Petromat Use Over Portland Cement Concrete Pavements

Case History # 11

Amoco Fabrics and Fibers Company

In 1997, Maxim Technologies, Inc. performed the most comprehensive study to date documenting the performance of paving fabrics. The Study included an exhaustive review of available research and field performance reports. One major application of paving fabric membrane interlayer systems is in pavement rehabilitation over existing asphalt concrete (AC) pavements and beneath a new AC overlay. A significant application of the paving fabric membrane interlayer system is in pavement rehabilitation over existing Portland cement concrete and beneath a new AC overlay. This case history contains exerpts from the Maxim Study and a compilation of breifly described case histories of sixteen sites where the paving fabric system was evaluated over PCC pavements. The full study, including an executive summary on the findings, may be viewed on the geosynthetic Materials Association (GMA) web site at: www.gmanow.com/techdoc/doc2.html/doc2_ltoc.html.

An application of paving fabric in the rehabilitation of existing PCC pavements was evaluated at the sixteen sites identified in Table 1. Fourteen sites are located within the United States in eight states and the remaining sites are located in Belgium and Austria. Almost half (i.e. 7) of the sites were evaluated for more than 5 years and three of the California, USA sites were observed for 10 or more years. A review of the results presented in Table 1 shows that the use of a paving fabric in the rehabilitation of PCC pavements resulted in a retardation in the development of reflection cracking. In addition the fabric appeared to be effective when used to correct a specific distress condition such as popouts (Illinois: References 7 and 14). However, paving fabric is not entirely effective in combating the reflection of existing transverse cracks or joints when there is existing excessive vertical movement or high deflection.

A case study in Georgia (Ref.3) provides important information concerning the impact in rehabilitation overlays involving AC overlay thickness alone (Figure 1) and the combination of AC overlay thickness with fabric (Figure 2) on the eventual development of reflection cracking related to original conditions of PCC pavements. From Figure 1 it can be seen that reflection cracking at a 60 percent level can be anticipated at one year for a 2” AC overlay; three years for a 4” overlay and nine years for a 6” AC overlay. In the same study (Ref. 3) the impact of the combination of AC overlay with paving fabric was also investigated and the results are presented in Figure 2. The 60 percent performance levels, based on percent reflection cracking, was three years for a 2” AC overlay with fabric, and six years for a 4” AC overlay with fabric. The 60 percent performance time for the 6” AC overlay with fabric, could not be reasonably be

projected because of the low level of percent reflection cracking achieved during the observation period.

It can be noted from Figures 1 and 2 that the addition of a paving fabric to a 2" AC overlay increased the time to 60 percent reflection cracking from one year with no fabric to three years with fabric. With this information in mind the results from Figures 1 and 2 were combined in Figure 3 to allow a visual assessment of the benefit of paving fabric in the rehabilitation overlay of existing PCC pavements. From Figure 3, it is apparent that the 2" AC/fabric section is equivalent to the 4" AC control section since one plots practically on top of the other. The inference is that an equivalent thickness of 2" AC is appropriate for installation of fabric in the Georgia environment at least at an AC overlay thickness of 2". For thicker overlays less deflection occurs and therefore the inclusion of fabrics produces a lower absolute difference. This is apparent for the use of fabric in a 6" AC overlay plot. The 6" layer with fabric has only half as much cracking as the control section.

In two of the longer case histories (i.e. 11 year California sites identified in References 1 and 2) cited in Table 1, the reflection cracking of the original longitudinal joints was only 10 percent, while the reflection cracking of the transverse joints was 20 percent or less after 11 years. In addition it was observed at the California site that virtually no transverse cracking was observed in AC overlays of 4.8" or greater thickness in the 8 or 9 years of test section observation. The fabric layer was apparently beneficial in retarding initial reflection cracking in AC overlays of less than 5". This information is basically confirmed in the Austrian case study (Reference 16) where a 4.75" AC overlay of an existing PCC pavement yielded less than 2 percent reflection cracking within a 30 month period of time.

Table 1. Literature Survey for AC Overlay with Paving Fabric on Existing PCC Pavements

Site Location	Opening Date	Time Years	AC Overlay With Fabric on Existing AC Pavements	Ref. NO.
California	Sep 1975	11.0	The existing PCC pavement was highly fractured. The rehabilitation design was directed to impede reflection cracking, despite anticipated large magnitude deflections. The plan for the rehabilitation section consisted of a nominal 1" leveling course, paving fabric and a nominal 2" AC overlay. After eleven years the pavement was performing well with 10% reflection of the longitudinal joints and 20% reflection of transverse joints. The pavement was still smooth with no evidence of failure.	1
California	Oct 1975	11.0	The existing PCC pavement was constructed in 1975 and displayed a moderate amount of block cracking and local subsidence.The rehabilitation design consisted of placement of a paving fabric and installation of a 3" AC overlay. The overlay survived an unusually severe winter. After eleven years the pavementwas performing well with10% reflection of longitudinal joints and 15% reflection of transverse joints.	2
Georgia	Mid 1976	6.0	For HMAC overlays of 2 and 4 inches, control sections developed 60% reflection cracking within 0.5 and 2.5 years, respectively. The same overlays (i.e. 2 and 4 inch thicknesses) composed of fabric developed 60% cracking within 2 .5 and 5.5 years, respectively.	3
California	Jan 1977	10.0	There is little benefit of fabric for thick AC overlays (> 0.4') of distressed PCC pavements, since most cracking is of the thermal (non load) type. An AC overlay, 0.40 feet or greater thickness is needed to retard reflection cracking for a 10 year period.	4

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Site Location	Opening Date	Time Years	AC Overlay With Fabric on Existing AC Pavements	Ref. NO.
California	Nov 1977	4.03	Existing PCC overlaid with 2" AC, fabric and 1.5" of AC. After 4 years the pavement was in excellent condition with rare transverse reflection cracking and intermittent longitudinal reflection cracking over the longitudinal joints.	5
Virginia	Jun 1979	2.0	Control section consisted of a 1.5" AC overlay , while the fabric sections also included the same AC thickness. Reflection cracking was significantly deterred by the fabric. The overlay reflected 35% of joints of PCC many of which were faint cracks discernible only upon close inspection.	6
Illinois	Jan 1980	6.0	The original PCC pavement displayed numerous popouts. Six years after construction of the AC-fabric overlay the road shows minor joint and transverse crack reflective cracking.	7
Pennsylvania	Apr 1981	2.0	Six paving membranes were compared in this investigation. There was reduction of 20% in the reflection cracks in treated sections compared to the untreated areas.Overall 38% of the transverse cracks were reflected in the control and untreated sections, while an overall 18% of the transverse cracks were reflected in the fabric sections. Reflection of the longitudinal cracks was minimal in either case about 2% in the untreated and control sections and 0 % in the treated sections.	8
Texas	Jul 1981	6.0	This project consisted of repair of continuously reinforced Portland cement concrete (CR CP) with placement of a fabric and a combined 3.5" thickness of HMAC. The transverse cracks, spaced about 3.3' on	9

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			center, were prevalent throughout the project. After 6 years there were few isolated transverse reflection cracks (1 every 500 ') dispersed throughout the project.	
Pennsylvania	Jun 1982	3.6	A minimum of 40% less cracking was observed in the fabric sections compared to the control sections. The fabric treatment is considered cost effective.	10
California	Jul 1982	4.0	The existing PCC was overlaid with 1.5" AC and a paving fabric. After 4 years there was little reflection cracking and the pavement was in excellent condition. The visible cracks were narrow and displayed no faulting. Evidently, water infiltration has been prevented.	11
Michigan	Jul 1982	4.0	After 4 years the average % of reflective cracking for longitudinal and transverse cracking were 36.2 and 42.5, respectively. The fabric remained intact ,afforded moisture protection for the subgrade. The use of fabrics for crack reduction may not be warranted.	12
Iowa	Oct 1982	4.0	The existing PCC pavement exhibited some spalling at the transverse joints and random cracking throughout the slabs. The rehabilitation included milling of the PCC, placement of geotextile and 2" AC overlay. The overlay survived an unusually severe winter without any signs of cracking. After 4 years transverse cracks had reflected through, but pot- holes or other distress were not noted.	13
Illinois	Jan 1983	4.0	Existing PCC pavement exhibited problems with popouts. The rehabilitation consisted of a .75" leveling course, paving fabric and 1.5" AC. After 4 years reflection cracking over transverse joints was observed but no popouts. The fabric provided waterproofing .	14

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Site Location	Opening Date	Time Years	AC Overlay With Fabric on Existing AC Pavements	Ref. NO.
Belgium	Jun 1985	7.0	The existing PCC pavement was built in 1937 and heavily damaged with many cracks in the surface. The rehabilitation consisted of the placement of fabric and then 3.15" of AC overlay. After 7 years very few cracks were observed in the fabric sections compared to the non-fabric sections.	15
Austria	Jun 1988	2.5	The existing AC overlay of PCC pavement was milled, the PCC cracks sealed, and the control section was overlaid with 4.75" of AC while the fabric section included a leveling course, placement of the fabric and a 2.4" AC overlay. The control and fabric sections performed equally well. The thicker control sectiondisplayed transverse crack reflection cracking of 0.5% within a year, 0.9% within 19 months and 1.8% after 30 months. The fabric section displayed transverse crack reflection cracking of 2.5% within a year, 3.9% within 19 months and 7.2% after 30 months.	16

Figure 1

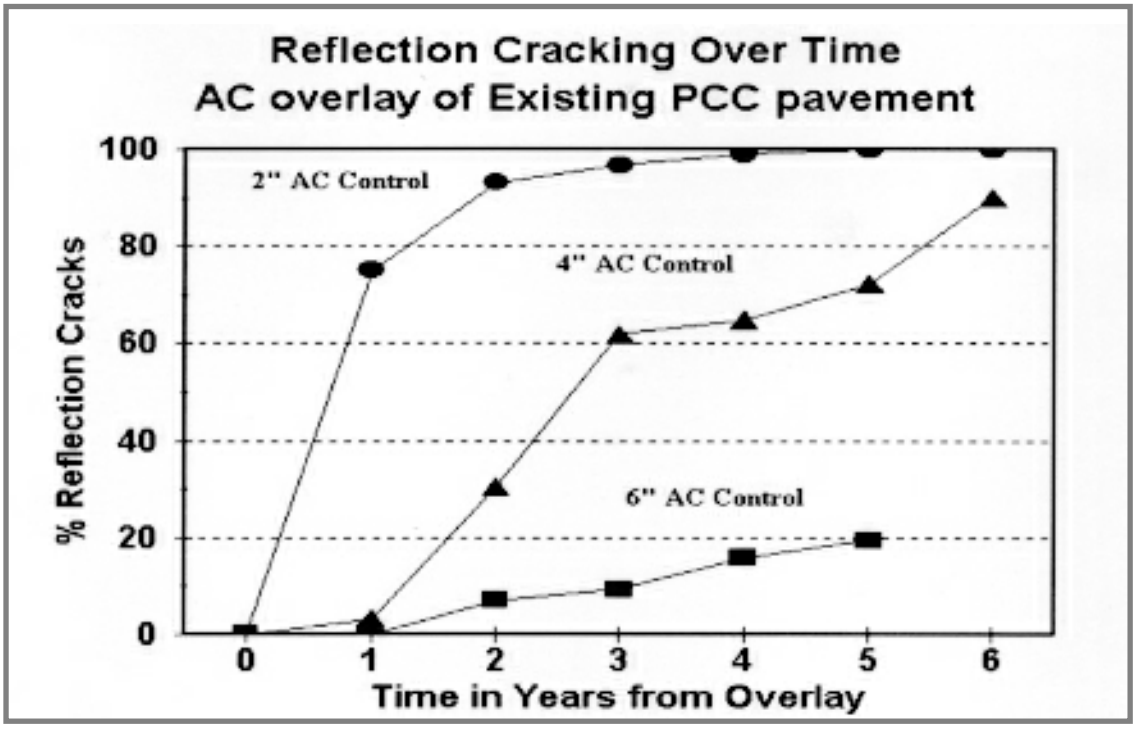


Figure 2

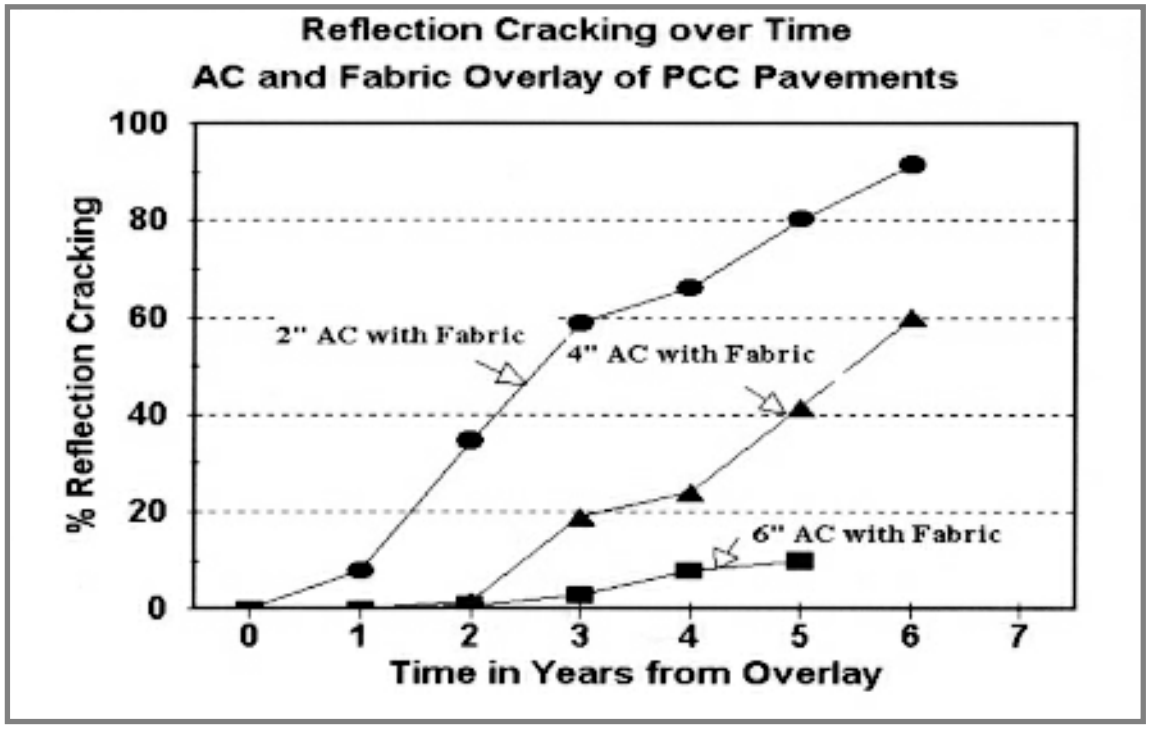
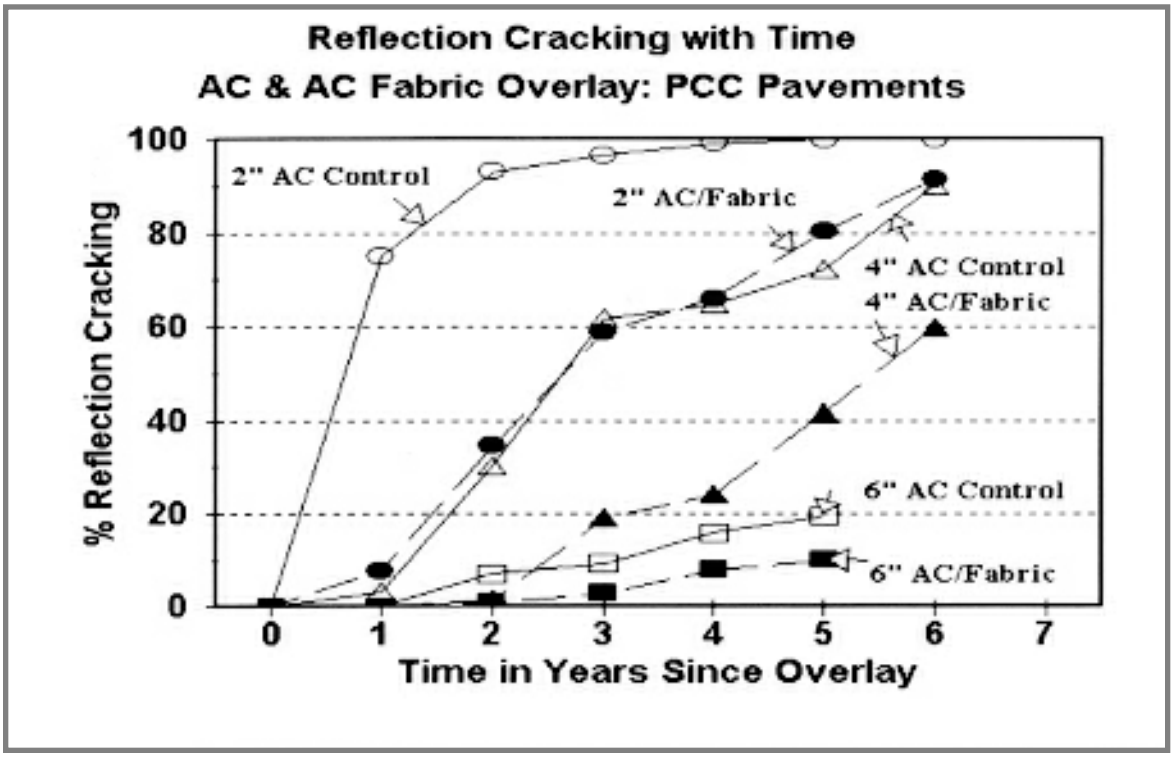


Figure 3



Based on their case studies California (Reference 4) suggested the following guidelines for use of pavement fabric interlayers in pavement rehabilitation:

1. A PRF interlayer should be considered to replace 0.10 foot of AC thickness in AC overlay designs to restore structural adequacy of AC pavement. However, the PRF should not be used to retard reflection cracking of transverse cracks (thermal cracking).

2. A PRF interlayer should not be used for retarding reflection cracks over in situ PCC pavements where differential vertical movements (Δ-vert) are greater than 0.008 inch. Generally, this includes most old PCC pavements which have not been cracked and seated.
3. A PRF interlayer should be considered as an option whenever a waterproofing barrier of the underlying pavement is required.

4. Generally, PRF interlayers should be used only on a full lane coverage basis.

5. Since there is some evidence that PRF properties may have an effect on AC overlay performance, additional field study of this aspect is recommended.

6. Since there is some evidence that a PRF interlayer may offer and AC thickness equivalency of approximately 0.15 foot, it is recommended that this observation be evaluated by additional field study.