

**County of Sacramento  
Department of Transportation  
Chip Seal over Fabric  
Excelsior Road**

8/10/2000

**Subject: Update of Test Sections Applying Various Chip Seals over Paving Fabric on Excelsior Road**

This report will present the current status of the test sections that were placed by Sacramento County in September of 1994. The test sections incorporated the use of pavement reinforcing fabric placed with two different binders as a waterproofing and stress dissipating interlayer under a variety of chip seals.

**INTRODUCTION**

The use of pavement fabric in conjunction with hot mix asphalt overlays has proven to be very successful since the early 1970's and now has become a common practice. The system has 3 primary benefits:

- A. Retarding reflective cracking
- B. Creating a waterproofing membrane to protect the pavement base and subbase from water intrusion, and
- C. Extending the pavement's fatigue life by the mechanism of a stress relieving membrane

The practice of using a chip seal in lieu of an asphalt overlay as a rehabilitation treatment rather than as a preventative measure has become more widespread. This is particularly used on rural roads and is mainly due to budget constraints and the coverage demands. This maintenance practice has been successfully used by Transportation Departments in Arizona, California and Oklahoma. Most recently the County of San Diego has done fairly extensive annual projects in the Borrego Springs area.

The concept of incorporating the reflective crack retardation and waterproofing properties of a paving fabric with the a low cost chip seal wearing surface has been used in Tulare County, the Cities of Saratoga, and Visalia as well as on private property at the Aerojet facility in Sacramento. The City of Sunnyvale has been doing Cape Seal (chip then slurry seal over the chip) over fabric for some 15 years. For those reasons the County of Sacramento chose to investigate the performance and economic benefits of two different tacks for the fabric and various combinations of chip seals over paving fabric as a potential surface treatment for road maintenance.

## **TEST DESCRIPTION AND METHODOLOGY**

The road chosen was Excelsior Road from Gerber Road to State Route 16, which is a two lane minor collector that carried an average daily traffic volume of 2,100 vehicles in 1994 and now carries 3,056 vehicles per day. The road has earthen shoulders and well-drained roadside ditches.

The southbound lane was chosen to receive test sections of chip seal placed over paving fabric while the northbound section would be used as a control with the placement of identical chip seals but without the paving fabric. A photo log was made of the test section, as well as a survey by the County's pavement management system. The pavement management system developed by the San Francisco area Metropolitan Transportation Commission relies on visual observations that categorize the type and severity of pavement distress. This survey indicated that the pavement condition rating (PCI) before the test was 53. This is in the range of FAIR condition rating. The pavement exhibited low to moderate cracking and moderate weathering. Some transverse cracks were also found. Evidence of discoloration on the pavement from the pumping of fine roadbase material was also noted. County Forces prepared the roadway by removing and replacing any sections of pavement that had severe evidence of subgrade failure. They also swept the roadway just prior to the application.

Hot liquid oil is typically used with a paving fabric on an overlay and emulsion oil is typically used for a chip seal. This requires two separate oil distributor trucks for the two different binders. However, fabric installations are normally accomplished by contractors who install both the fabric and their binder. The test sections were selected to incorporate applications of AR-4000 oil and LMCRS-2 oil, with single and double chip seals. We could then observe the construction efficiency, cost, and performance with single and double chip seals. Flexible delineators were then erected in the field to determine the test locations (see attached)

Of note is one section on the east side of Excelsior Road between the intersections of Gerber/Birch Ranch Road and Excelsior/Birch Ranch Road, where a landscaped berm (8-10 feet high) on the east side of Excelsior Road, traps water within the roadside ditch year around. It is the author's opinion that this is the contributing factor for the sections of Excelsior Road that had to be removed and reconstructed in this vicinity.

## **APPLICATION**

The success of the waterproofing membrane is dependent on the fabric being fully saturated with asphalt. The amount required to saturate is dependent on two elements. One is the weight of fabric used. Consulting with the Asphalt Interlayer Association it was found that they concur with the AASHTO recommendation of a minimum 4.1

oz/square yard fabric. That fabric typically requires .25 gal/square yard of liquid asphalt to saturate and bond to the existing surface. The AIA DOES NOT recommend the use of emulsions as a binder for the fabric. The potential for trapped water under the fabric and delayed construction time (allowing the water to evaporate) does justify the slight cost difference in binding with liquid asphalt versus an emulsion. The second variable is the condition (porosity) of the existing pavement. Excluding *very* coarse dry pavements, the AIA believes the .25 application rate would be appropriate. In the latter case of very absorptive pavements the rate could go up to .28 gallons/square yard.

Critical with chip seal applications is that the fabric be properly embedded and totally saturated. Some agencies accomplish this by rubber tire rolling the fabric after placement and/or by sanding and opening the placed fabric to traffic. The County rolled but did not open the fabric to traffic for liability reasons. It is critical that the fabric laydown unit place the fabric very quickly after the binder is on the pavement and still at an elevated temperature. The pressure on the laydown equipment should be adjusted to assure total embedment/saturation, yet not lead to bleeding. Therefore, the balance between on-pavement binder temperature and laydown equipment pressure is critical to accomplish complete fabric embedment and saturation without bleeding. Light sanding and rolling will assure the fabric is properly embedded. The excess sand should be swept off prior to beginning of the chip sealing operation. NOTE: In the event the fabric is not totally saturated, some of the binder intended to hold the chips would be absorbed in to the fabric. Then there may be insufficient binder and lead to chip loss.

At this point the surface (with paving fabric in place) is ready to accept the chip seal. If the paving fabric is properly installed, NO change or accommodation needs to be made in the binder application rate for the chip seal, be it emulsion or liquid asphalt. In this case the County applied the specified tack rate for the various chip seals; the chips were placed and rolled. The control was prepared and the chip applied in the same manner except without the fabric.

The County recommends the chip seal operation be performed when the ambient temperature is above 75°F. The California Chip Seal Association sets 80°F pavement temperature as a minimum and cautions that if nighttime temperatures drop in to the 30's and 40's rock loss will probably be much higher.

## **COST ANALYSIS**

At the time of the installation the County took current costs of single chips seals (~\$.045/sf) and double chip seals (~\$.09/sf) and added the cost of the fabric installation (~\$.05/sf). This did not include a proportionate increase for the production volume reduction experienced with the test sites when compared to the Counties typical production rates (~300,000 sf/day vs. 500,000 sf/day). One must understand that chip

placement production was substantially reduced in that 12 different procedures were included within the project scope. Secondly, fabric placement was slowed due to the staging of the test. It is therefore assumed that production rate should closely approach normal rates with a single selected procedure.

Sacramento County has recently placed crumb rubber modified chip seals. This process requires that the chips be pre-coated with asphalt and heated for placement into hot liquid asphalt that contains melted recycled tire crumbs at 18 percent by weight. The cost of this treatment is \$0.31/sf.

In summary, the comparative cost of single chip over fabric at ~\$.095/sf versus a 1.5 inch asphalt concrete overlay with fabric at \$.43/sf results in a 4 fold cost savings. The life cycles of overlay vs. a chip seals are different. A standard life for a chip seal is assumed to be 3 to 5 years, rubber chip seal at 8 to 10 years, and overlay at 15 to 17 years. The life cycle of chip seal with fabric is not known. However, the 6-year results of the pavement management survey indicate a significantly prolonged life.

## CONCLUSION

A 1995 summary of the test site after approximately eight months and experiencing the THIRD wettest winter on record for the Sacramento area led to the following comments:

“In review of the overall appearance of the test sections, it was clear that the pavement reinforcing fabric created an impermeable interlayer that protected the underlying roadbase from water intrusion and the subsequent pumping of fines. The fabric showed evidence of dissipating the influence of underlying pavement distress and minimized the development of reflective cracking in chip seal”. Now after almost 6 years the site has been visited again and the pavement conditions are included in the spreadsheet attached. The results are very pronounced. All of the original road sections were given Pavement Condition Indexes of 53 or FAIR. After almost 6 years those sections receiving paving fabric all had PCI's of 83 or VERY GOOD (lacking 2 points of being in the Excellent category). In contrast, the control sections varied from a low of 46 to a high of 65 resulting in an average of 53, or FAIR, and equal to their original condition. The simple introduction of a paving fabric at a cost of approximately \$.05/sf increased the PCI's across the board by 30 rating points. In the sections where liquid asphalt was used to place the chip, the average PCI's were slightly higher (56.5) when compared to the sections where emulsion was used (51.5). This may not be sufficient to suggest one has benefit over the other. Interestingly, the double chips **did not** result in overall better ratings than single chips when paving fabric **was not** used. And likewise, when comparing performance of double chip to single chip **with** fabric the results were **identical** in all six sections.

In reviewing the results of the laboratory testing by San Diego County of their chip seal over fabric projects they report that skid resistance numbers are higher with chip seal than

a new asphalt overlay. They show that new overlays average 30% higher skid numbers when compared to old asphaltic concrete. In contrast, new chip seals increased on average by almost twice that (~56%).

## **RECOMMENDATIONS**

Mr. Roschen, Sacramento County, recommends that all of the treatments (chip, chip + fabric, rubber chip, & overlay) have a current life cycle analysis to bring the cost comparisons to a present worth.

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