Thin Maintenance Surfaces for Municipalities

tech transfer summary

When appropriately selected and applied, thin maintenance surfaces are a successful and cost-effective addition to any urban preventive maintenance program.

Objectives

- Provide suggestions for thin maintenance surface (TMS) techniques that urban street officials can easily test and include in their current programs
- Design a decision matrix for evaluating which TMSs are appropriate for specific circumstances

Problem Statement

In light of nationwide city budget shortfalls, cost-effective methods of extending pavement service life must be developed to slow the decline of safety and rideability of these street systems. Many busy urban street officials have limited awareness of and experience with the vast number of preventive maintenance options available. The difficulty of selecting an appropriate technique is compounded by the fact that many techniques work well in certain circumstances but are wholly ineffective in others.

While previous phases of TMS research have provided information about the uses of thin maintenance surfaces in rural settings, this research focuses on how TMS strategies can be used effectively in urban areas.

Research Description

TMSs are a set of cost-effective preventive maintenance surfacing techniques that can be used to extend the life of bituminous pavement by providing a waterproof seal and a new wearing course (without adding to the structural support). This research project facilitated the construction of five TMS test sections located in three Iowa cities—Cedar Rapids, Council Bluffs, and West Des Moines. Researchers documented construction practices and surveyed the condition of each test section before and after construction and again after the first winter, recording the amount and severity of distresses and calculating the pavement condition index.

Key Findings

Since the conditions of the test sections varied greatly, the different TMS sections cannot be directly compared to determine which surface was most successful. Instead, each section should be seen as a case study from which some general conclusions can be made.

TMSs are suitable preventive maintenance techniques for a municipal street department's pavement preservation program. To promote successful application, careful attention should be paid to the following factors:

- Planning (including daily and seasonal construction scheduling and securing necessary equipment and materials)

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RESEARCH PROJECT TITLE
Thin Maintenance Surfaces for Municipalities

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- Selection of aggregate (type and gradation) and binder, considering what is both available and appropriate for a particular type of TMS
- Quality control during construction, especially ensuring that the aggregate is properly embedded

Evidence from the test sections supports the following conclusions with regard to specific TMS techniques:

- A case study provides evidence that seal coat constructed with pre-coated chips and high-float emulsion provides a robust combination that can be a highly effective preventive maintenance technique in a municipal setting.
- Based on the micro-surfacing test section, a higher proportion of fines in the aggregate gradation can help create a smoother and tighter surface than micro-surfacing projects placed in Iowa in 1999.
- Based on the micro-surfacing test sections, limestone aggregate obtained within Iowa performed as well as aggregate imported from outside of Iowa.
- Sound testing showed that the noise intensity of micro-surfacing decreases as it is trafficked and that, after several months of traffic, the decibel level of micro-surfacing is similar to that of an HMA surface.
- Geotechenical fabric bonded to pavement with emulsion as a tack coat appears to be a feasible, cost-effective solution for limiting reflective alligator cracking through a seal coat (when distress does not deflect under load).

Implementation Benefits

- TMSs are cost-effective strategies for extending the lives of bituminous pavements.
- As part of a preventive maintenance system, TMSs can help spread out the workload and decrease the amount of rehabilitation and reconstruction necessary to maintain a street system in good condition.
- The TMS decision matrix, generalized in the table below, facilitates informed decisions about preventive maintenance strategies by putting important reference information at the fingertips of busy street officials.
- Since the test sections were designed with techniques and materials common or available in Iowa, other Iowa cities and counties should be able to reproduce the results of the test sections to a large degree when conditions are similar.

Implementation Readiness

- The decision matrix and Thin Maintenance Surface Handbook are available for immediate use.
- Further testing on bonded geotechnical fabric should be performed to verify these research findings.
- The modification of the recommended aggregate gradation for micro-surfacing should be further tested to verify its effectiveness.
- Additional noise testing should be performed on other micro-surfacing sections to verify the reported findings.

Generalized decision matrix for selecting appropriate TMS solutions

Factor		Fog seal	Seal coat	Slurry seal	Micro-surfacing	Thin HMA overlay
Traffic	AADT < 2,000	↑	↑	↑	↑	↑
	2,000 < AADT < 5,000	↑	←→*	←→*	↑	↑
	AADT > 5,000	↑	←→†	←→*	↑	↑
Bleeding		↓	↑	↑	↑	↑
Rutting		↓	↓	↑	↑	↑
Raveling		↑	↑	↑	↑	↑
Cracks	Few tight cracks	↑	↑	↑	↑	↑
	Extensive cracking	↓	↑	↓	↓	↑
	Alligator cracking	↓	←→	↓	↓	↓
Low friction		May improve‡	May improve	May improve	May improve§	May improve
Price ($/yd²)**		$0.10–$0.80	$0.80	$0.90	$1.50	$4.40

↑ Recommended ↓ Not recommended ←→ Marginal

*There is a greater likelihood of success when used in lower speed traffic.
†Not used in Iowa, but other states have seen success.
‡Fog seal will reduce friction for the first few months until traffic wears binder off of the tops of aggregate.
§Micro-surfacing reportedly retains high friction for a longer period of time.
**Prices were obtained from interviews and anecdotal evidence from author.