

Disclaimer

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CHAPTER 13 INTERLAYERS

13.1 OVERVIEW

Pavement interlayers are materials or combinations of materials that can be placed within a pavement structure during new construction, HMA overlays, or some preservation treatments to extend pavement service life. Most interlayers will mitigate reflective cracking and reduce the amount of surface water that will penetrate the pavement structure. When used with structural overlays (rehabilitation), some interlayers might also allow for a reduction in thickness of the HMA overlay. Interlayers might also provide stress and/or strain relief for a subsequent surface treatment.

Interlayers have a limited role in the world of pavement maintenance. They are primarily used with thin overlays and double chip seals to retard cracking and prevent water from reaching the base and subgrade. As a result, interlayers can help the pavement structure last longer, provide a smoother ride throughout the life of the pavement by reducing cracking, and require less maintenance in the future.

This chapter provides general guidelines on the use of interlayers and is not designed to be a standalone document in the decision-making process. It should be noted that factors such as traffic volume, structural section and pavement condition should be considered when considering interlayers. There are many types of interlayers and associated research surrounding these products. It is recommended that manufacturer representatives be consulted if there are questions about using their products.

13.2 TYPES OF INTERLAYERS

Several types of interlayers have been used in California including geosynthetic interlayers (fabrics, mats, grids and composite grids), special chip seals and other manufactured products. Many of the types of manufactured products discussed in this chapter require 0.15 ft. hot mix overlay to complete the application, which places them as a preservation strategy for Caltrans. However, most City and County agencies in California allow up to 2-inch overlays for standard maintenance and can include these types of interlayers. All interlayers can also be used with thicker-lift rehabilitation strategies. The types of interlayers discussed in the Guide include:

13.2.1 Geosynthetic Pavement Interlayers

Paving Fabric (Figure 13-1) A 'felty' non-woven geosynthetic fabric that becomes saturated with asphalt cement when placed over an asphalt cement tack coat prior to a hot mix asphalt (HMA) overlay. This paving fabric has also been used prior to a double chip seal system (instead of an HMA overlay), as discussed later in this chapter. This is known as a Geosynthetic Reinforced Chip Seal (GRCS). Paving fabric comes in rolls wide enough to cover the entire lane width.



Figure 13-1 Paving Fabric

Paving Mat (Figure 13-2) – A thinner, stiffer (high modulus of elasticity), non-woven fiberglass/polyester hybrid or fiberglass/polypropylene material that becomes saturated with asphalt cement when placed over an asphalt tack coat prior to an HMA overlay. Paving mats come in rolls wide enough to cover the entire lane width.



Figure 13-2 Paving Mats

Paving Grids (Figure 13-3) – A material formed into a grid by a regular network of integrally connected elements with openings greater than or equal to 1/2-inch to allow interlocking with the surrounding HMA materials. This grid is either installed with a self-adhesive or with a lightweight scrim backing (a non-woven fabric material < 1.2 oz/yd² attached to the grid)

and/or tack application, prior to an HMA overlay. Paving grids are available in various widths.

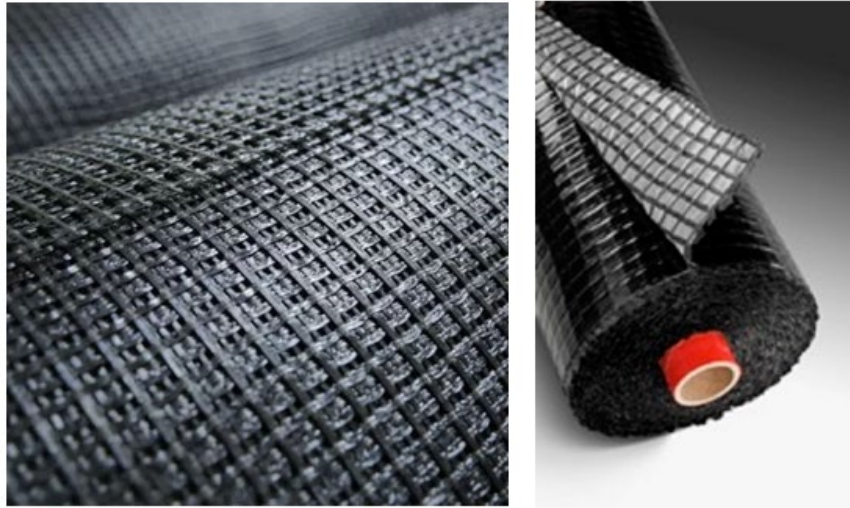


Figure 13-3 Paving Grids

Paving Composite Grids (Figure 13-4) – A Paving Grid, as defined above, laminated, bonded or integrated with a paving fabric (must meet requirements in Section 13.5.1, Table 13-3), which becomes saturated with asphalt cement tack coat when placed with an HMA overlay.

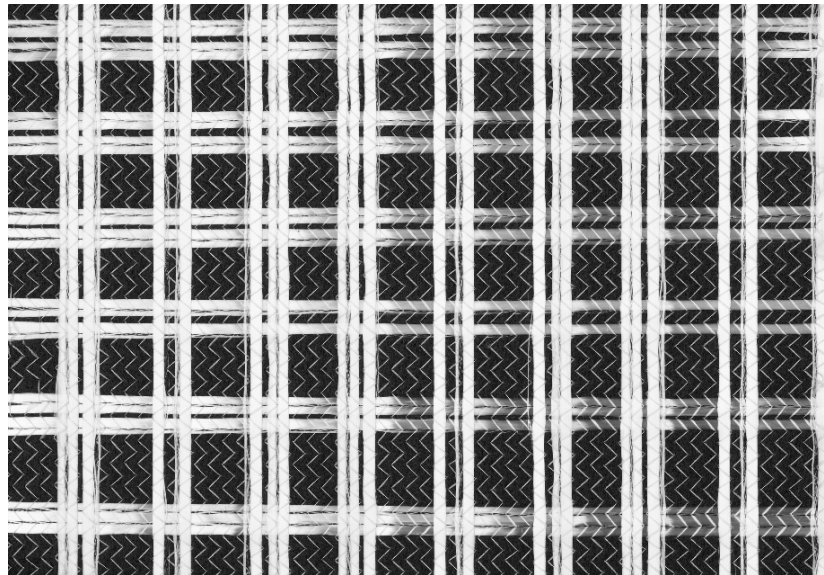


Figure 13-4 Paving Composite Grids

Composite Membranes (Figure 13-5) – Narrower ‘strip’ material of various widths (e.g., 12-inch, 18-inch, 24-inch, 36-inch and 48-inch) comprised of rubberized and/or polymerized asphalt and geosynthetic materials that are applied to localized areas of pavement, either with a self-adhesive or asphalt tack application. They are placed prior to an HMA overlay.



Figure 13-5 Application of Composite Membranes

It should be noted that all paving interlayers are recyclable if installed properly included, making certain there is enough asphalt absorbed in the interlayer.

13.2.2 Non-Geosynthetics

Asphalt Rubber Chip Seal (ARCS) (also called Stress Absorbing Membrane Interlayer – Rubber (SAMI-R)): An application of hot applied asphalt rubber binder covered with a pre-coated, pre-heated aggregate chip (Figure 13-6) placed prior to an HMA overlay, slurry seal or micro-surfacing. ARCSs are discussed in detail in Chapter 7 (Chip Seals).



Figure 13-6 Asphalt Rubber Chip Seals

13.3 PROJECT SELECTION, INTERLAYERS SELECTION AND BENEFITS

13.3.1 Project Selection Considerations

When using a thin overlay or chip seal as a wearing surface, consider an interlayer as a cost-effective addition to the chosen strategy. Use of an interlayer is based on several factors :

- Final surface treatment material and thickness (if overlay)
- Existing distresses - including types and severity levels
- Climate, soil, and traffic conditions
- Curviness of the road
- Moisture or water damage concerns
- Cost of interlayers
- Geosynthetic interlayers are not recommended for 8% grade or higher

Interlayers may reduce the overall initial cost of some projects by addressing the existing pavement distresses in lieu of dig out and repairs or thicker overlays. Interlayers may also decrease the life-cycle cost of rehabilitation or maintenance treatment by significantly extending the life of the pavement. Most interlayers are not used to add structural strength to a pavement. However, some interlayers have established structural coefficients. Manufacturers' documentation should be consulted when considering an interlayer to add structural strength to a pavement section.

When using an interlayer, a user must be familiar with pavement distress types and should have a good understanding of Chapter 1 of this Guide. Tables 13-1 and 13-2 offer some guidance on the type of interlayers that are effective with different types and levels of distress in addition to cost considerations.

Interlayers were originally designed specifically to deal with cracking that is not load associated. Wheel path alligator cracking is associated with wheel loading and indicates a lack of structure, so interlayers are not the optimum choice to address this type of cracking. However, if alligator cracking exists across the entire surface of the roadway and is not specific to the wheel path/loading area, it is most likely caused by age oxidation of the pavement. Interlayers are an excellent choice to help delay this type of distress from reflecting through the new wearing surface.

13.3.2 Distress types

In cases of structural (thicker), not maintenance (thin) overlays, interlayer is effective where the control of reflection cracking is a primary concern. Other types of distresses (thermal cracking, rutting, bleeding, raveling, etc.) are not normally addressed with the use of interlayers. If active pumping is present, it usually indicates a poor base/subgrade condition which will require drainage corrections prior to an interlayer. If rutting is present, it can usually be addressed with a leveling course, or micro-surfacing, then an interlayer could still be applied in conjunction with a surface treatment or thin overlay to gain life extension benefits.

Fatigue/Alligator Cracking

Alligator cracking is either load related (wheel path only) or caused by age oxidation of the entire existing pavement. If alligator cracking is caused by wheel loading combined with a lack of structure, then it will be in the wheel path area only. Interlayers are not the optimum choice to address this type of cracking. However, if alligator cracking exists across the entire surface of the roadway and is not specific to the wheel path/loading area, it is most likely caused by age oxidation of the pavement. Interlayers are an excellent choice to reduce age oxidation types of distress from reflecting through the new wearing surface.

Moisture Intrusion

Damage caused by water intrusion into a pavement structural section is a major cause of many types of distresses including, but not limited to, loss of subgrade support, stripping (separation of the asphalt and aggregate in a hot mix material), potholes, localized failures, crack propagation, and pavement deterioration caused by freeze-thaw.

One of the major benefits of most interlayers (except grids) is to provide a moisture barrier to surface water intrusion (e.g., rain, landscape watering). The effectiveness of an interlayer as a moisture barrier is dependent on the proper asphalt tack coat application rate associated with the respective interlayer system. The interlayer can prevent the intrusion of the surface moisture into the pavement structural section, which would weaken the pavement. Water intrusion caused by underground issues such as springs or standing water in ditches cannot be addressed with an interlayer. In those instances, proper drainage will be required prior to any pavement interlayer installation.

So regardless of any crack reduction benefit a material (e.g., fabric, mat, grid) interlayer might provide, there is a waterproofing effect resulting in little or no surface water penetrating the pavement and weakening the aggregate base and subgrade. This benefit is especially pronounced in areas of clay subgrade that weaken severely when wet. Therefore, in these situations there can be a 'structural' benefit from an interlayer, even with just a thin maintenance overlay - providing other sources of ground water are mitigated.

Pavement milling operations (e.g., for mill & fill patching or cold in-place recycling) should try to preserve the interlayer benefits by not milling through or otherwise disturbing the interlayer, where practical. Also, the future 'mill-ability' of an interlayer should be a consideration in pavement overly strategies involving interlayers.

Thermal Cracking

Fabric or mat interlayers are usually not effective in mitigating thermal cracks reflecting into new asphalt overlays. These wider cracks exhibit thermal horizontal movement and should be treated with the stronger 'grid' type interlayers. Special crack sealers or hot mastic filler can also be effective in treating thermal cracks after they form. Saw cutting of the old pavement and/or the new overlay – to reduce thermal stresses - has also been effective in reducing the severity of thermal cracking in HMA pavement. An interlayer could provide an important water proofing benefit in these situations.

13.4 SURFACINGS USED OVER INTERLAYER MATERIAS

Table 13-1 summarizes the types of final wearing surface, with required depths for HMA, necessary to be used with each interlayer material. An overlay thickness greater than 0.15 ft. is generally considered CAPM or pavement rehabilitation, rather than pavement preservation. All thicknesses of overlay paving and the most common interlayers are included here. Some engineers have reduced the thickness of overlay based on equivalent performance to justify economics. Research by FHWA implies that a paving fabric is equivalent to 0.1 ft of asphalt concrete for relatively thin (less than 0.42 ft) overlays that are structurally adequate (Holtz et.al., 2008). Caltrans doesn't reduce the thickness of pavement structure to compensate for the use of interlayers. Table 13-2 summarizes the effectiveness of various interlayer systems for different crack types and moisture conditions. In case of wheel path fatigue cracking mitigation, interlayers with thicker overlays (greater than 0.2 ft.) may be required. Yet, block cracking and lane wide age-related alligator cracking could be mitigated with overlays up to 0.15 ft.

Table 13-1 Final Wearing Surfacing Requirement Minimums for Various Interlayers

Type of Interlayers	Chip Seal	HMA Overlay Thickness Min 0.10 ft. (1¼")	HMA Overlay Thickness Min 0.125 ft. (1½")	HMA Overlay Thickness Min 0.167 ft. (2")	Slurry or Micro Surfacing
Paving Fabric w/ HMA Overlay			X		
Paving Fabric w/ Chip Seal (double)	X				X
Paving Mat			X		
Paving Grid			X		
Paving Composite Grid				X	
Composite Strip Membranes			X		
AR Chip Seals		X			X
PMA Chip Seals		X			X
PMRE Scrub Seals		X			X

Note: X = Acceptable Surface Treatment for Interlayer

¹A CAPM by Caltrans definition is Capital Preventive Maintenance. A CAPM treatment may still be a pavement preservation technique but does not meet the "Maintenance" funding definition.

Table 13-2 Anticipated Effectiveness vs Types of Cracking and Moisture Intrusion

Interlayer	Alligator Cracking Load Related	Alligator Cracking Age Oxidation (Low to Medium)	Alligator Cracking Age Oxidation (Medium to High)	Block, Longitudinal, and Non-Thermal Transverse Cracking Low to Medium (CW < 1/2 in)	Block, Longitudinal, and Non-Thermal Transverse Cracking High (1/2 in < CW < 1 in)	Thermal Cracking Low (CW < 1/4 in)	Thermal Cracking Medium (1/4 < CW < 1/2 in)	Thermal Cracking High (1/2 in or greater CW)	Moisture Intrusion
Paving Fabric w/ Overlay	F	G	G	G(2)	G(2)	F(2)	F(2)	N	E(3)
Paving Fabric with Double Chip Seal	F	E	E	G(2)	G(2)	F(2)	N	N	E(3)
Paving Mat w/Overlay	G	E	E	G(2)	G(2)	F(2)	F(2)	N	E(3)
Paving Grid w/Overlay	G	E(1)	E(1)	E(2)	E(1)	F(2)	F(1)	N	N
Paving Composite Grid w/overlay	G	E	E(1)	E(2)	E(2)	E(2)	F(2)	N	E
Composite (Strip) Membranes	N	N	N	E(2)	E(2)	E(2)	F(2)	N	E
AR Chip Seal w/overlay	G	E	E	E(2)	G(2)	E(2)	G(2)	G(4)	E

E = Excellent Results

G = Good

F = Fair

N = Not Recommended

L = Low Severity

M = Medium Severity

H = High Severity

CW = Crack Width

- (1) Interlayer with leveling course first
- (2) Interlayer with crack filling first
- (3) Interlayer dependent on binder application rate
- (4) Interlayer with crack filling first or milling

13.5 MATERIALS, APPLICATION AND SPECIFICATIONS

Specifications for Geosynthetic interlayers are found in Section 96 of the Caltrans 2025 Standard Specifications.

13.5.1 Paving Fabric

Paving fabric can be used with either HMA overlays or with double chip seals. If used with a HMA overlay, the minimum depth of compacted overlay must be at least 0.12 ft, which implies that it could be used in a HM-1, CAPM or Rehabilitation Strategy.

Table 13-3 lists specifications for paving fabric as per Caltrans 2025 Standard Specifications, Section 96. Also see Section 92-1.02, "Materials" of Caltrans 2025 Standard Specifications for more details. The 2025 AASHTO M355 Geosynthetic Pavement Interlayer Specification is also included in the reference list.

Table 13-3 Paving Fabric Specifications (Caltrans Standard Specification, Section 96, 2025)

Property	Test Method	Value
Elongation, minimum in each direction, %	ASTM D4632	50
Grab breaking load, 1-inch grip, minimum in each direction, lbs.	ASTM D4632	100
Hydraulic bursting strength, minimum, psi	ASTM D3786	200
Mass, minimum, oz/yd ²	ASTM D5261	4.1
Melting point (min, °F)	ASTM D276	325
Asphalt retention, minimum, gal/yd ²	ASTM 6140	0.2

Binder Requirements for Installation of Fabric prior to an Overlay

The surface area to receive the fabric shall be sprayed with a tack coat of PG grade asphalt binder. The PG grade is determined based on the ambient temperatures on the jobsite during installation. Typical binders used are PG 64-10 and PG 70-10. Higher ambient temperatures will require the stiffer (PG 70-10) binder in order to reduce the chance of bleeding under construction traffic.

The recommended binder application rate is 0.25 ± 0.03 gal/yd². In milled areas, binder application rate shall be increased by 0.05-0.10 gal/yd² to account for the increased surface area and roughness. The asphalt binder should be spread in the range of 290°F to 325°F as read on the temperature gauge on the truck applying the material.

Binder Requirements for Installation of Paving Fabric prior to a Double Chip Seal

PG 70-10 is the preferred grade of asphalt binder for the tack coat to be applied prior to installation of the paving fabric. Asphalt emulsion is not recommended. The difference is in the application rate and the amount of saturation of the fabric required prior to the application of the chip seal. The typical application rate of the binder shall be increased to 0.30 ± 0.03 Gal/ yd². In addition, the fabric shall be rolled immediately, while hot, with a rubber-tired roller to ensure that the fabric is saturated with the tack coat prior to the chip seal application.

13.5.2 Paving Mat

Paving mat is used under HMA overlays of a minimum compacted thickness of 0.12 ft. This places a paving mat in the CAPM or Rehabilitation category. Specification requirements for paving mats are shown in Table 13-4.

Table 13-4 Paving Mat Specifications (Caltrans Standard Specifications, Section 96-1.02, 2025)

Property	Test Method	Value
Ultimate Elongation, max, %	ASTM D5035	5
Breaking Force, min, lbs.	ASTM D5035	45
Mass per Unit Area, oz / yd ²	ASTM D5261	3.7
Melting Point, min, °F	ASTM D276	400
Asphalt Retention, mini, gal/yd ²	ASTM D6140	0.10

The AASHTO specification for Paving Mat includes 3 types in Table 13-5. The Caltrans specification is nominally consistent with the AASHTO Type III, and that all the AASHTO Types equal or exceed the requirements of the Caltrans specification.

Table 13-5 AASHTO Paving Mat Specifications

Test	Method	Units	Paving Mat (Class 2) Type I	Paving Mat (Class 2) Type II	Paving Mat (Class 2) Type III
Mat Breaking Strength	ASTM D5035 Method 2C-E	lbf/2 in. (N/50 mm)	560 (2500)	280 (1250)	45 (200)
Mat Elongation	ASTM D5035	%	5	5	5
Mass Per Unit Area	ASTM D5261	oz/yd ² (gm/m ²)	7.0 (237)	4.0 (135)	4.0 (135)
Melting Point	ASTM D276	°F (°C)	420 (216)	420 (216)	420 (216)

Binder Requirements for Installation of Paving Mat - The surface area to receive the mat shall be sprayed with a PG grade 64-10 or 70-10. Higher ambient temperatures will require the stiffer PG 70-10 binder to reduce the chances of oversaturation of the mat under construction traffic.

The typical binder application rate should be in the range of 0.15 to 0.20 ± 0.03 Gal/yd² depending on manufacturer. Tack coat application rates should follow manufacturer recommendations. In milled areas, the binder application rate should be increased by 0.05-0.10 Gal/yd² to account for the increased surface area and voids. The asphalt binder should be spread at 290 to 325°F on the temperature gauge on the truck applying the material.

13.5.3 Paving Grid

The paving grid is used under HMA overlays of a minimum compacted thickness of 0.125 ft. This places a paving grid in the CAPM or Rehabilitation category. Specifications for paving grids are shown in Table 13-6.

Table 13-6 Paving Grid Specifications

Property	Test Method	Grid Type Class I	Grid Type Class II	Grid Type Class III
Grid Aperture size, range, inches	Callipered	> 0.5	> 0.5	> 0.5
Elongation, maximum, %	ASTM D6637	12	12	12
Mass, minimum, oz/yd ²	ASTM D5261	16	10	5.5
Tensile strength @ ultimate, minimum, (lbs./in) a		560 × 1,120	560 × 560	280 × 280
Melting point (min, °F)		325	325	325

a. or class I, machine direction × cross direction. For class II and III, both directions

Binder Requirements for Scrim-Applied Paving Grid – The surface area to receive the paving grid shall be sprayed with a PG grade 64-10 or 70-10 (depending on typical ambient temperatures on the jobsite) paving grade asphalt binder. Higher ambient temperatures will require a stiffer PG binder. The typical binder application shall be 0.06-0.10 +/- 0.03 Gal/yd². Paving Grids shall not be placed directly on milled surfaces. The asphalt binder should be spread in the range of 290°F to 325°F as read on the temperature gauge on the truck applying the material.

Binder Requirements for Self-Adhesive Paving Grid – Self-adhesive grids may require a tack coat for installation. Paving Grids shall not be placed directly on a milled surface. If a tack coat is specified and approved by the manufacturer or their representative, the tack coat shall be emulsified asphalt or PG grade binder as referenced above. If emulsified asphalt is used, ensure a binder solids content of minimum 65% and a residual asphalt application rate of 0.02-0.05 gal/yd². See the manufacturer’s recommendations for details.

Cover Requirements for Paving Grid – An overlay thickness of minimum 0.12 ft compacted depth is required in conjunction with a paving grid application.

13.5.4 Paving Composite Grid

Paving composite grid is used under HMA overlays of a minimum compacted thickness of 0.12 ft when a leveling course is used or 0.15 ft on a milled surface (per manufacturer’s recommendations). The fabric must meet Section 13.5.1, Table 13-3. This places a paving composite grid in the CAPM or Rehabilitation category. Specifications for paving composite grid are shown in Table 13-7.

Table 13-7 Paving Composite Grid Specification, Caltrans Specifications, Section 96)

Property	Test Method	Grid Type Class I	Grid Type Class II	Grid Type Class III
Aperture size, range, inches	Callipered	> 0.5	> 0.5	> 0.5
Elongation, maximum, %	ASTM D6637	5	5	10
Mass, minimum, oz/yd ²	ASTM D5261	16	10	5.5
Tensile strength @ ultimate, minimum, lb./in	ASTM 6637	560 × 1,120	560 × 560	280 × 280
Melting point (Min °F)	ASTM 276	325	325	325

Binder Requirements for Paving Composite Grid Installation - The surface area to receive the composite grid shall be sprayed with a PG grade 64-10 or 70-10 (depending on typical ambient temperatures on the jobsite) paving grade liquid asphalt binder. Higher ambient temperatures will require stiffer PG binders to reduce the chances of oversaturation of the composite under construction traffic.

The typical binder application shall be 0.25 ± 0.03 Gal/yd². In milled areas, the binder application rate shall be increased by 0.05-0.10 Gal/yd² to account for the increased surface area and voids. The asphalt binder should be spread in the range of 290°F to 325°F as read on the temperature gauge on the truck applying the material.

13.5.5 Composite Strip Membranes

Composite strip membranes are used under hot mix overlays of a minimum compacted thickness of 0.12 ft. This places the composite strip membranes in the HM-1, CAPM, or Rehabilitation category. The specifications for the materials used in composite strip membranes are shown in Table 13-8.

Table 13-8 Composite Strip Membranes Specification (Caltrans Standard Spec, Section 96, 2025)

Property	Test Method	Value
Puncture Strength, min, lbs.	ASTM D4833	200
Permeance, perm, maximum	ASTM E96	0.10
Elongation at break (min %)	ASTM 882	50
Strip Tensile Strength, lbs./in	ASTM 882,	50
Pliability	¼ inch Mandrel, 180 @ - 25°F	No cracks in fabric or bitumen
Melting Point (°F)	ASTM D276	325

Primer Placement - The purpose of a primer is to improve the adhesion of the strip membrane under "marginal" conditions that tend to reduce bonding. Such conditions include moisture, dust, cold temperatures, and irregular surfaces. Use only primers recommended by the manufacturers of the products.

13.5.6 Asphalt Rubber Chip Seals

Hot asphalt rubber chip seals (ARCS) can be used under HMA overlays of any thickness or slurry or micro-surfacing. This allows ARCS to be used for maintenance, CAPM or Rehabilitation.

ARCS have a long history of being used as interlayers prior to placement of an HMA overlay. They are similar in application to a conventional type of chip seal, but the application rate of the binder is much higher ranging from 0.55-0.65 gal/yd². The thicker layer of binder provides improved resistance to reflection cracking and water intrusion.

The material requirements for the hot asphalt rubber binder component of the system are detailed in Chapter 7 of this manual. More information on the use of this product can be found in the Caltrans Asphalt Rubber Usage Guide updated in 2006 (Caltrans, 2006).

13.6 CONSTRUCTION GUIDELINES

The following are general guidelines to ensure a successful installation of material interlayers (paving fabric, paving mat, paving grid, paving composite grid and composite strip membranes). For each specific project, the project specifications, project engineer's direction, and manufacturer's recommendations must be followed. Construction guidelines for chip seals can be found in Chapter 7.

13.6.1 Surface Preparation

The following are the steps needed:

- Potholes, cracks greater than 1/4-inch, and/or local distresses related to structural, or subgrade failures shall be repaired.
- Pavement must be free of dirt, water, oil, and other foreign materials. Broom or air-clean the surface if necessary. This is an extremely important step. Spraying asphalt onto contaminants will prevent interlayers from adhering to the existing pavement surface, and the materials may delaminate during or after construction.
- Rutting, if exists, must be corrected through milling or by placing an HMA leveling course or micro-surfacing.
- General roughness can be corrected by micro milling or placing a smooth micro-surfacing prior to placement of an interlayer.
- If a finish or profile milling (micro milling) is performed, a leveling course is not required prior to placement of most material interlayers. This will depend on

the smoothness of the surface created during the milling operation and the specific interlayer material being placed. The following finish tolerances are required for any profile or finish milling:

- Remove asphalt concrete to a minimum depth of 1/4-inch
 - Provide a surface relief (distance between ridges) of no more than 1/4-inch
 - Maintain 1/4-inch grade tolerance (transversely and longitudinally)
 - There shall be no more than 1/4-inch vertical height variation between planed and un-planed surface at inside edge of conform and taper mills
- If cold planning/milling is performed, a leveling course is typically required prior to placement of material interlayers, other than paving fabric. This will depend on the smoothness of the surface created during the milling operation. The following finish tolerances are required for placement of paving fabric over a cold-planed surface:
 - Remove old HMA to a minimum depth of 3/8-inch
 - Provide a surface relief (distance between ridges) of no more than 3/8-inch
 - Maintain a 3/8-inch grade tolerance (transversely and longitudinally) from a 10-foot straightedge
 - There shall be no more than 3/8-inch vertical height variation between planned and unplanned surface on inside edge of conform and taper mills
 - With the exception of using composite strip membranes on the joints, a leveling course is required over all Portland cement concrete (PCC) pavements. Typical Caltrans practice for PCC pavements is to crack-and-seat the old PCC prior to a rehabilitation overlay using an interlayer. However, interlayers can also be used on non-crack-and-seat rigid pavements prior to overlays.
 - All paving grid applications, except for paving composite grids, require an HMA leveling course.
 - Proper grade and cross-slope must be established. Manholes, catch basins, and utility appurtenances must be raised to a level of the new overlay.

13.6.2 Road Surface Condition (Before Installation)

- The pavement must be moisture free. Do not install material interlayers during precipitation.
- The ambient air temperature must be $\geq 50^{\circ}\text{F}$ and rising.
- Pavement temperature must be $\geq 40^{\circ}\text{F}$ and rising.
- On newly placed HMA surfaces, the surface temperature of the new HMA must be allowed to cool below 130°F before placement of the interlayer.
- If necessary, the leveling course may be opened to traffic prior to placement of the interlayer to allow the tires to further knit the surface.

13.6.3 Binder Materials and Application

Binder materials for interlayer tack coats must meet the following requirements.

- Delivered from an approved source
- Delivery ticket specifies the grade for use on the project
- Temperature is within the specified range

Apply new binder (tack coat) uniformly over the clean surface using a distributor truck with a current calibration. The truck shall have clean, uniformly angled, properly sized nozzles and a bar that is at the correct height to apply the material in a triple overlap spray pattern (Figure 13-7). Edge nozzles shall be clog-free and angled perpendicular to the spray bar for a clean edge.



Figure 13-7 Interlayer Binder Application

The distributor truck applying the asphalt binder shall be equipped with computer control and readout to ensure proper application rates. Spot application rate checks should be performed as per Section 13.7 of this chapter.

13.6.4 Material Application

The following are some general guidelines:

- Using mechanical placement equipment, or manually, embed the interlayer in the hot PG tack coat promptly before the asphalt cools. (Figures 13-8, 13-9, 13-10, and 13-11).
- Keep the interlayer material taut and wrinkle free. Providing tension during application will help to achieve this. Providing broom pressure will also assist

in reducing wrinkles.

- For sharp curves, material can be cut from the roll to desired length and positioned by hand to avoid wrinkles.
- For paving fabric and mat, transverse overlaps shall be 4 to 6 inches. Longitudinal overlaps shall be 2 to 4 inches.
- For paving grid and composite grid, transverse overlaps shall be 3 to 6 inches. Longitudinal overlaps shall be 1 to 2 inches.
- Transverse overlaps should be lapped in the direction of paving to minimize the risk of being picked up by the paving equipment and process. All overlaps shall receive an application of a tack coat.
- Only construction and emergency vehicles are allowed to drive on the interlayer prior to the placement of an overlay.
- Longitudinal joints shall be placed on lane delineation if possible.
- Manufacturers' Material Safety Data Sheet (MSDS) 's and installation guide shall be reviewed and adhered to during installation.



Figure 13-8 Tractor Mount Application of Fabric



Figure 13-9 Truck Mount Application of Paving Mat



Figure 13-10 Tractor Mount Paving Grid Installation



Figure 13-11 Composite Paving Grid Installation

13.6.5 Specific Guideline for Each Type of Interlayers

The following items are specific to each of the individual interlayer materials and need to be adhered to in addition to the general guidelines above. Manufacturer guidelines and recommendations should be consulted prior to installation.

Specifics for Paving Fabric Installation with an HMA Overlay

The following factors need to be considered:

- A tack coat should be applied uniformly at the proper rate for the fabric used.
- A tack coat should not be applied more than 100 ft. ahead of fabric laydown.
- Fabric should be applied promptly onto the hot tack coat.
- Paving fabric comes in rolls wide enough to cover a full lane (12 ft.).
- Large wrinkles (1-inch and larger) shall be slit and lapped in the direction of paving.
- All fabric shall be smoothed with brooms in order to maximize tack coat contact and remove air bubbles.
- The width of asphalt tack coat application shall be 2 to 4 inches beyond the edges of the fabric.
- No joints or laps shall result in more than two layers of fabric.
- On rough milled surfaces, sweeping and a HMA leveling course are recommended (On micro-milled surfaces, a leveling course may not be needed).
- Adequate temperature of the HMA for the overlay is important, so temperature should be checked.
- Rolling of the hot HMA overlay should occur promptly after its placement, as

- temperature is critical to maximize saturation of the fabric with the tack coat.
- Normally, levelling course is required before the use of fabric interlayers in HMA overlays of PCC pavement.

Specifics for Paving Fabric Installation with A Double Chip Seal Application

The following factors need to be considered:

- Ambient temperature requirements for fabric under chips are between 65°F and 100°F. Pavement temperature shall be 60°F and rising. Fabric shall not be placed unless temperatures and weather conditions will also allow for completion of the chip seal immediately following the fabric application.
- The asphalt tack coat shall be applied at a minimum rate of 0.30 gal/yd², increased as surface conditions dictate.
- The width of asphalt tack coat application shall be 2 to 4 inches beyond the edges of the fabric.
- All wrinkles must be cut out completely with no lapping. Wrinkles and/or laps will reflect through a chip seal immediately.
- Fabric shall be butted (no lapping) at both longitudinal and transverse joints.
- Brooms on lay down equipment shall apply uniform pressure across full width of fabric.
- Fabric must become completely saturated with the asphalt tack coat during laydown procedure. Binder application rate for the chip seal can be increased to compensate for any incomplete saturation of the fabric, however this is not the recommended practice.
- Fabric shall be rolled with rubber-tired rollers (minimum 3) immediately after placement to maximize tack coat contact and remove air bubbles. Rollers should stay within 25 to 75 feet of the fabric laydown equipment at travel below 5mph. A release agent must be sprayed on the rubber tires to prevent pick-up of the fabric.
- Rolling must consist of at least 6 coverages within 15 minutes.
- Sanding can be used to prevent traffic tires from adhering to and picking up the fabric. The cover sand shall be uniform, clean, dry and free from deleterious matter, applied at 3-5 lb./yd².
- Traffic speed control must be maintained as necessary for safety. All loose sand shall be removed prior to application of the chip seal.
- Grades or slopes greater than 10% require additional consideration.
- Fabric for chip applications is not recommended in the following areas
 - The bubble portion of cul-de-sacs
 - Sharp curves
 - Intersection radii
 - The last 100 feet approaching an intersection that requires traffic to stop, turn or reduce speed
- Chip seal work should be in accordance with Caltrans Standard Specifications, Section 37, with emphasis on the following items.
- The binder for the double chip seal layers should be PMCRS-2h.
- Binder application rate should be 0.30-0.40 gal/yd².
- Chips for the first chip layer should be 3/8-inch max.
- Chips for the second chip layer should be 5/16-inch max.
- Rolling of the chips should be with a pneumatic tired roller at 5 mph maximum

- with six coverages within 30 minutes of the chip application.
- Sweeping of excess chips should be a minimum of 2 hours after placement and delayed longer if ambient temperature is below 80°F.

Specifics for Paving Mat Installation with An HMA Overlay

The following factors need to be considered:

- If milling of the existing asphalt pavement has been performed, a leveling course may be required prior to placement of a paving mat. This will depend on the smoothness of surface created during the milling operation.
- Because paving mat is stiffer than fabric, it will have to be cut and realigned (chorded) on curves (For this reason, it is better suited for straighter roads).
- A leveling course is required over all Portland cement concrete pavements.
- The paving mat comes in rolls wide enough to cover a full lane (12 ft).
- The width of asphalt tack coat application shall be 2 to 4 inches beyond all edges of the mat.
- Large wrinkles (1-inch and larger) shall be slit and lapped in the direction of paving.
- Rolling of the new HMA overlay should occur promptly after its placement in order to maximize saturation of the mat by the tack coat.

Specifics for Paving Grid Installation with An HMA Overlay

The following factors need to be considered:

- A leveling course is required for all paving grid installations.
- For scrim-applied paving grids, tack coat shall be applied at a rate that will bond the scrim and the paving grid to the existing pavement.
- For self-adhesive paving grids, if a tack coat is specified and approved by the manufacturer or their representative, then the tack coat shall be used on the self-adhesive paving grid (See manufacturer's recommendations for details).
- Prior to installation of a self-adhesive grid, test for proper adhesion to the existing pavement according to manufacturer's adhesion guidelines.

Specifics for Paving Composite Grid Installation prior to HMA Overlay

The following factors need to be considered:

- If milling has been performed, sweeping and a leveling course may be required prior to placement of composite paving grid, especially if the milling is deep or rough.
- Follow practices for paving fabric described above.

Specifics for Asphalt Rubber Chip Seal Construction (Figure 13-12 and 13-13)

The specifics listed here are very limited. For complete documentation on Chip Seal Construction refer to Chapter 7 of this manual.

- Asphalt rubber chip seal applications are similar to those of a conventional chip seal.
- The surface must be prepared and cleaned.
- The hot rubberized binder is applied at an application rate which depends on the existing distresses, traffic, and size of cover aggregate.
- Aggregate is typically pre-heated and pre-coated with asphalt to reduce the amount of dust on the aggregate and ensure a good bond to the asphalt binder.
- The aggregate is applied immediately and rolled into the mat.
- Finishing consists of brooming off the excess aggregate.



Figure 13-12 Asphalt Rubber Binder Being Applied



Figure 13-13 Chips Applied and Sweeping Edge for 2nd Pass

13.7 FIELD TESTING FOR MATERIAL INTERLAYERS

The following focuses on 'material' type interlayers only (Paving Fabric, Mat, and Composite Grid). Field testing related to chip seals may be found in Chapter 7 of this Guide.

13.7.1 Tack Coat Rate Test - Equipment Required

The following need to be considered:

- Field Inspection Form
- Measuring Scale of 2g accuracy (preferably portable)
- Testing units (12-inch × 12-inch rigid material, 1/8-inch or 1/4-inch hardboard, plywood or heavy fabric)

13.7.2 Tack Coat Application Rate Determination

The following need to be done:

- Pre-weigh test units and write weight on underside of test units.
- Have Binder Spreader unit pull to level area (both across and down the length of the truck).
- Record starting gallons of asphalt binder taken from Spreader Truck tank gauge. The truck must be parked level for 1st and all subsequent readings. Using the same location is optimal.
- Instruct the spreader operator not to pump additional binder onto or off the truck without taking readings.
- Record the temperature of the asphalt binder inside the tank.

13.7.3 Calibration of Distributor Truck

The following must be done:

- Have binder application spray unit located at the starting point of tack coat placement.
- Instruct spreader operator to set the application rate of the spreader to the desired rate (e.g. 0.25 gal/ yd²).
- Place test unit(s) on pavement (minimum of one, maximum of three) directly in front of the truck. If one, place in center of truck, if there are three places in center of truck and outside of wheel paths.
- Instruct the operator to proceed forward applying asphalt binder until the test unit(s) has been crossed with sprayed asphalt binder.
- Retrieve test units (show care handling hot asphalt coating) and re-weigh.
- Subtract the original weight recorded on the underside of the sample from the gross weight including the sprayed asphalt binder.
- Compare resulting weight with the binder weight application chart.

- If required, have the operator adjust the application rate up or down to reach desired rate.
- Retest, if necessary, until the desired application rate is confirmed. (Note: the same testing units can be used repeatedly by simply recording new tare weights prior to a second application of binder).

13.7.4 Other Project Monitoring

The following should be done:

- All rolls of paving interlayer materials should arrive at the job site in a plastic wrapper. This indicates the roll is complete and has been protected from sun and water. (If partial rolls are brought to the jobsite, these should be set aside, and all placed at the same time as the length will have to be calculated to determine total square yard). On partial rolls, the inspector can request one or two wraps of the exposed fabric to be removed to ensure no ultraviolet degradation has occurred. The manufacturers tag each roll both outside on that wrapper as well as inside on the cardboard core. These tags provide all necessary information regarding the manufacturer, manufacturer tracking number, the weight per square yard, the width and length of that roll.
- If the inspector is not with the interlayer laydown operations at all times the contractor shall retain the tags as the rolls are applied, for determination of total square yards placed.
- To check the tack coat application rate at any time during the project, the inspector can take another reading on the tank of the distributor truck (truck must be level) at the completion of a full fabric roll.
- Subtract the current tank reading from the beginning to determine total gallons of asphalt binder placed.
- Retrieve the roll tags from the spreader operator to determine the number of rolls installed.
- Multiply the number of rolls times the square yards in the roll to get total square yardage.
- Divide the total gallons of paving grade asphalt binder placed by the total square yards placed and determine tack coat application rate (gal/yd²) to that point.

13.8 TROUBLESHOOTING GUIDE

The following guide provides a summary of possible problems, typical causes and potential solutions associated with paving material (geosynthetic) interlayers (Table 13-9). The guide was primarily based on guidelines from the FHWA Pavement Preservation Checklist Series and manufacturers' installation guidelines FHWA 2021). The troubleshooting guide for chip seals used as interlayers may be found in Chapters 7.

Table 13-9 Troubleshooting Guide for Interlayers

Problem	Causes and Solutions
<p>Wrinkles Have Formed During Placement of a Material Interlayer</p>	<p>Cause:</p> <ul style="list-style-type: none"> • Lay down equipment out of alignment or lack of tension on roll • Lay down equipment turned without stopping and cutting the interlayer • Equipment has turned on top of the interlayer • Broken or weak core causes sagging of roll <p>Solutions:</p> <ul style="list-style-type: none"> • Make sure fabric applicator is driving straight; veering to the left or right can cause wrinkles • Check equipment for proper tension and alignment of the fabric roll • Minimize equipment traffic on interlayer • For mat material, cut and chord more frequently • Insert metal bar inside fabric roll core to prevent fabric rolls from sagging
<p>Vehicles and/or Equipment Tires Are Picking Up, Sticking to or Tearing Material Interlayer</p>	<p>Cause:</p> <ul style="list-style-type: none"> • High ambient temperatures • Over-application of binder tack coat (if this is the cause, reduce binder rate but do not go below the specified application rate) • Excess construction or public traffic on installed material <p>Solution:</p> <ul style="list-style-type: none"> • Broadcast small quantities of HMA or sand over interlayer (sweep up all sand prior to surface treatment) • Do NOT reduce tack coat below specified application rate • Switch to truck-mounted fabric application • If a problem is persistent in an area, switch to a modified asphalt tack coat? • Repair damaged areas of material
<p>Blisters Form Under Material Interlayer</p>	<p>Causes:</p> <ul style="list-style-type: none"> • Pavement is wet and/or saturated <p>Solution:</p> <ul style="list-style-type: none"> • Roll the interlayer with a rubber-tire roller until it adheres to the pavement • Dry the rest of the pavement before continuing with interlayer installation • Install drainage if subgrade is saturated and not drying out

Table 13-9 Troubleshooting Guide for Interlayers (Continued)

Problem	Causes and Solutions
<p>Paving Fabric Shrinks (Edge Curls) When Laid on Tack Coat</p>	<p>Cause:</p> <ul style="list-style-type: none"> • Tack coat is too hot <p>Solution:</p> <ul style="list-style-type: none"> • Wait longer before installing fabric or mat on tack coat
<p>Material Interlayer Is Not Sticking to Tack Coat</p>	<p>Cause:</p> <ul style="list-style-type: none"> • Tack coat too cold • Insufficient tack coat • Milled surface too rough • Material placed with wrong side down • Tack coat binder absorbed by new leveling course or patch <p>Solution:</p> <ul style="list-style-type: none"> • Check binder temperature and application rate • Close gap between distributor and fabric tractor • Add leveling course or patching • Ensure proper material placement • Pre fog seal patched areas
<p>Tack Coat Not Sticking to Pavement</p>	<p>Cause:</p> <ul style="list-style-type: none"> • Pavement is wet or dirty (dust/oil/etc) • Tack coat binder too cold <p>Solution:</p> <ul style="list-style-type: none"> • Clean and or dry the pavement • Check and adjust binder temperature

13.9 REFERENCES

AASHTO Specification: Geosynthetic Pavement Interlayer Specification for Highway Applications, 2025 (Adopted August 2024).

Ahrlrick, Randy, Users Guide: Asphalt Rubber and Geotextile Interlayers, USAE Waterway Experiment Station, Miscellaneous paper. CL-92-20, August 1992.
<https://apps.dtic.mil/sti/tr/pdf/ADA264781.pdf>

Asphalt Interlayer Association (AIA) website. <https://www.aia-us.org/>

Caltrans, Asphalt Rubber Usage Guide, 2006.
<https://www.ra-foundation.org/wp-content/uploads/2012/06/Asphalt-Rubber-Usage-Guide.pdf>

California Department of Transportation, Design Bulletin 81-02 update, October 2, 2019.
<https://dot.ca.gov/-/media/dot-media/programs/design/documents/signed-dib-81-02-100219.pdf>

California Department of Transportation (Caltrans), Standard Specifications, 2025.
https://dot.ca.gov/-/media/dot-media/programs/design/documents/2025_stdspecs.pdf

Caltrans Highway Design Manual, Chapter 600, May 2022.
<https://dot.ca.gov/-/media/dot-media/programs/design/documents/chp0600-a11y.pdf>

Caltrans Highway Design Manual, Chapter 610, May 2022.
<https://dot.ca.gov/-/media/dot-media/programs/design/documents/chp0610-092923-a11y.pdf>

Caltrans Highway Design Manual, Chapter 630, May 2022, Section 631.9.
<https://dot.ca.gov/-/media/dot-media/programs/design/documents/chp0630-092923-a11y.pdf>

Caltrans Construction Manual, Chapter 4: Construction Details, Section 96: Geosynthetics, July 2019. <https://dot.ca.gov/programs/construction/construction-manual/section-4-96-geosynthetics>

Caltrans Construction Cost Data Book, 2023. <https://sv08data.dot.ca.gov/contractcost/>

FHWA NHI-07-092, Geosynthetic Design & Construction Guidelines, Reference Manual, Chapter 6 Pavement Overlays, August 2008.

FHWA Pavement Preservation Check List for Interlayers, 2021.
<https://www.fhwa.dot.gov/pavement/preservation/ppcl14.pdf>

Geosynthetic Materials Association. <https://geosynthetics.textiles.org/>

Holtz, Robert, Barry Chistopher, and Ryan Berg, Geosynthetic Design and Construction Guides, Chapter 6, Pavement Overlays, FHWA-NHI-07-092, 2008.

Kim, Y. R., Sudarsanan, N., & Xue, L. G. (2022). Development of geosynthetic pavement interlayer improvements (No. FHWA/NC/2019-19). North Carolina Department of Transportation. Research and Development Unit.
https://connect.ncdot.gov/projects/research/RNAProjDocs/2019-19_Final%20Report.pdf

Pavement Preservation Academy Manuals from California Pavement Preservation Center (2023):

- Asphalt Pavement Repair and Resurfacing Preparation:
https://scholarworks.sjsu.edu/mti_publications/414/
- Chip Seals: <https://transweb.sjsu.edu/sites/default/files/1845A-Chip-Seal-Manual.pdf>
- Slurry Seals and Micro-surfacing:
<https://transweb.sjsu.edu/sites/default/files/1845B-Cheng-Manual-Slurry-Surfacing.pdf>
- Cape Seals & Multilayer Systems:
<https://transweb.sjsu.edu/sites/default/files/1845C-Cheng-Cape-Seal-Manual.pdf>
- Thin Asphalt Overlays: <https://transweb.sjsu.edu/sites/default/files/1906-RB-Cheng-Manual-Thin-Asphalt-Overlay.pdf>

Pavement Preservation and Recycling Alliance www.roadresource.org, accessed 2024.

Smith, Roger D., Laboratory Testing of Fabric Interlayers for Asphalt Concrete Paving: Interim Report; Transportation Research Record 916 (TRB), Caltrans 1983.
<https://onlinepubs.trb.org/Onlinepubs/trr/1983/916/916-002.pdf>

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