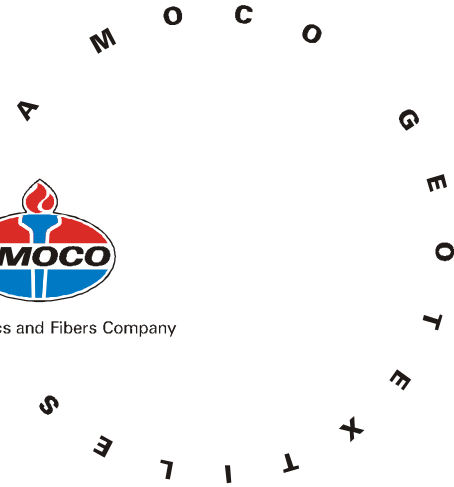


Paving Fabric Repairs Deteriorating Road In Severe Canadian Climate

Case History # 9



Amoco Fabrics and Fibers Company



by
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Introduction

Surface water can infiltrate into the road base and subgrade soil through cracks and pores in the pavement. This water intrusion can soften the subgrade soil and degrade its structural capacity. It also contributes to migration of the subgrade soil up into the road base (aggregate), causing further deterioration of the load-bearing characteristics of the pavement. Several detailed research studies have demonstrated that most pavement damage results from excess water, primarily infiltrating surface water¹

This problem is compounded in the severe climatic conditions of Canada. Winter temperatures may reach -20°C (-4°F) to -35°C (-31°F) and during winter heat waves, warm to 5°C (41°F) to 10°C (50°F). These freeze-thaw cycles cause expansion and contraction of water within the pavement and the road construction materials themselves. This action accelerates damage from water infiltration. A common result is quick and severe fracturing of the pavement.

These were precisely the problems observed in roadways within the boundaries of the City of Verdun, Québec, at the beginning of the 1980's.

In response to a proposition by Amoco Fabrics and Fibers Ltd., the City Civil Engineer agreed to try Amoco's paving fabric to solve these problems. This Case Study summarizes the results of a seven-year research project undertaken by the City of Verdun to evaluate the benefits of paving fabrics. The research included a comparison of the performance of pavements with and without asphalt overlay paving fabrics. The research found that paving fabrics can significantly reduce the degree of pavement cracking in freeze-thaw environments.

Case Study Site

In 1986, a section of Wilibrord Street, between Bannantyne Avenue and Champlain Boulevard, was selected for resurfacing with paving fabric. A control section on the neighboring Joseph Street was resurfaced without fabric. The two streets had similar traffic conditions and initial degree of cracking, allowing for viable comparison of the reappearance of cracks after repaving.

Wilibrord Street was constructed in June 1969 over subsoil of clayey silt. The original pavement cross-section is illustrated in Figure 1. Located in a residential district, Wilibrord and Joseph streets were subjected, at that time, to traffic densities of up to 8,000 vehicles per day, with an average of 2,500 vehicles per day. The

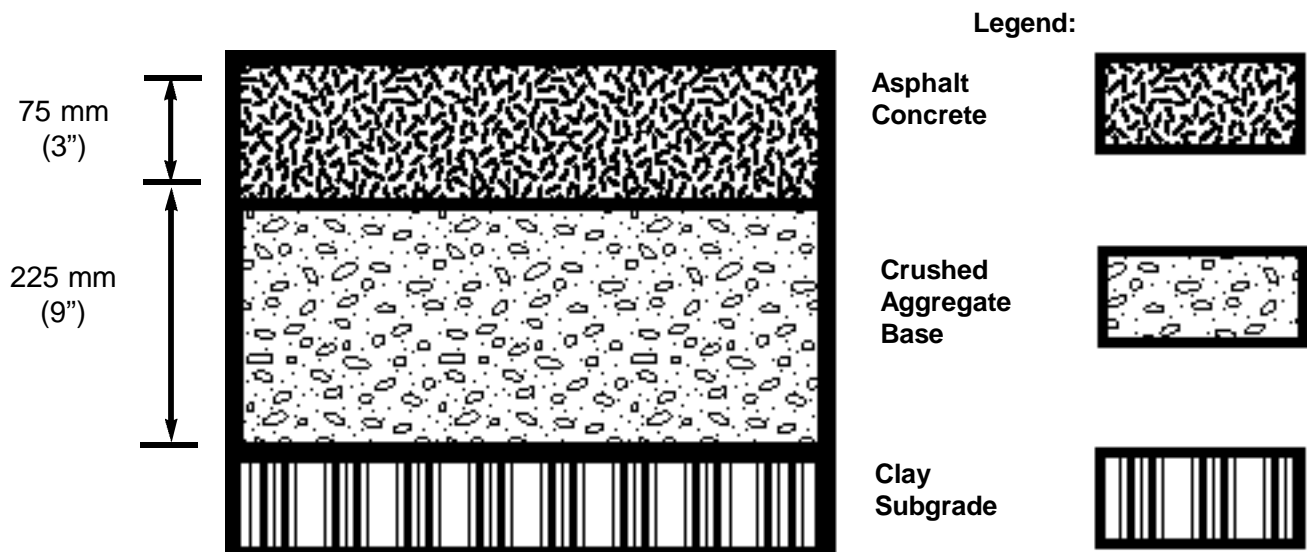


Figure 1: Initial Pavement Cross Section

width of the street is 9.0m (30 ft); the section selected for fabric installation was 261m (856 ft) long.

The conditions of pavement cracking at the site were documented in 1981 in a study conducted by the Centre de Recherche de Contrôle Appliqué à la Construction (CRCAC)². The degree of cracking was defined on a scale of 0 to 100%, where 100% would indicate a totally fractured surface with level differentiations exceeding 15mm (0.6 in). On Wilibrord Street, the degree of cracking was measured to be 58.3%; on Joseph Street, the degree of cracking was 49.3%. The highly advanced state of cracking was attributed to three key factors:

- Poorly planned drainage of the surface water, leading to infiltration and contamination of the foundation of the road
- Swelling and contraction of subgrade soils due to changes in moisture, and
- The effects of freeze-thaw cycles altered the subgrade and road-base materials and caused surface course damage.

Further deterioration of the pavements certainly occurred between 1981 and 1986, when resurfacing took place, but no measurements of the degree of cracking were taken during that period. Some utility installation was performed on Wilibrord Street in 1985, requiring excavation to

about 1.0m (3.3 ft) deep and subsequent backfill with compacted crushed stone. This added to potential for reflective cracking in the pavement.

Fabric Installation

The pavement was resurfaced using Amoco's Petromat® paving fabric. The fabric is designed to absorb asphalt tack coat to form a low permeability, stress-absorbing membrane. When placed between the original pavement and an asphalt overlay, the fabric becomes an integral part of the roadway section, forming a barrier to water infiltration and reducing reflective cracking in the new asphalt surface.^{3,4,5,6,7,8}

First, City equipment was used to clean the section of Wilibrord Street to be resurfaced. Cracks were then sealed by spreading an asphalt mix over the area prior to paving fabric installation. This method was chosen because the depth, width, and intensity of cracking was such that traditional methods of sealing would have been time consuming and ineffective.

A water-based emulsion was applied to the pavement surface at a rate of 2.0 liters/square meter (0.4 gal/square yard). The emulsion consisted of approximately 60% asphalt and 40% water. The emulsion was allowed to cure for one hour before paving fabric was placed. This additional curing step is not required when uncut paving grade asphalt tack coats are used.

The paving fabric was placed using a rubber-tired front-end loader. The equipment was adjusted occasionally during placement to maintain constant tension on the geotextile, and wrinkles were eliminated by hand brooming. The material was overlapped 152mm

(6 in.) at each longitudinal and transverse joint. Extra binder was applied at the overlaps to ensure adherence and the fabric was trimmed at the edges of the pavement. The surface course consisted of 38mm (1.5 in.) of asphalt overlay.

Results

The section was inspected visually one a weekly basis for six weeks after installation. No irregularities were observed regarding the performance of visual appearance of the newly installed surface.

After one year and on entire freeze-thaw cycle, the street surfaces were evaluated according to the methods of CRCAC, which were originally applied for the 1981 evaluation. The findings were evaluated using PAVE', a specially developed software program provided by the office of the Municipal Engineer of the City of Verdun. The program ensured the uniformity of data collection and evaluation. The degree of cracking of Willibrord Street was established to be 10.8%; for the control section on Joseph Street, the value was 20.9%.

Long-term monitoring was judged essential to definitely conclude if the installation of paving fabric on Willibrord Street truly met the goal of pavement waterproofing. A five-year period was initially pro-

posed and was later extended to seven years. During this time Technical Services of the City of Verdun monitored cracking in both streets and evaluated the data using PAVE'. The results, published by the City of Verdun in 1989^{9,10}, are summarized in Table 1 and shown graphically in Figure 2. The data provide clear and convincing evidence of the immediate and long-lasting benefits that this paving fabric application provided to the City of Verdun. The City has applied Amoco paving fabrics in other installations with similarly excellent results.

Figure 2: Paving Fabric Decreases Degree of Cracking

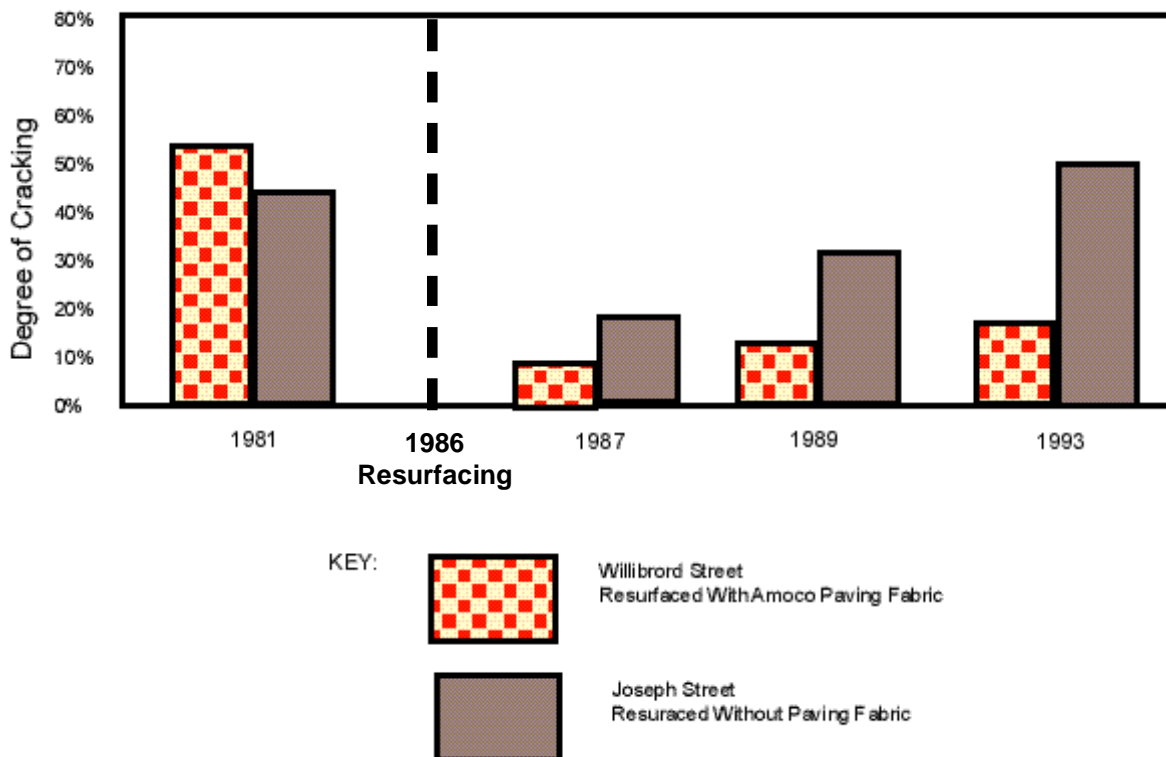


Table 1: Pavement Cracking Monitoring Data

	1981: Before Resurfacing		1987: 1 Year After Resurfacing		1989: 3 Years After Resurfacing		1993: 7 Years After Resurfacing	
	Willibrord	Joseph	Willibrord	Joseph	Willibrord	Joseph	Willibrord	Joseph
Longitudinal Cracking	50.7%	87.8%	10.0%	45.0%	10.0%	65.0%	35.0%	70.0%
Transversal Cracking	100.0	75.8	20.0	20.0	40.0	40.0	40.0	90.0
Alligator Crack Pattern	16.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Degree of Cracking	58.3	49.3	10.8	20.9	18.3	34.6	20.47	55.08

1986
Resurfacing

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