreader box mounted on six yard dump trucks. The half inch size pea stone was applied at an average rate of 36 pounds per square yard and immediately rolled with a self propelled 10 ton pneumatic roller. The

stone had been preheated at a hot mix plant to insure it was free of surface moisture. The temperature of the stone varied from 190° F to 250° F at the time of application. In addition, the first four loads of stone were precoated with 1/2 to 1 percent asphalt per ton of stone to reduce surface dustiness and improve adhesion. Close examination revealed excellent bond between the asphalt rubber and both the precoated and uncoated chips even though a significant amount of fine dust was present with the application of the latter.

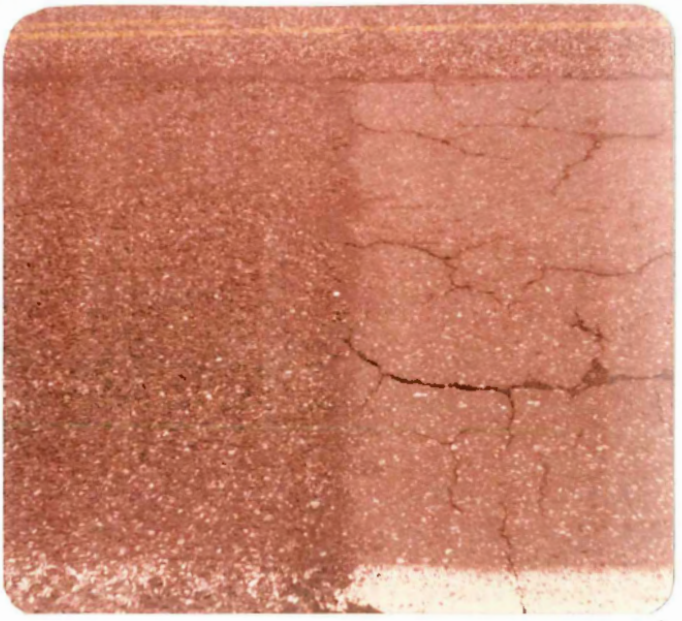
The application of stone was withheld from the edges which were to receive adjoining passes, to insure complete surface coverage with the asphalt rubber. Overlapping of the succeeding pass resulted in sufficient transfer of heat to soften the cold material with satisfactory stone embedment attained. There were no problems with bleed through of the asphalt rubber. A wire bristle power broom was used to sweep excess cover aggregate onto shoulder areas. The procedure worked satisfactorily except at locations where wheel rutting exceeded 1/2 inch in depth. Stones at such locations were displaced by traffic prior to the application of the bituminous overlay without any reported damage to windshields.

A total of 1600 lineal feet of roadway covering 4444 square yards was treated with the asphalt rubber. The application was completed in 3 hours 45 minutes with the rate of coverage limited by the speed with which the cover stone could be applied. The first 262 by 10 foot wide pass received only one half of the desired rate due to incorrect gauge settings. The overall rate of application on the remainder of the experimental section averaged 0.58 gallons per square yard (104 mils thick)

Hot Spray Application

Applying Cover Stone

Completed Treatment
Prior to Overlay



Area Exposed to Traffic For
9 Months, Note Cracks in Abuting
Untreated Area

based upon gauge measurements on the distributor.

The asphalt rubber and stone chip surface remained exposed to traffic for 33 days without any visual evidence of wear or rutting. On October 9, 1978, a one inch course of Type II bituminous mix was placed over all except the last 35 feet of asphalt rubber and stone on the westerly end of the test section. Cores taken on the project revealed an average thickness of 1 3/8 inches over the control section and 1 inch over the experimental treatment. Somewhat lower pavement densities were also noted on the samples taken from the experimental section.

## Cost of Treatment

The cost of the experimental treatment can only be estimated since the asphalt rubber was furnished and applied free of charge. At the time of the installation, the Arizona Refining Company would have been expected to apply the product at a cost of approximately $0.85 per square yard. District Maintenance Forces were used to place the cover stone, remove excess stone, and for traffic control. They included a foreman, two equipment operators and 10 maintenance workers at a cost of $550.00. Equipment rental for the one day application totaled approximately $500.00 which included the use of 5 - 6 c.y. trucks, 2 pickups, 2 rollers and a power broom. The heated cover aggregate was purchased at $7.00 per ton with 80 tons used. The total expenditure for material and application at $0.85 per square yard plus labor and equipment costs of $1610.00 resulted in a final cost of $1.21 per square yard for the 4444 square yards treated.

A total of 444 tons of bituminous pavement were placed over the experimental and control sections at a cost of $21.80 per ton. A comparison between the cost of the asphalt rubber at $1.21 per square yard and the bituminous pavement at $1.23 per square yard inch reveals that the cost of the experimental treatment was equal to a 1 inch lift of pavement.

## Performance Analysis After One Winter

The control and experimental sections were inspected on January 4 and 29, February 21 and April 12, 1979. Observations of the asphalt rubber test sections revealed a gradual increase in the percent of reflective cracking from 2% in January, to an average of 17% in April. At the same time, the control section disclosed crack reflection rates of 6% to 12%. There were no cracks noted in the 35 foot section of exposed asphalt rubber nor was the material effected by traffic or snow plows.

Further inspection in May, 1979, revealed that the cracks in the bituminous overlay over the asphalt rubber had closed up to a degree that made it difficult to detect many of them. This prompted a detailed inspection on June 6, 1979 which revealed an average of 7% visible reflective cracks or a reduction of 59% under the amount noted in April. The amount of cracks in the control section remained constant at 12%. The 35 foot section of exposed asphalt rubber and cover stone remained satisfactory through August 7, 1979 when it was overlaid with pavement as part of an adjoining maintenance project.

## Summary

An asphalt rubber interlayer was offered for experimental use to determine if the material could reduce or eliminate reflective cracking in a new bituminous overlay when exposed to Vermont's climatic conditions. The product, manufactured by the Arizona Refining Company under the trade name of ARM-R-SHIELD, consisted of 79 percent AC 10 viscosity asphalt cement, 1 percent rubber extender oil and 20 percent reclaimed ground rubber. The material was spray applied at an average rate of 0.58 gallons per square yard on a severely cracked 1600 foot section of 20 year old bituminous pavement. The asphalt rubber membrane was quickly covered with preheated half inch pea stone at a rate of 36 pounds per square yard and rolled with a pneumatic roller. A power broom was used to sweep excess cover stone onto shoulder areas. The asphalt rubber and stone cover remained exposed to traffic for 33 days without any visual evidence of damage. One inch of bituminous pavement was placed over the system, except for the last 35 lineal feet of roadway which was left as an exposed surface treatment.

Field inspections during the first winter revealed a gradual increase in the percent of reflective cracking over the asphalt rubber from 2% in January to 17% in April. At the same time the control section which had an additional 3/8 inch of overlay thickness disclosed crack reflection rates of 6% to 12%. Inspections made in May and June revealed that many of the cracks in the overlay over the asphalt rubber healed together resulting in a 59% reduction in the amount of cracks below the total logged in April.

The 35 foot test section of exposed asphalt rubber and cover stone remained free of visible cracks and was not adversely effected by traffic, snow plows, or weather conditions.

The cost of the experimental treatment including material, application, cover stone, labor and equipment rental was estimated at $1.21 per square yard. Based upon the $21.80 per ton project cost for bituminous mix, the cost of the experimental treatment was equal to a one inch course of bituminous pavement.

## Preliminary Conclusions

The Arm-R-Shield asphalt rubber treatment displayed a number of desireable features including excellent bond between the asphalt rubber and cover stone, an acceptable riding surface and complete resistance to tire and snow plow damage on the area left exposed to traffic. Such properties make the system a likely candidate for use as a surface treatment in lieu of rehabilitation with a single 1 - 1 1/2 inch course of pavement.

A higher percent of reflective cracking occurred on the asphalt rubber and one inch overlay section than on the 1 3/8 inch overlay control treatment. However, the interlayer did promote healing of the cracks with the advent of warmer weather. The failure of the asphalt rubber in reducing the level of reflective cracking is believed due in large part to the lack of crack filling or a leveling course application. Either treatment would have aided the asphalt rubber in bridging over the larger cracks which ranged up to 1 1/2 inches in width by one inch in depth.

## Recommendations

1. The performance of the ARM-R-SHIELD System should be monitored for at least two additional years.

2. The ARM-R-SHIELD System should be specified as a surface treatment in place of the standard overlay procedure on a project slated for rehabilitation. Preparation of the existing pavement surface on such a project should include crack filling and also a nominal 1/2 inch leveling course if the surface alignment requires it.

## References


1. Snow, R. H. Reducing Reflection Cracking in Bituminous Overlays Utilizing A Strain Relieving Interlayer of Rubberized Slurry, Report 74-3, Vermont Department of Highways, May, 1974

2. Snow, R. H. Alternative Reflection Crack Treatments Pulverization and Rubberized Slurry SRI Initial Report 75-1 March 1975 and Final Report 77-4, August, 1977, Vermont Department of Highways

3. Snow, R. H. Reducing Reflection Cracking in Bituminous Overlays Utilizing A Strain Relieving Interlayer of Rubberized Slurry, Final Report 77-1, Vermont Department of Highways, February, 1977

4. Frascoia, R. I. Cold Recycling Asphalt Pavement US Rte. 4 Sherburne, Vermont, Initial Report 79-1, Vermont Agency of Transportation, January, 1979

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

# WORK PLAN FOR CATEGORY II EXPERIMENTAL PROJECT

## STRESS ABSORBING MEMBRANE INTERLAYER FOR PAVEMENTS WORK PLAN 78-R-38

### OBJECTIVE OF EXPERIMENT

To evaluate the performance of a Stress Absorbing Membrane Interlayer designed to minimize reflection cracking in bituminous concrete pavements.

### PROJECT

Newbury F 026-1 (23)

### PROJECT LOCATION

On U.S. 302 beginning approximately 3.410 miles southeasterly of the Ryegate-Newbury Town Line and extending easterly approximately 1.588 miles.

### EXPERIMENTAL WORK LOCATION

Beginning at Station 155+50 and extending easterly 0.303 miles (1600 feet) to Station 171+50.

### MATERIALS TO BE USED

Arm-R-Shield, a stress absorbing membrane interlayer (SAMI) composed of asphalt cement, rubber extender oil, and ground rubber which is designed to reduce reflective cracking and prevent surface moisture from penetrating into the pavement being overlaid. The material is manufactured by the Arizona Refining Company, P.O. Box 1453, Phoenix, Arizona 85001. Phone (602) 258-4843.

### APPLICATION PROCEDURE

The asphalt-rubber material shall be applied by pressure distributor truck within the temperature range of $375^{0}$ - $425^{0}$ F and at a rate of 0.45 - 0.60 hot gallons per square yard. An application of dry aggregate at a uniform rate of 30 to 40 pounds per square yard shall follow as closely as possible behind the application of hot asphalt-rubber material. No spread shall be in excess of a length which can be immediately covered with aggregate. Rolling shall commence immediately following the spread of aggregate using pneumatic-tired rollers to embed the aggregate particles into the asphalt-rubber membrane. Revolving and drag brooms shall be used to redistribute and remove excess aggregate.

## CONTROL SECTION AND TREATMENT

The control section shall consist of one inch of Type III Bituminous Pavement placed over the existing pavement beginning at Station 171+50 and extending 375 feet easterly to the recycled pavement section at Station 175+25.

## COST

Estimated cost for the experimental test section is as follows:
Arm-R-Shield - no charge for the material (applied prices generally quoted at $450.00/ton or $1.10 per sy. @ 0.6 gal/sy application rate). Labor, equipment, and material $1820.32 (see detailed estimate on attached sheet)
Item 406.25 Bituminous Concrete Pavement. One inch wearing course of Type III mix 355 tons at $21.80/ton = $7739.00 Total Cost = $9559.32.

The estimated cost for control section is as follows:

Item 404.65 Emulsified Asphalt 6 cwt @ $14.00/cwt = $84.00
Item 406.25 Bituminous Concrete Pavement 82 tons @ $21.80/ton = $1787.00

## DATE OF APPLICATION

Prior to September 15, 1978.

## PROPOSED EVALUATION PROCEDURE

The investigation will include the following steps.

1) Record initial design, construction and maintenance records on the existing pavement in the test area.

2) Visually inspect, document and photograph the condition of the pavement including detailed crack surveys on portions of both the experimental and control areas.

3) Observe and record conditions and events which occur during the experimental application.

4) Compare the performance of the experimental treatment with that of the control section.

## DURATION OF STUDY

The experimental project will be evaluated for a minimum of two years or until valid conclusions can be obtained on the performance of the Stress Absorbing Membrane Interlayer.

## SURVEILLANCE

The experimental feature shall be monitored during the application and at least once each winter and spring for the duration of the study.

REPORTS

An initial report covering the application and a final report drawing conclusions on the effectiveness of the experimental material shall be submitted to the Federal Highway Administration.

Materials & Research Division
Agency of Transportation
September 7, 1978.

Reviewed By:

R. F. Nicholson

R. F. Nicholson, P.E., Materials & Research Engineer

Date: Sept. 11, 1978

ARIZONA REFINING COMPANY
P. O. BOX 1353
PHOENIX, ARIZONA 85001
(602) 253-4843

Arizona Refining Company
Specification M 101-78

# SPECIFICATION FOR ARM-R-SHIELD$_{TM}$

## 1.0 DESCRIPTION

ARM-R-SHIELD is a mixture of asphalt cement, rubber extender oil and ground rubber blended together at an elevated temperature in the manner, proportions and sequence herein described. When hot-spray applied and allowed to cool to ambient temperatures, it forms a tough, durable and adhesive membrane suitable for use in the construction of:

a. surface treatments for paved surfaces (chip seals)

b. stress absorbing membrane interlayers (SAMI)

c. bridge deck waterproofing membranes.

When hot-poured into pavement joints and cracks, and allowed to cool, it is suitable for use as a joint and crack filler.

## 2.0 MATERIALS

### 2.1 Asphalt Cement

The asphalt cement shall be a grade meeting the general requirements of AASHTO Specification M 226 or ASTM Specification D-3381 as determined by prior laboratory testing of asphalts available in the respective project area. It shall be fully compatible with the ground rubber to be used in producing ARM-R-SHIELD.

### 2.2 Rubber Extender Oil

The extender oil shall be a resinous, high flash point aromatic

hydrocarbon meeting the following test requirements:

| | |
|---|---|
| Viscosity, SSU at 100°F (ASTM D-88) | 2500 min. |
| Flash Point, C.O.C., °F (ASTM D-92) | 392 min. |
| Molecular Analysis (ASTM D-2007) | |
| Asphaltenes, %W | 0.1 max. |
| Aromatics, %W | 55 min. |

2.3 Ground Rubber

The rubber shall be U. S. Rubber Reclaiming Company designation G274, or approved equal, meeting the following physical and chemical requirements:

a. Composition:

The rubber shall be a dry, free flowing blend of 40% powdered reclaimed (i.e. devulcanized) rubber and 60% ground vulcanized rubber scrap selected to have a high natural rubber content. It shall be free from fabric, wire or other contaminants except that up to 4% of a dusting agent, such as calcium carbonate, may be included to prevent caking of the particles.

b. Sieve Analysis:

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

c. Mill Test:

When 40 to 50 grams of rubber retained on the No. 30 sieve are added to a tight set 6-inch rubber mill, the material shall band on the mill roll in one pass. (Note: This test is to establish

that a sufficient quantity of reclaimed, devulcanized rubber is present.)

d. Natural Rubber Content (ASTM D-297), %W 30 min.

3.0 ASPHALT-RUBBER BLEND

The asphalt-rubber blend (ARM-R-SHIELD) shall be a combination of the asphalt cement, extender oil and ground rubber mixed together at elevated temperature in accordance with the following proportions and procedures:

3.1 Preparation of Asphalt-Extender Oil Mix

Blend together the preheated asphalt cement (250-400°F), and sufficient rubber extender oil (usually from 1 to 7%) to reduce the viscosity of the asphalt cement to within the range of 600 to 2000 Poises at 140°F, when tested in accordance with AASHTO M-226. Mix thoroughly by recirculation, stirring, air agitation, or other appropriate means.

3.2 Addition of Rubber

Increase the temperature of the asphalt cement-extender oil blend with appropriate heat exchangers to within the range of 350-425°F and then add an amount of specified ground rubber equal to 20%, plus or minus 2% by weight of the total asphalt-rubber blend. Add the rubber as rapidly as possible and continue recirculating for a period of not less than 30 minutes after incorporation of all the rubber. Adequate recirculation and/or agitation of the total combined material shall be maintained to provide good mixing and dispersion. Sufficient heat should be applied to keep the temperature of the total blend between 350-425°F while mixing.

4.0 APPLICATION

The final rubber-asphalt blend (ARM-R-SHIELD) is ready for application

immediately after mixing by either hot-spray application in a distributor truck or by hot-pour in various devices. In the event a delay occurs when the product is ready to be applied, the heat shall be turned off until the job resumes.

The product may also be allowed to stand overnight and be applied the following day, provided the heat is turned off and restarted at a time interval prior to application sufficient to insure that the application temperature is again within the application temperature range of 375-425$^{o}$F. Mixing by recirculation or stirring shall be maintained during reheating to obtain temperature uniformity and avoid localized overheating which may damage the product.


Arizona Refining Company
Specification C 202-78

CONSTRUCTION SPECIFICATION

for

ARM-R-SHIELD$_{TM}$ STRESS ABSORBING MEMBRANE INTERLAYER

1.0 DESCRIPTION

This work shall consist of the placement of a one-course asphalt-rubber membrane (ARM-R-SHIELD) on an existing asphalt or Portland cement concrete surface prior to placing an asphalt concrete overlay.

2.0 GENERAL REQUIREMENTS

2.1 Preparation of Existing Surface

Prior to application of the asphalt-rubber membrane, the entire paved surface to be treated shall be cleaned by sweeping, blowing and other methods until free of dirt and loose particles. Pot holes, depressions and other irregularities shall be patched as required. No water shall be present on the surface.

2.2 Seasonal and Weather Limitations

Construction shall not proceed when the ambient temperature is below 50°F, when rain is falling, or when wind conditions are unfavorable to obtaining a uniform spread.

3.0 MATERIALS

3.1 Asphalt-Rubber Membrane

The asphalt-rubber membrane material shall be ARM-R-SHIELD meeting

the requirements of Arizona Refining Company Specification M 101-78.

3.2 Mineral Aggregate

Aggregate to be spread on the membrane to provide a working surface for construction equipment shall consist of a hard, clean aggregate such as crushed rock, dry pea gravel or sand. It shall be of uniform quality throughout and shall be free from dirt and other deleterious substances.

The aggregate shall conform to either of the following grading requirements:

| Sieve Size | Medium Grade % Passing | Fine Grade* % Passing |
|---|---|---|
| 1/2 in. | 100 | - |
| 3/8 in. | 85 - 100 | 100 |
| No. 4 | 10 - 30 | 75 - 100 |
| No. 8 | 0 - 10 | 30 - 80 |
| No. 16 | 0 - 5 | 0 - 50 |
| No. 200 | 0 - 2 | 0 - 5 |

*(Note: Should the interlayer be required to carry traffic longer than 24 hours prior to placing the overlay, it shall be necessary to place medium grade aggregate listed herein or the type called for in Arizona Refining Specification C 201-78 for "ARM-R-SHIELD Surface Treatment.")

3.3 Certification

Prior to application, the Contractor shall submit certifications of specification compliance for all materials.

4.0 EQUIPMENT

4.1 Distributor Truck

At least one pressure-type bituminous distributor truck in good

condition will be required. The distributor shall be equipped with an internal heating device capable of even heating of the material up to 425°F; have adequate pump capacity to maintain a high rate of circulation in the tank; have adequate pressure devices and suitable manifolds to provide constant positive cut-off to prevent dripping from the nozzles. The distribution bar on the distributor shall be fully circulating. Any distributor that produces a streaked or irregular distribution of the material shall be promptly repaired or removed from the project.

Distributor equipment shall include a tachometer, pressure gauges, volume measuring devices, and a thermometer for reading temperature of tank contents.

It shall be so constructed that uniform applications may be made at the specified rate per square yard within a tolerance of plus or minus 0.05 gal./sq. yd.

4.2 Aggregate

Any self-propelled aggregate spreader in good condition of sufficient capacity to apply the aggregate within the time period specified will be required. The spreader shall be so constructed that it can be adequately gauged and set to uniformly distribute the required amount of aggregate at regulated speed.

4.3 Brooms

Revolving brooms shall be so constructed as to sweep clean or redistribute aggregate without damage to the ARM-R-SHIELD membrane.

4.4 Pneumatic-Tired Roller

There shall be at least two multiple wheel self-propelled pneumatic-tired rollers with provisions for loading to eight to twelve tons as deemed necessary. Pneumatic-tired rollers shall have a total compacting width of at least 60 inches and shall have minimum tire pressure of 60 pounds per square inch.

4.5 Trucks

Trucks of sufficient number and size to adequately supply the material will be required.

5.0 CONSTRUCTION DETAILS

5.1 Application of ARM-R-SHIELD

The asphalt-rubber material shall be applied by pressure distributor truck within the temperature range of 375-425°F and at a minimum rate of 0.60 gallons (hot) per square yard. (For estimating purposes, use 7.6 pounds per hot gallon.) If a job delay occurs, the heater in the distributor should be turned off and restarted in sufficient time before start of spreading to reheat material to at least 350°F prior to resumption of spreading. No spread shall be in excess of a length which can be immediately covered with aggregate.

The application from the distributor shall be stopped before the tank is empty to be sure the application does not run light. At all startings, intersections, and junctions at transverse joints with previous spreads or other pavements, provision shall be made to insure that the distributor nozzles are operating at full force when the application begins. Building paper or other suitable devices shall be used to receive the initial application from the

nozzles before any material reaches the surface at the transverse joint. The paper or device shall be removed immediately after use without spilling surplus material on the surface.

Longitudinal joints shall be reasonably true to line and parallel to centerline. The overlap in application of asphalt-rubber material shall be the minimum to assure complete coverage. Where any construction joint occurs, the edges shall be broomed back and blended so there are no gaps and the elevations are the same, and free from ridges and depressions.

During application, adequate provision shall be made to prevent marring or discoloration of adjacent pavements, structures, vehicles, foliage or personal property.

5.2 Application of Aggregate

The application of the medium-sized aggregate shall follow as closely as possible behind the application of the hot asphalt-rubber material, which shall not be spread further in advance of the aggregate spread than can be immediately covered. The application of the fine-sized aggregate shall be delayed until the membrane has reached approximately the same temperature as the pavement. Construction equipment and other vehicles shall not drive on the uncovered apshalt-rubber material.

The dry aggregate shall be spread uniformly at the rate of spread directed by the engineer, generally between 10 and 40 pounds per

square yard. Any deficient areas shall be covered with additional material.

Only sufficient aggregate should be applied to provide a working surface for construction equipment needed to place the asphalt concrete overlay. Refer to the note on Mineral Aggregate, 3.2, under this Specification C 202-78.

5.3 Rolling

There shall be at least three complete coverages by the pneumatic-tired roller to embed the aggregate particles firmly into the asphalt-rubber membrane.

5.4 Sweeping

Prior to placing the overlay all loose material shall be swept or otherwise removed.

5.5 Tack Coat

A tack coat shall generally be required prior to the placement of the asphalt concrete overlay on the asphalt-rubber membrane, except when the fine grade aggregate is specified as cover material.

6.0 MEASUREMENT AND PAYMENT

6.1 Quantities

Quantities subject to payment are as follows:

(1) ARM-R-SHIELD - per ton or gallon

(2) Aggregate - per ton or cubic yard.

6.2 Basis of Payment

Payment for ARM-R-SHIELD shall be in full compensation for all

labor, use of equipment, and incidentals necessary in furnishing, hauling, heating and applying the material in accordance with these specifications.

Payment for aggregate shall be in full compensation for all labor, use of equipment, and incidentals necessary in preparation of surface; furnishing, hauling and spreading aggregate; and rolling and sweeping operations.