SUSTAINABLE PAVEMENT DESIGN: DOING MORE WITH LESS

Bob Wicklund, A.Sc.T. , PMP, Regional Municipality of Halton & Jason Miron, C.E.T. , R.V. Anderson Associates Limited

The Regional Municipality of Halton recognizes the inherent environmental issues associated with construction projects, such as pollution, disruption to the local communities, traffic interruptions, and high resource consumption.

To help address these concerns, the Region adopted a Green Procurement Policy that integrates sustainability considerations into the decision process at all phases of a project's (and product's) lifecycle.

For three recent road resurfacing projects, this forward-thinking approach allowed the Region to realize improved environmental net benefits, as well as cost-savings, through implementing more sustainable technologies, and getting them to work in the "real world."

Traditional road resurfacing projects involve pavement removal and disposal, production, transportation, and placement of asphalt. These activities consume considerable energy and resources, as well as disrupt the local community. Recognizing this, efforts were made during the planning stage to find "greener" methods.

Detailed pavement condition assessments undertaken at the planning stage found that three innovative, "green" solutions could be used: CIREAM (cold-in-place recycling with expanded asphalt mix), SAMI (stress absorbing membrane interlayer), and pulverized asphalt.

Although these technologies are not new, the Ontario engineering and construction industry has been relatively slow to adopt their regular use, mostly due to general unfamiliarity and uncertainty about their historical track records.

THE TOP 5 SIGNIFICANT BENEFITS

1 Material re-used and reduced resource consumption

The use of CIREAM technology eliminated the need to haul and dispose of 4,600 tonnes existing milled asphalt off-site at Trafalgar Road (totalling 9.2 lane kms), as well as the need for new material to be brought onto the site.

For Steeles Avenue (totalling 18 lane kms), SAMI technology was used in a trial section to significantly reduce the disposal of materials off-site.

SAMI technology used a product called Fibremat, which comprises fibreglass strands sandwiched between two layers of asphalt emulsion, covered by a thin layer of stone, for a thickness of 10 mm. The SAMI layer provides tensile strength and inhibits cracks from reflecting through to the surface.

In total, 15,000 m^2 of SAMI was used in lieu of additional asphalt removal, which would have required an additional 2,700 tonnes of asphalt removal and replacement. On this section of the project, 60 mm of the 240 mm of existing asphalt was removed, followed by the placement of the SAMI layer and then the top asphalt.

The pavement rehabilitation of Campbellville Road (8.6 lane kms) utilized a majority of the existing asphalt on site by pulverizing and re-using it as a granular base. Approximately 6,300 tonnes of existing asphalt was reused.

2 Reduced carbon footprint

The project approach resulted in a significantly reduced carbon footprint in comparison to traditional removal and replacement techniques.

The combined technologies used on these projects assisted in reducing the amount of milled asphalt hauled off-site at Trafalgar Road, Steeles Avenue, and Campbellville Road – approximately 4,600, 2,700, and 6,300 tonnes respectively.

The three technologies also assisted in minimizing the construction duration, which reduced hydrocarbon emissions and resulted in lower construction costs when compared to conventional full depth removal and replacement.

3 Reduced energy consumption

Approximately 4,000 tonnes of warm mix asphalt was placed on Trafalgar Road. Warm mix asphalt requires a lower mix temperature than the standard hot mix asphalt, reducing the average production energy consumption by 20 to 30 per cent.

Using SAMI technology along Steeles Avenue resulted in less energy consumption for removal of the existing pavement, as well as less energy consumption in the production, transportation, and placement of additional asphalt.

The three technologies utilized significantly reduced the hauling of materials off site, as well as the production, transportation, and placement of additional asphalt.

4 Minimized social disruption

The use of the SAMI technology at Steeles Avenue reduced overall noise and pollution – a general inconvenience to the public. It also significantly reduced the construction duration when compared with conventional methods of pavement structure removal and replacement.

SAMI allows traffic to drive on the new surface almost immediately after it is placed. Four metre sections can be placed at a jogging speed. The technology offers significantly less traffic disruption and lower impacts on local businesses and residents.

5 Increased worker safety during construction

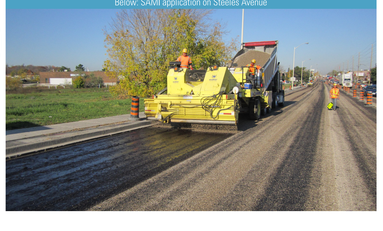
The technologies reduced the overall construction duration, which allowed the road conditions to return to normal more quickly. This improves general safety for the public and workers.

Warm-mix asphalt placed on Trafalgar Road produced lower emissions, which provided a safer environment for workers.

Above & Below: SAMI application on Campbellville Road

Pulvarization with hot-mix asphalt overlay on Campbellville Road resulted in 70% savings when compared to conventional approaches

Lowest lifecycle costs; the majority of materials were reused



Above: SAMI application and top asphalt on Campbellville Road
Below: SAMI application on Steeles Avenue

SAMI marginally increased project costs but also increased tensile strength and projected pavement lifecycle savings

Above: SAMI application on Steeles Avenue
Below: Completed resurfacing of Steeles Avenue

Minimized construction duration and traffic disruption when compared to conventional approaches

Above & Below: CIREAM operations along Trafalgar Road

CIREAM technology resulted in 40% lower construction costs when compared to conventional methods

The estimated 30 year lifecycle cost was 30% lower as a result of CIREAM technology

Above & Below: CIREAM operations on Trafalgar Road