PAVEMENT TECHNOLOGY ADVISORY
- MATERIAL SAMPLING AND TESTING OF EXISTING HOT-MIX ASPHALT PAVEMENTS-
PTA-T5

INTRODUCTION

In order to select the most suitable rehabilitation strategy for any pavement, it is necessary to know the specific mode(s) of failure occurring within that pavement. Many failure modes exist, but most hot-mix asphalt (HMA) failure modes can be categorized as "durability-related," or "stability-related." Durability-related failure modes are associated with age and weather, while stability-related failure modes are associated with mixture design problems and displacement in the HMA mix under normal loading.

Pavement distresses arise from the failure modes, so regular pavement distress surveys can provide clues to which mode(s) may be occurring within a pavement. Unfortunately, similar pavement distresses may arise from different failure modes, making it difficult to diagnose which mode(s) are at work. The most accurate method of diagnosis is material sampling and testing of the existing pavement.

THIN HMA OVERLAYS

Testing samples of the existing pavement is especially important when a thin HMA overlay is being considered. Thin HMA overlays provide little structural support, so if the existing HMA-surfaced pavement is weakened by unapparent failure mode(s), the overlay may perform poorly.

These conditions can arise in HMA-surfaced pavements with stripping in underlying layers. Stripping is a durability-related failure mode that occurs when prolonged exposure to water "strips" the binder film from the aggregate. This weakens the pavement and makes it prone to displacement. Stripped pavement will often become rutted under normal loading, which may be attributed mistakenly to instability in the surface mix. Milling in conjunction with a thin HMA overlay is often prescribed in such a scenario; however, in this case, milling may further weaken the fragile pavement causing premature failure of the overlay.

SAMPLING PROCEDURE

Samples of the existing HMA-surfaced pavement are obtained by core removal. For HMA overlaid concrete pavements, only the HMA layers are cored. At least six 4-inch diameter cores per lane are taken for every five miles of project length. The cores are taken at 8-inch center to center spacing, in one row of six, or two rows of three, along the outside wheelpath of the lane. Extreme care is taken when extracting the cores, avoiding such tools as pry-bars and screwdrivers that may cause damage. Replacements for damaged cores should be obtained.

Immediately after removal, each core is blotted dry with a cloth rag, labeled, and placed in a sealed plastic bag to preserve the moisture and condition of the core. Each core is set upright, out of direct sunlight, in a vented or air-conditioned vehicle. When coring has finished, the samples are transported to the district materials laboratory, taking care in transport not to damage the cores.

ADDITIONAL FIELD DATA

Photographs are taken showing:

- Close-up of the pavement surface.
- Wide perspective of the location.
- Coring equipment and processes.
- Signs of severe distress in the core.
- Evidence of layer debonding.
- Inclusion of mud or foreign materials.
- Other unusual circumstances.

A record of each photograph is logged in a journal along with some brief notes.

When significant rutting is present, manual rut measurements are made with an approved straight edge and rut gauge. An option for multiple-overlaid pavements with severe early age rutting is to remove a pavement slab and observe the rutting contribution of each layer. Contact the Bureau of Materials and Physical Research (BMPR) if this option is being considered.

LABORATORY TESTING

Lab testing is performed within three days of the field sampling. The cores are separated into component layers by sawing, or by freezing and splitting. The percent density, split tensile strength, and the extent of stripping in the specimens are determined. A flow chart indicating the specific order and methods of testing is included at the end of this document.

Percent Density is determined from the bulk specific gravity (Gmb) and maximum specific gravity (Gmm) of each specimen. Percent density ratings are assigned, as shown in Table 1:

Table 1: Percent Density Ratings

Percent Density	Rating
100 to 98.0	Poor *
97.9 to 96.0	Good
95.9 to 94.0	Excellent
93.9 to 92.0	Good
< 91.9	Poor **

* Likely stability problems.

** Likely durability problems.

Split Tensile Strength is determined for two scenarios. "As-received" split tensile strength represents field conditions at the time of sampling, while "conditioned" split tensile strength mimics wet, summer conditions. Split tensile strength ratings are assigned, as shown in Table 2:

Table 2: Split Tensile Strength Ratings

Split Tensile Strength (psi)	Rating
> 100	Excellent
80 to 100	Good
50 to 80	Fair
30 to 50	Poor *
< 30	Unstable

* Likely stability problems.

Extent of Stripping is determined by visually inspecting the specimens immediately after split tensile testing. Composite strip ratings are assigned, as shown in Table 3:

Table 3: Composite Strip Ratings

Composite Strip Rating	Description
1.0 to 1.3	No Stripping to Slight Stripping
>1.3 to 1.7	Slight to Moderate Stripping
>1.7 to 2.3	Moderate Stripping
>2.3 to 2.7	Moderate to Severe Stripping
>2.7 to 3.0	Severe Stripping

COORDINATION OF EFFORTS

Due to the short turnaround from coring to testing, communication is imperative. Since the test results help planners to select rehabilitation activities, and designers to make provisions that set the stage for good performance, coordination of sampling and testing with planning and design efforts is crucial.

If you have any questions, please contact:

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Material Testing Flow Chart

(Procedures for cores taken from existing pavements only)