GUIDELINES ON THE USE OF THIN SURFACE MIXES FOR PAVEMENT
PRESERVATION

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ABSTRACT

Thin surface mixes (TSMs) are high-performance overlays designed to be placed at a thickness of between 0.5 and 1 inch and are used primarily as a pavement preservation surfacing. These mixes are comprised of high quality aggregates and polymer-modified binders with minimum binder contents of 6.0%. No recycled materials are allowed. These mixes also must pass rutting and cracking requirements. The mixture design and performance test requirements result in a surfacing that is more flexible, durable, and skid resistant than conventional dense-graded overlays. The objective of this paper is to present recommended guidelines on the use of these mixes based on the experiences of TxDOT’s Austin District.

TSMs are best used on structurally sound pavements beginning to show signs of age-associated distress: block cracking, longitudinal cracking in the wheel path, shallow rutting, raveling, oxidation, and/or loss of friction. One of the key construction issues with TSMs is ensuring a good bond to the existing surface. Either a non-tracking tack or spray-applied underseal membrane is recommended to ensure a good bond. Another key construction issue is achieving good compaction. Because these surfaces are so thin and there is no density control, it is critical to select a good rolling pattern.

The costs of TSMs are generally more (per ton) than conventional dense-graded mixes; however, due to their thin application, they cost less per square yard. The Austin District has realized a 30 percent cost savings per square yard over typical 2-inch conventional, dense-graded mixes.

Keywords: Thin overlays, Hot mix asphalt, Pavement preservation, Construction
BACKGROUND
Thin surface mixtures (TSMs), such as thin overlay mix (TOM) and ultra-thin mix (UT mix), are high-performance overlays designed to be placed at a thickness of between 0.5- and 1-inch. TSMs will become a standard specification in the upcoming 2014 specification, and these mixtures will be designed and constructed following the Texas Department of Transportation’s (TxDOT’s) Item 347 specification.

TxDOT began research several years ago into the use of high performance mixes which could be placed very thin to provide a cost-effective, crack-resistant mix as an alternative to chip seals as well as 2-inch conventional dense-graded overlays (1-6). The TSMs described in this paper were first developed in-house in the TxDOT Austin District, and they have since been used on a variety of pavement projects in other TxDOT districts. The primary use of TSMs is for pavement preservation. Given that these mixtures are durable and flexible, they serve this purpose very well. The objective of this paper is to present guidelines on the use of these mixes based on the experience of the Austin District. These guidelines are specific to Texas climatic conditions and would require additional study to adapt to other climates.

TxDOT’s conventional dense-graded mixes (Spec Item 341) typically are designed with locally available aggregates (often limestone) which do not tend to maintain good long-term skid resistance. Typical asphalt contents range from 4.8 to 5.2% and may or may not contain a polymer modified binder. In addition, reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS) are allowed at this time and there is no cracking test requirement. The low asphalt content and use of recycled materials tends to make these mixes quite stiff and not a good choice for a surface layer only one inch thick intended to resist reflective cracking. On the other hand, the TSMs described in this paper require high quality aggregates with good long-term skid properties, asphalt contents 6.0% or greater, polymer modified asphalt, no recycled materials, and a stringent cracking test. And while these mixes are more expensive (on a per ton basis) the savings is realized in the reduced thickness.

Some of the mixture requirements of TSMs are shown in Table 1.

| TABLE 1 Gradation limits for TOMs and UT mixes (TxDOT Spec Item 347). |
|-----------------|----------------|----------------|
| **Sieve Size**  | **TOM**        | **UT**         |
| 1/2"            | 100.0¹         | 100.0¹         |
| 3/8"            | 95.0 – 100.0   | 98.0 – 100.0   |
| #4              | 40.0 – 60.0    | 70.0 – 95.0    |
| #8              | 17.0 – 27.0    | 40.0 – 65.0    |
| #16             | 5.0 – 27.0     | 20.0 – 45.0    |
| #30             | 5.0 – 27.0     | 10.0 – 35.0    |
| #50             | 5.0 – 27.0     | 10.0 – 20.0    |
| #200            | 5.0 – 9.0      | 2.0 – 12.0     |

**Property**
- Binder Content, % Minimum²: 6.0  6.5
- Design VMA³, % Minimum: 16.0  16.5
- Plant-Produced VMA³, %Minimum: 15.5  16.0

1. Defined as maximum sieve size. No tolerance allowed.
2. Unless otherwise shown on the plans or approved by the Engineer.
3. Voids in Mineral Aggregates (VMA)
As mentioned previously, TSMs make use of polymer-modified asphalt at a minimum content of 6.0 percent for TOMs and 6.5 percent for UT mixes. The TOMs, in particular, exhibit a coarse surface texture as shown in Figure 1a, which contributes to high skid resistance and is excellent for stop-and-go traffic applications. UT mixes have a finer texture as shown in Figure 1b.

![Typical Coarse Texture of TOM](image1) ![Typical Fine Texture of UT](image2)

**FIGURE 1 Typical surface textures of a TSMs.**

In addition, ride quality improvement is typically 25–35 percent better than the preexisting ride quality, and these mixtures have been documented to reduce noise levels by up to 10 dB from the pre-existing noise conditions, which equates to about half the perceived noise level. For example, a TOM placed on IH-35 resulted in 2009 resulted in an improvement in noise measured with On-Board Sound Intensity (OBSI) meter from 104 dBA to 98.5 dBA. The International Roughness Index (IRI) on this interstate originally ranged from 68-74 in/mi and after the one-inch TOM was placed, the IRI ranged from 35-39 in/mi. A noisy chip seal (RM 12) in the Dripping Springs area had an OBSI measurement of 109 dBA and after placement of a TOM the OBSI was measured to be 97 dBA.

Data available from the Austin District show that the use of TSMs realized a 30 percent savings per square yard over typical 2-inch, conventional, dense-graded mixes. A few of these projects are listed in Table 2.

**TABLE 2. Example of cost savings from a few projects in the Austin District.**

<table>
<thead>
<tr>
<th>Highway</th>
<th>Actual Bid Price for 1-inch TOM</th>
<th>Cost Estimate for TxDOT Item 341 Conventional Dense-Graded 2-inch overlay (Statewide Bid Avg)</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH-35</td>
<td>$2,428,209</td>
<td>$3,368,927</td>
<td>$940,719</td>
</tr>
<tr>
<td>RM 32</td>
<td>$397,704</td>
<td>$527,723</td>
<td>$130,019</td>
</tr>
<tr>
<td>RM 620</td>
<td>$347,254</td>
<td>$534,237</td>
<td>$186,983</td>
</tr>
<tr>
<td>SH 130</td>
<td>$557,387</td>
<td>$857,518</td>
<td>$300,131</td>
</tr>
<tr>
<td>FM 1431</td>
<td>$431,492</td>
<td>$663,835</td>
<td>$232,342</td>
</tr>
<tr>
<td>US 87</td>
<td>$802,929</td>
<td>$1,235,276</td>
<td>$432,347</td>
</tr>
<tr>
<td>FM 3406</td>
<td>$285,753</td>
<td>$439,619</td>
<td>$153,867</td>
</tr>
<tr>
<td>Total Expense</td>
<td>$5,250,728</td>
<td>$7,627,135</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
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<td></td>
</tr>
<tr>
<td><strong>Total Cost Savings</strong></td>
<td><strong>$2,376,407</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Percent Savings</strong></td>
<td><strong>31%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FIGURE 2  TOM on IH 35 under construction  
– placed in 2009 and still performing excellently.
## TABLE 3 Where to and where not to use TSMs

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Where Not to Use TSMs</th>
<th>Where to Use TSMs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visual distress</strong></td>
<td>• Widespread deep rutting &gt; 0.5 inches deep</td>
<td>• Shallow rutting ≤ 0.5 inch</td>
</tr>
<tr>
<td></td>
<td>• Surface cracks wider than 3/8 inch</td>
<td>• Top-down cracking</td>
</tr>
<tr>
<td></td>
<td>• Areas of extensive, deep (&gt; 4 inches) patching (&gt; 20%; this assumes the pavement is structurally inadequate)</td>
<td>• Block cracking (Fig. 4b)</td>
</tr>
<tr>
<td></td>
<td>• More than 20% by area of the section has moderate to severe alligator cracking</td>
<td>• Less than 20% moderate fatigue cracking (assuming spot repair prior to TSMs)</td>
</tr>
<tr>
<td></td>
<td>• Areas where layer debonding or subsurface stripping is suspected (needs ground-penetrating radar and coring survey to verify)</td>
<td>• Longitudinal cracking in the wheel path, shallow rutting (Figure 4f)</td>
</tr>
<tr>
<td></td>
<td>• Areas of severe bleeding/flushing (these need to be milled first)</td>
<td>• Overlaying notch-and-widen sections</td>
</tr>
<tr>
<td></td>
<td>• Pavements with more than two failures per mile (as shown in Figure 3, sections with base failures)</td>
<td>• Transverse cracking (used in conjunction with an underseal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Raveling (Figure 4c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Highly oxidized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Polished surface (loss of skid)</td>
</tr>
<tr>
<td><strong>Structural condition</strong></td>
<td>• TxDOT’s Flexible Pavement System Design (FPS 21) analysis predicts that an overlay of more than 2 inches is required</td>
<td>• FPS 21 analysis predicts an overlay of 2 inches or less</td>
</tr>
<tr>
<td></td>
<td>• Structural Condition Index (SCI) less than 0.7 (SCI = existing structural capacity/required structural capacity) (7)</td>
<td>• SCI greater than 0.7</td>
</tr>
<tr>
<td><strong>Roadway applications</strong></td>
<td>• Pavements where the existing surface has high air voids (permeable friction courses [PFCs] and in some cases coarse matrix high binder [CMHB]). These should be milled first.</td>
<td>• Concrete pavements provided it is well bonded to the concrete via non-tracking tack or asphalt rubber seal coat.</td>
</tr>
<tr>
<td></td>
<td>• Pavements judged to be structurally deficient (in continuous need of patching, Figure 4a)</td>
<td>• Bridge decks with good bonding as described above</td>
</tr>
<tr>
<td></td>
<td>• Directly on top of granular base (should apply surface treatment first)</td>
<td>• Good for both low and high volume traffic roadways</td>
</tr>
<tr>
<td></td>
<td>• Excessively rough pavements (unless a level-up is placed first)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cross slope correction is required (unless a level-up is placed first)</td>
<td></td>
</tr>
</tbody>
</table>

*FIGURE 3 Unstable areas which are not good candidates for thin overlays.*
FIGURE 4 Good and bad candidates for TSMs.

a) Excessive Patching or Failures
b) Block Cracking
c) Raveling Chip Seal
d) Structural Deficiency
e) Structural Deficiency
f) Minor Longitudinal Cracking
Good Applications for TOMs

Some applications where a TOM is a good alternative to a 1.5- to 2-inch dense-graded mix include the following:

- Urban areas where maintaining grade at curb lines and driveway entrances is required.
- Where clearance at bridge underpasses and guardrail height clearances need to be maintained.
- Roadways requiring high friction resistance, such as roadways with high traffic volume, moderate to high posted speeds, steep grades, horizontal curves, and other roadway features that contribute to crashes, especially wet-weather crashes.
- Roadways requiring a tough, durable mix to resist shear forces in areas with turning, stopping, and acceleration movements, such as intersections or ramps. TSMs can be used as an alternative to PFCs in areas like intersections or curb/gutter sections where PFCs tends to ravel or cannot be placed.
- Low- to moderate-volume rural roads that have performed well with surface treatments but—due to noise concerns, friction, or ride quality—are not good candidates for an additional seal coat. If these types of roadways have high deflections, conventional dense-graded overlays tend to crack prematurely. More flexible, crack-resistant TSMs should provide a longer service life.
- Low-volume roadways needing an overlay but where the shoulders are in good condition and do not need the overlay. Since a TOM can be placed at a thickness of only 0.75- to 1-inch and a UT mix can be placed at 0.5 to 0.75-inches, the shoulder drop-off is not a safety concern. In these cases, the shoulders can be fog sealed.
- Any roadway where a crack-resistant overlay is needed due to excessive cracking, such as that shown in Figure 5. TOMs with a good underseal provide an effective crack resistant surface.
- As the final surface in new pavement construction to minimize future maintenance costs.

Good Applications for UT Mixes

Texas has many miles of low-volume roadways where the only preventive maintenance treatment applied over the years has been regular applications of seal coats. Multiple seal coats in some of these cases can lead to surface stability problems. The newly developed UT mix, although not a seal coat, offers TxDOT maintenance forces an economic alternative for areas where repeat seals are not the optimal treatment option.

It is anticipated that the low cost and slight thickness of the UT mix will make it a very valuable alternative for TxDOT’s maintenance forces for a range of applications. The cost of the UT mix is approaching that of a 2-course surface treatment.

Some applications where UT mixes are a good economical alternative are:

- Sections with skid problems.
- Low-volume roadways as a replacement for seal coats or when substantial variations in texture exist (Figure 6), or where minor rutting is present (Figure 7).
- Sections with multiple seal coats which have become unstable. These must be milled off prior to placement of a thin overlay (Figure 8).
FIGURE 5  Wurzbach Parkway in San Antonio—A good candidate for a TOM.

FIGURE 6  Surfaces with Varying texture are a good candidate for a UT Mix.

FIGURE 7  Surfaces exhibiting minor rutting are acceptable.
FIGURE 8 Surface stability problems due to multiple chip seals must be milled prior to placement of a UT mix.

MIX DESIGN AND MATERIAL PROPERTIES

The following are the critical material properties and considerations when designing TSMs. By definition, a TSM is a flexible, durable thin overlay that is resistance to both rutting and cracking and offers high surface friction.

- **High-quality aggregate**: To withstand high levels of stress within a thin section of material, the aggregate used in TSMs must be hard and durable. An MgSO₄ soundness loss of 20 or less is proposed.

- **PG 70 or PG 76**: Polymer-modified asphalt (such as PG 70 or 76) is critical to provide the elasticity to resist cracking and the stiffness to resist rutting. A mix is not a TSM without polymer-modified asphalt. PG 76-22 is the preferred binder type for high-volume roadways or roadways with significant amounts of truck traffic, especially with high summer temperatures. When specifying PG 70-22, sample and test the binder to assure the elasticity recovery is achieved because some PG 70-22 asphalt can be obtained with little to no polymer modification.

- **Recycled materials** and shingles are not permitted in TSMs. Recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS) would make the overall asphalt mix too stiff and prone to cracking, especially with thinner lift applications. Since the goal is to produce a flexible surface course, the incorporation of any recycled asphalt would, by definition, not produce a TSM.

- **Minimum binder content**: Most of the TSM designs placed around the state thus far have optimum design asphalt contents ranging from 6.2 to 6.8 percent for TOMs and 6.8 to 7.4 percent for UT mixes. Currently, Item 347 requires a minimum asphalt content of 6.0 percent for TOMs and 6.5 percent for UT mixes. The specification also calls for paying for the binder as a separate bid item to further guarantee achievement of the target asphalt cement (AC) content, and the operational tolerance does not allow the contractor to produce the mix below the minimum AC requirement.

- **Performance test requirements**: To ensure high performance, TSMs must pass stringent performance tests. This includes passing the Hamburg wheel tracking test for the PG grade of the binder used for rut resistance and lasting more than 300 cycles in the Texas overlay tester (Tex-248-F) for cracking resistance for design purposes.
• **Texas gyratory compactor (TGC):** TxDOT has found that TSMs are tough, harsh mixes requiring top-quality angular materials. The Superpave gyratory compactor (SGC) does not seem to have the angle/energy to adequately compact this type of mix. Adequate compaction of these mixes in the SGC often requires the addition of rounded field sands and dirty screenings, which can have a detrimental impact on performance tests. The Austin District has found that the TGC with its larger compaction angle is able to compact the material and can establish adequate binder content. Refer to TxDOT Test Procedure Tex-206-F (http://www.txdot.gov/business/resources/testing.html).

• **Operational tolerances:** The TOMs are typically designed with a laboratory-molded density requirement of 97.5 percent. However, in testing the trial batch, the laboratory-molded densities often exceed the specified operational tolerances of ±1 percent, often exceeding 98.5 percent. Under normal operations, this would cause the designer to reduce the design asphalt content. This can be done provided that the performance test requirements or the minimum asphalt content is not violated. Several TOMs and UT mixes have been placed with laboratory-molded densities on the trial batch at or close to 99 percent with no observed performance problems. The TOMs are gap-graded mixes and are very stable under loading. The UT mixes when placed very thin tend to cool very quickly therefore the likelihood of over-densification is minimal. This issue will continue to be evaluated.

**KEYS TO SUCCESSFUL CONSTRUCTION**

The following are some key factors that contribute to the successful construction of TSMs.

**Preparing and Repairing**

It is critical to perform spot repair in localized areas with significant distress. Mill and fill areas with fatigue cracking, failures, or shallow rutted areas. If there are a number of areas requiring deep full-depth repair, the pavement structure may not be sound, and a thin overlay may not be appropriate in this case.

**Level-Up**

Usually the TSMs result in a 25 to 35 percent decrease in roughness as measured by the IRI. However, if the section has a roughness greater than 120 in/mile, a level-up layer will be required.

**Milling**

Milling is recommended when the existing pavement exhibits the following conditions.

- A highly oxidized, stiff pavement surface prone to further distress if left under an overlay.
- Cross-slope corrections are needed.
- Minor to moderate ride issues (need to be corrected, may require profile milling).
- Extensive thermal cracking or top-down cracking (greater than 40 percent by area).
- Extensive recent crack seals on the existing pavement.

If milling is required, micro-milling is recommended to create a finer finish with small peak-to-valley depths to prevent compaction and ride issues.
**Bonding**

If a thin overlay has a poor bond to the existing roadway, it will fail quickly. If the TOM is to be placed directly over an existing HMA surface, then it is recommended that a bonding course, such as non-tracking tack or a spray-applied underseal membrane, be used to bond the overlay. A spray paver may also be used. As shown in Figure 9, commonly used conventional tack materials pick up excessively in the wheel paths, especially under heavy loads such as those under a materials transfer device.

There are several good new tack coat products that have entered the market “track” less than conventional tack coats. Low application rates of these nontracking tacks on the order of 0.03–0.06 gals/yd$^2$ are recommended. A pull-off test can be conducted both on laboratory cores and in the field to measure the effectiveness of the tack coat to bond the new overlay to the existing hot mix. The pull-off tester shown in Figure 10 is a very effective tool for achieving this.

![Figure 9 Poor performance of conventional tack coat material under heavy loads.](image)

![FIGURE 10 Pull-off tester for measuring bond strength (ASTM C 1583).](image)

It is also essential that the application of tack be applied in a very uniform manner to the existing pavement surface. This uniformity can be verified using ASTM E2995 *Estimating the Application Rate of Bituminous Distributors*. In this procedure, pre-weighed calibration pads are placed transversely on the roadway in front of the distributor (Figure 11). The distributor then drives over the pads spraying asphalt. The calibration pads are removed from the roadway and re-weighed.
Underseals
A chip seal is often placed beneath the overlay to address two issues: bonding and waterproofing. Since TSMs have such high asphalt contents, the mix has good sealing characteristics, which lessen the need for underseals. Underseals beneath thin surface mixtures should only be used when:

- There are significant unsealed cracks in the existing roadway.
- Milling will expose underlying cracking.
- Voids from distress like stripping will be exposed after milling.
- Overlaying newly widened pavement sections. Place underseal over everything to seal construction joints.
- There are inadequate funds or opportunity to seal or repair pavement distresses.

If it is determined that an underseal is required, the following material selection, rates, and construction have been used with success:

- Polymer-modified binder, whether asphalts or emulsions, should be used. Soft binders used in the underseal have a history of bleeding through TSMs and other types of overlays. This bleeding occurs especially at the start and end of distributor runs. With the high concentration of asphalt between the TSM and the underseal, this has led to isolated shear failures, like shoving or rutting.
- A TxDOT Item 302 Grade 5 (1/4-in maximum) aggregate is recommended. In some cases, 3/8 to ½ in aggregate may be too coarse, and there is the possibility of the aggregate penetrating through the surface.
- Given the importance of bonding, lighter aggregate rates, such as 1CY/ 300 SY, have been used to increase the exposure of the asphalt and promote adhesion. In addition, over-applying aggregate can cause delamination of the overlay due to a lack of bonding.
- All underseals must be engineered to the materials available and the road conditions.
- Proper seal coat or underseal practices, such as sweeping and vacuuming the surface clean before applying the underseal, are critical to assure proper bonding and prevent delamination.

Mixture Placement
- Warm Mix Additives are recommended as a compaction aide if the haul distance is greater than 40 miles. The ambient air temperature is recommended to be greater than 70°F for placement, but this can be reduced to 60°F if warm-mix asphalt (WMA) additive is used. No reduction in mix plant production temperatures is proposed. TSM mixtures should always be produced with a production temperature greater than 300°F.
Pave-IR: If it is absolutely necessary to pave at temperatures below 70°F, then the use of the Pave-IR system is highly recommended to monitor temperature uniformity. The contractor should also ensure there is adequate trucking to minimize pavement stops.

Material Transfer Vehicles (MTV), such as shuttle buggies, are highly recommended. Given the cooling rate of thin overlays, MTVs help maintain optimal compaction temperature and uniformity of thin overlay mixtures during placement. MTVs also help minimize the effects of thermal segregation, which can lead to low density and moisture infiltration.

Compaction
TOMs are tough mixes to compact. Pneumatic-tired rollers are not permitted because of excessive pick-up. The use of dual steel wheel rollers working in tandem is recommended (Figure 12) and should be mandatory when operating at ambient temperatures below 70°F. It is the contractor’s job to select the best rolling pattern. A pattern that has worked well in the Austin District for the TOMs is three passes where each pass consists of one vibratory pass (low amplitude) followed by one static back. It is recommended to minimize the amount of vibratory compaction to lessen the risk of wash boarding. Having the rollers close to the paver for the initial pass is essential. Also avoid over-compaction of the TOMs, especially those incorporating WMA as a compaction aid. The completed TOM should have a coarse surface texture as shown in Figure 1.

For the UT, mix the Austin District has found that static compaction is adequate, typically between 4 and 5 passes.

TSMs are high-asphalt content mixes and tend to be very sticky. It is important that the rollers have adequate release agents.

Acceptance in the Field
The thickness of TSMs is usually insufficient to measure density in the field. The TxDOT water flow test (Tex-246-F) (Figure 13) is recommended for acceptance and for adjusting rolling patterns to ensure adequate density and impermeability. For TOMs, the water flow should be greater than 60 seconds. Thermal segregation profile or use of the Pave-IR is critical to identify segregation which may lead to low density, permeability, and water infiltration. MTVs can help minimize the potential for thermal segregation. When moderate or severe thermal segregation is identified, perform water flow testing in these affected areas to verify adequate density and impermeability.
Management of Windrows

As with all other applications, it is important to eliminate “chunks” of hot mix that are often seen at the end of windrows. The contractor should have dedicated personnel to remove these chunks or cold clods. The chunks that form at the top of the haul truck bed occur more often during night jobs or when weather is cool. Experience has shown that they do not remix, especially for these thin lifts. These areas in the final mat often lead to localized pop-outs.

Delivery trucks that can supply the material in windrows are recommended so that cold chunks can be easily seen and removed.

SUMMARY

TSMs are high-performance overlays designed to be placed at a thickness of between .5 and 1 inch and are used primarily as a pavement preservation surfacing. These mixes are comprised of high quality aggregates and polymer-modified binders with minimum binder contents of 6.0 for TOMs and 6.5 for UT mixes. No recycled materials are allowed. These mixes also must pass rutting (Hamburg Wheel tracking test) and cracking (Texas overlay test) requirements. The mixture design and performance test requirements result in a surfacing that is more flexible, durable, and skid resistant than conventional dense-graded overlays. In addition, ride quality improvement is typically 25–35 percent better than the pre-existing ride quality, and these mixtures have been documented to reduce noise levels by two to four times the pre-existing noise conditions.

TSMs are best used on structurally sound pavements beginning to show signs of age-associated distress: block cracking, longitudinal cracking in the wheel path, shallow rutting, raveling, oxidation, and/or loss of friction. They have been used successfully on rural FM/RM roadways and the TOM mix has performed well on I-35 in Austin for more than five years carrying 80,000 ADT with 10 percent trucks. A pavement evaluation should be conducted for any upcoming TSM project. Pavements exhibiting the following: widespread deep rutting, moderate to severe alligator cracking, severe bleeding or flushing (unless milling first), or where layer de-bonding is suspected. It is critical to repair significantly distressed areas and mill and fill areas with fatigue cracking, failures or shallow rutted areas.

One of the key construction issues with TSMs is ensuring a good bond to the existing surface. Either a non-tracking tack or spray-applied underseal membrane is recommended to ensure a good bond. Another key construction issue is achieving good compaction. Because these surfaces are so thin and there is no
density control, it is critical to select a good rolling pattern. The use of dual, steel-wheel rollers working in tandem is recommended and if the haul distance is more than 50 miles or if temperatures are cool, then a warm mix additive (without reducing the mix temperature) is recommended as a compaction aid. The costs of TSMs are generally more (per ton) than conventional dense-graded mixes; however, due to their thin application, they cost less per square yard. The Austin District has realized a 30 percent cost savings per square yard over typical 2-inch conventional, dense-graded mixes.
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