Innovations Pre-Proposal & Proposal

1. TITLE: Double Chip over Paving Fabric and AR Chip Seal Surface Maintenance Treatment
2. CONTACT: Ray Myers c/o AIA www.info@aia-us.org 916-933-9140
3. DESCRIPTION: Double Chip over Paving Fabric is an innovative way to enhance the performance of a new wearing surface, Chip Seal, with a waterproofing membrane. AR Chip Seal should provide the same benefits and this section would give the opportunity to accomplish a side by side comparison.
4. BENEFITS: Keeping water out of the base aggregate is critical. Refer to the 2006 Highway Design Manual, Chapter 650. ***Saturation of the pavement or underlying subgrade, or both generally results in a decrease in strength or ability to support heavy axle loads.*** These treatment methods provide a waterproofing membrane and new wearing surface when an asphalt overlay is not needed. Correctly installed Paving Fabrics have a 40-year history of providing the greatest degree of waterproofing. Far greater than that of a conventional chip seal.
5. SELECTION CRITERIA: Good candidates for this strategy are pavements exhibiting aged hardening, cracking and deterioration up to but not including base failures, pumping or rutting. Locations with AADT's of up to 10,000 have been done successfully. Although freeze/thaw sites have performed well (South Lake Tahoe) for chip over fabric, any sites where water is moving vertically up through the pavement are not acceptable candidates. The application conditions of the strategy are delineated in Chapter 13 of the PPTG Maintenance Strategies handbook.
6. SPECIFICATIONS:

PAVING FABRIC INTERLAYER GUIDE SPECIFICATION
WHEN USED UNDER CHIP OR CAPE SEALS

Water is known to be the source of premature deterioration of roadway sections 80% of the time. The primary source of water getting to the base aggregate is water that passes through the asphalt. The use of paving fabric interlayers in conjunction with chip seals or cape seals is a very cost effective way to provide a new wear surface and provide waterproofing. An added benefit is the retardation of reflective cracking present in the underlying asphalt concrete pavement. Chip or Cape sealing over fabric is a surface treatment for roads that have a sound structural section, that do not deform under load. The chip or cape seal extends the life of the asphalt surface by providing an all weather surface-wearing course with improved skid resistance. The load bearing capacity of the road section is maintained because the base aggregate is kept dry by applying these surface treatments.

The fabric must be completely saturated and bonded to the underlying asphalt concrete pavement by applying a liquid asphalt/bituminous tack coat, such as paving asphalt, prior to placing the fabric. Emulsions are NOT recommended to be used to bond and saturate the paving fabric.

Fabric placement with chip or cape seal is not recommended at the following locations: 1) the bubble portion of cul de sacs, 2) intersection radii 3) the last 100 linear feet approaching an intersection that requires traffic to stop or slow down and 4) and in areas where subsurface water is coming to the surface through the pavement.

AR Chip Seal Specifications: Please refer to AR Chip Standards

MATERIAL SPECIFICATIONS for Chip over Fabric

Fabric Binder

Please refer to AIA Standard Specification for binder.

Paving Fabric
Please refer to AIA Standard Specification for Paving Fabric

Sand
A chip or cape seal over fabric system can be successfully accomplished with or without the use of sand after placement of the paving fabric. NOTE: Sanding is beneficial during seating of the fabric in to the asphalt binder because it serves as a bond breaker between vehicle tires (either construction or public vehicles) and any asphalt binder that may surface on top of the fabric. It also serves to absorb any excess binder that may penetrate the fabric. Pneumatic tired rollers are needed on the fabric immediately upon placement. Tires may pull the saturated fabric from the pavement if sand is not used. It will be necessary to use a parting agent on the roller tires. The use of the parting agent shall be used in a manner that will keep the fabric from being pulled up by the tires but yet not in any way affect the binder for the chip. Tire spray nozzles should have check valves to disallow siphoning and spraying operation limited to one rotation of the roller tire. It is recommended that chip operations commence as soon as the fabric rolling is complete. Opening the placed fabric to public traffic (without sanding) prior to chip placement is NOT recommended. In-place paving fabric can become slick when exposed to moisture, either from rain, dew or irrigation water and can present a low skid resistance on the fabric for traffic.
If sanding is the desired method (this does not imply poor fabric embedment can be corrected by sanding and rolling), the following information is provided:
Cover sand shall be uniform, clean and free from deleterious matter and organic contaminants conforming to the following gradation:

Sieve Size	Percent Passing
3/8-inch	100
No. 4	90-100
No. 200	0-5

Chip Seal Materials – In conformance with Agency requirements.

WEATHER REQUIREMENTS
Paving asphalt shall be applied when the atmospheric temperature is 60°F and rising, and atmospheric temperatures are not expected to reach 100°F that day. Pavement surface is dry and shall be 55°F and rising. Inclement weather is not predicted from the time fabric placement begins to 24 hours after chip sealing is completed. It is also recommended the ambient/pavement temperatures required of the chip and cape seal are also present. If not, fabric placement is not recommended if ambient /pavement temperatures cannot be obtained for each phase of the operation (fabric, chip, and cape seal).

MATERIAL PLACEMENT
Place Liquid Paving Asphalt Binder (Tack Coat)
Liquid paving asphalt for tack coat shall be applied between 290°F and 350°F. The application rate of paving asphalt shall be a minimum of 0.28 gal per square yard. The application rate of the tack coat needs to be sufficient to ensure the fabric is fully saturated with liquid paving asphalt, but not so heavy that there is excess binder on the surface of the fabric. This is a critical judgment decision that must be made as the project proceeds. Varying quantities of cracks, pavement roughness and porosity of the existing asphalt will require varying applications rates of tack coat. Insufficient tack coat will not fully saturate the fabric and binder applied for the chips will be absorbed into the fabric. This results in the chips not being adequately adhered. Excessive tack coat application may result in the chip/fabric system shoving during hot weather when the asphalt binder typically softens.
Liquid paving asphalt shall be placed on pavement, 2 to 4 inches beyond outside edges of the fabric. Where fabric and chip will be butted (e.g., roadway centerlines & lane lines) care must be taken not to overlap tack coat on either the paving fabric or the chip seal.

Place Fabric
Paving fabric must be completely embedded in the liquid paving asphalt tack coat immediately after the tack coat is placed. Broom pressure must be applied uniformly across the full width of the fabric being placed. Transverse and

longitudinal joints shall be butt joints and shall not overlap. Longitudinal joints shall be placed in the same location as travel lane delineation (striping). When desired, fabric and chip seal can be held back 4-6 inches from all valve or manhole covers and gutters to provide a more aesthetically pleasing transition for Cape Seals.

Place Sand (Optional)
Prior to opening to traffic or rolling operations, the fabric may be sanded by a mechanical sand spreader at a uniform application rate of 2 to 6 pounds per square yard. The fabric should be rolled immediately before and after sand is placed with pneumatic-tired rollers to insure proper seating of the fabric.

Rolling Operation (Sanded and un-sanded operations)
Rollers shall be pneumatic tired and should not exceed speeds of 5 miles per hour during all passes. Rolling should begin immediately behind the fabric placement and/or the mechanical sand spreader (if sand is applied). Enough rolling has been done when the texture of the underlying pavement surface is visible on the surface of the fabric. Excess sand shall be removed immediately prior to beginning chip seal operations.

Place Chip Seal
Materials and placement requirements should be in conformance with Agency requirements. Chip seal can be placed as soon as the fabric is fully embedded, damaged fabric repaired, and sand is removed, if applicable.

Place Slurry Seal
Materials and placement requirements should be in conformance with Agency requirements.
The slurry seal being used to complete the Cape Seal system *can* be placed immediately after the initial sweeping of the chip seal. This means the next day after the chip has been placed, if desired. Many agencies, however, allow the chip to be exposed to vehicle traffic for about a week. If this is done, another sweeping *must* occur prior to placement of the slurry seal to be certain all loose chips are removed. Type I slurry seal will provide the smoothest surface. Type II will be slightly more costly but provides longer wear and more texture.

7. BACKGROUND: This process has been used by San Diego County since the late 1980's as well as in Northern California with successful sites dating back almost 25 years. Papers on the above projects have been presented to: ***1999 Western Pavement Maintenance Forum***, ***Foundation for Pavement Preservation 2001, International Pavement Maintenance Conference in Limoges, France 2004,*** and to the ***Transportation Research Board 2003 at the 8th International Paving Conference on Low Volume Roads***. California cities have utilized the process going back to the mid 1970's. Contra Costa County has been using the process as a localized repair methodology for over 20 years. The ***FHWA*** has reviewed projects in midwest states and as far away as Australia. An ***FHWA Pavement Preservation Checklist*** for the process is under current review in preparation for publication. A test section was placed on California State Hwy 245 North of Hwy 198 in the summer of 2004 and is performing well.
8. POTENTIAL LOCATION: Highway 43, ½ mile North of Highway 46 to the Kern County line (PM 25.7 to PM 38.8). The maintenance engineer is Bill Moses. The test sections should include a control section with no treatment, another section with just conventional chip a section with double chip over fabric and last a section with AR chip. The sections should be identified with flexible paddles.
9. ESTIMATED COSTS: Are taken from 2007 Chapter 13 of the MTAG Manual:

Fabric placement costs would be:

a. Small projects	= 5000 sy/day	$1.90 to $3.50 per sy
b. Medium projects	= 5k to 10k sy/day	$1.65 to $2.75 per sy

c. Large projects = 10k sy/day and larger $1.40 to $2.25 per sy

Estimated PME Chip Seal costs are:

a. Small projects $3.00 to $3.50 per sy
b. Medium projects $2.25 to $2.75 per sy
c. Large projects $1.80 to $2.00 per sy

Estimated AR Chip Seal costs are:

a. Small projects $4.25 to $5.00 per sy
d. Medium projects $4.00 to $4.75 per sy
e. Large projects $3.75 to $4.55 per sy

10. POTENTIAL PROBLEMS, IMPACTS AND REMEDIES: (NOTE)These are from the FHWA Preservation Checklist

Common Problems and Solutions for Fabric Application

(Problem: Solution)

- **Wrinkles in the Fabric**
  1. Insert metal bar inside fabric core to prevent fabric rolls from sagging.
  2. Adjust roll brakes to maintain proper tension on fabric roll.
  3. Cut and overlap fabric on horizontal curves.
  4. Do not use rolls that were rolled improperly at the factory.
  5. Make sure fabric applicator is driving straight; veering to the left or right can cause wrinkles.

- **Excessive liquid asphalt spattering**
  Reduce spray pressure on spreader bar.

- **Non-uniform application of paving grade asphalt (fabric binder):**
  1. Check temperature of paving grade asphalt meets project requirements.
  2. Check viscosity of paving grade asphalt meets project requirements.
  3. Insure nozzles are aligned properly.
  4. Check height of spray bar.
  5. Check spray bar pressure.
  6. Determine if any nozzles are plugged
  7. Clean or replace nozzle tips.
  8. Back flush distributor bar.

- **Paving grade asphalt bleeding or flushing through fabric:**
  1. Broadcast hot mix on fabric (overlay projects)
  2. Broadcast sand on fabric (chip seal projects)
  3. Reduce application rate of paving grade asphalt as long as the minimum recommended amount of paving grade asphalt is maintained.
  4. Check down pressure of brooms on fabric applicator.
  5. Check fabric weight meets project requirements.
  6. Check viscosity of paving grade asphalt meets project requirements.
  7. Ambient or pavement temperatures may be too high; see #1 and #2 above.

- **Fabric not bonding at longitudinal and transverse joints:**
  1. Liquid asphalt not applied two to four inches beyond fabric ends. Reapply poor saturated area with paving grade asphalt.
  2. Brooms on fabric applicator unit are not applying uniform pressure across the full width of the fabric.

Common Problems and Solutions for Chip Seal Application

(Problem: Solution)

- □ **Aggregate embedment over 80 percent:**
  Consider lowering asphalt application rate.
- □ **Aggregate embedment less than 50 percent:**
  Consider raising the asphalt application rate.
- □ **Excessive asphalt splattering:**
  The spray pressure is too high
- □ **Streaking or drill marks in asphalt:**
  1. Asphalt too cold.
  2. Viscosity of the asphalt is too high.
  3. All nozzles are not at the same angle.
  4. Spray bar is too high.
  5. Spray bar is too low.
  6. Spray bar pressure is too high or low.
  7. Nozzle is plugged.

- □ **Exposed liquid asphalt binder remains after aggregate application:**
  Chip spreader gate may be clogged or malfunctioning.

- □ **Excessive aggregate:**
  Spreader gate may be malfunctioning or chipper head may be overloaded

- □ **Uneven aggregate application:**
  Recalibrate the chip spreader; gates may not all be set the same.

- □ **Asphalt on top of the aggregate:**
  1. Chip spreader may be operating too fast.
  2. Truck, roller, or pilot car may be operating incorrectly

- □ **Chips being dislodged:**
  1. Asphalt application rate too low.
  2. Aggregate is dirty or dusty.
  3. Traffic or equipment speeds are too high
  4. Brooming has been started before the asphalt is properly set.

- □ **Liquid Paving Asphalt is bleeding or flushing:**
  Application rate is too high.

- □ **Loss of Aggregate at meet lines after brooming:**
  Check meet line procedure.

11. WARRANTIES: A warranty by the contractor to place materials that meet the specifications is appropriate.

12. MSDS: MSDS for Paving Grade Asphalt shall be provided

13. EVALUATION PLAN: This project should have 4 sections.
    a. Control section (no maintenance treatment)
    b. Conventional chip seal section
    c. Double chip seal over paving fabric
    d. AR chip seal

Pavement condition of all sections should be rated before placement and again on an annual basis going forward. Overall long term pavement condition rating when compared to individual strategy cost will provide life cycle benefit.

14. DEFINITION OF SUCCESS: The success of the system will be based on life extension of the roadway. The cost should be equal to or less than any other strategy that would provide the same benefit.

15: SUBMITTERS:

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