HMA Pavement Mix Type Selection Guide

Manual Purpose

- Provide designers with a method for selecting appropriate mix types considering factors such as:
  - Existing pavement condition and necessary preparation
  - Subsurface Pavement structures
  - Environment
  - Traffic
  - Economy

- Manual developed by cooperative effort of the FHWA and NAPA

- Brown, Epps, Garcia, Gulden, Hansen, Harrington, Michael, Page, Petros, Scofield, Sines, Weigel
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*Intended Audience*

- Consultant Engineers
- Architects
- New hires
  - State Agencies and Industry
- Provides a base line to begin from whether your in CT, ME, NH, NJ, NY, PA, or RI
- Information presented today will be familiar to many of us so please bear with me
HMA Pavement Mix Type Selection Guide

What's in the Selection Guide?

- Standard definitions
  - Pavement Layers and traffic
- General recommendations for surface preparation
- Discussion of mix types covered by the manual
  - Dense Graded, SMA, and OGFC
- Decision tree for mix type selection
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**Dense Graded Mixes**

- Considered the HMA workhorse since they may be used effectively in all pavement layers and for all traffic conditions.
- Can be used for structural and functional overlays, for leveling and patching, and to provide pavement friction.
- Defined by their Nominal Maximum Aggregate Size.
- Defined by relative coarseness of the specific mix.

Table 2 – Definition of Fine- and Coarse Dense Graded Mixtures
## HMA Pavement Mix Type Selection Guide

### Dense Graded Mixes

Table 2: Definition of Fine- and Coarse Dense-graded Mixtures

<table>
<thead>
<tr>
<th>Mixture NMAS</th>
<th>Coarse-Graded</th>
<th>Fine-Graded</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5 mm (1 1/2&quot;)</td>
<td>&lt;35 % Passing 4.75 mm Sieve</td>
<td>&gt;35 % Passing 4.75 mm Sieve</td>
</tr>
<tr>
<td>25.0 mm (1&quot;)</td>
<td>&lt;40 % Passing 4.75 mm Sieve</td>
<td>&gt;40 % Passing 4.75 mm Sieve</td>
</tr>
<tr>
<td>19.0 mm (3/4&quot;)</td>
<td>&lt;35 % Passing 2.36 mm Sieve</td>
<td>&gt;35 % Passing 2.36 mm Sieve</td>
</tr>
<tr>
<td>12.5 mm (1/2&quot;)</td>
<td>&lt;40 % Passing 2.36 mm Sieve</td>
<td>&gt;40 % Passing 2.36 mm Sieve</td>
</tr>
<tr>
<td>9.5 mm (3/8&quot;)</td>
<td>&lt;45 % Passing 2.36 mm Sieve</td>
<td>&gt;45 % Passing 2.36 mm Sieve</td>
</tr>
</tbody>
</table>
## AASHTO MP2 Table 4 – Gradation Classification

<table>
<thead>
<tr>
<th>Nominal Max Aggregate Size</th>
<th>37.5 mm</th>
<th>25.0 mm</th>
<th>19.0 mm</th>
<th>12.5 mm</th>
<th>9.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Control Sieve</td>
<td>9.5 mm</td>
<td>4.75 mm</td>
<td>4.75 mm</td>
<td>2.36 mm</td>
<td>2.36 mm</td>
</tr>
<tr>
<td>PCS Control Point</td>
<td>47</td>
<td>40</td>
<td>47</td>
<td>39</td>
<td>47</td>
</tr>
</tbody>
</table>
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Dense Graded Mixes
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Advantages of Fine- and Coarse Dense Graded Mixes

- **Fine-Graded Mixes**
  - Lower permeability
  - Improved workability (< 25 mm (1”) NMAS)
  - Thinner lifts
  - Greater durability for low volume roads
  - Smooth texture

- **Coarse-Graded**
  - Allows thicker lifts to be placed
  - Increased macro texture
  - Economy
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Stone Matrix Asphalt Mixes

- Gap-graded HMA which maximizes rutting resistance and durability
- Stable stone on stone skeleton held together by a rich mixture of PGB, filler, and stabilizing agent
- Used almost exclusively for surface courses on high volume interstate and US highways
- Can be considered as an intermediate layer in cases where heavy slow moving vehicles use the pavement
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Open Graded Friction Course Mixes

- Designed to be permeable to water to reduce the potential for hydroplaning, and splash and spray
- Use of modified asphalts and/or fibers is highly recommended to increase the amount of binder in the mix improving their durability and performance
- Should only be used on medium to high volume roadways with high posted speeds
- Asphalt treated permeable base is used below dense graded or SMA mixes as a drainage layer
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Recommended General Mix Types for Surface, Intermediate, and Base Courses – Figure 2
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Recommended General Mix Types for Surface, Intermediate, and Base Courses – Figure 2
HMA Pavement Mix Type Selection Guide

Recommended Mix Types for Surface, Intermediate, and Base Courses – Figure 3
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Recommended Mix Types for Surface, Intermediate, and Base Courses – Figure 3
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Determining Appropriate Mix Type Decision Tree

- Determine the total thickness of HMA required
  - New construction – structural design
  - Rehabilitation – pavement and structural design evaluation
- Determine the type of mixture appropriate for the surface coarse based on traffic and cost
- Determine the proper aggregate size to use for the mix
  - Pavement loading the main concern
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Determining Appropriate Mix Type Decision Tree

Continued ..

Consider appearance
- Larger NMAS mixes will have coarse texture and may not be appropriate for all applications

Consider traffic flow through the work zone
- When lane drop-offs are allowed smaller NMAS mixes may be preferred for safety

Consider construction phasing
- Will an underlying layer be exposed to traffic for extended time or over the winter? If yes, a smaller NMAS mix may be preferred

Never compromise on performance when selecting a mix type.
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Determining Appropriate Mix Type Decision Tree

- Subtract the thickness of the surface course from the total thickness
- Repeat steps 2 and 3 for the remaining lifts
- Example Problem
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Decision Tree Example Problem

- Given: A structural evaluation for a 20 km new pavement on a high volume, urban highway with heavy truck traffic requires a total thickness of 300 mm (12”) of HMA, sections of pavement will be open to traffic following completion of intermediate course

- Solution:
  - Step 1 Determine total thickness
    - Provided as a given
  - Step 2 Determine type of mix for surface course
    - Proper aggregate size considering loading
    - Consider appearance
    - Consider traffic flow
    - Consider construction phasing
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Recommended Mix Types for Surface, Intermediate, and Base Courses – Figure 3
Based on Figure 3 either SMA, OGFC, or Dense Coarse Graded Mix would be appropriate

- Select 12.5 mm DCG mix for surface at 50 mm

Step 3 Subtract surface lift from total section required
- Total remaining HMA for intermediate and base course 250 mm

Step 4 Repeat steps 2 and 3 until complete
- Proper aggregate size considering loading
- Consider appearance
- Consider traffic flow
- Consider construction phasing
Based on Figure 3 either Dense Fine Graded, SMA, or Dense Coarse Graded Mix would be appropriate

- Select 2 lifts of 19 mm DCG mix for intermediate course at 75 mm

Subtract intermediate lifts from remain HMA required

- Total remaining HMA for base course is 100 mm

Step 4 Repeat steps 2 and 3 until complete

- Proper aggregate size considering loading
- Consider appearance
- Consider traffic flow
- Consider construction phasing
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Decision Tree Example Problem - Continued

Based on Figure 3 either Dense Fine Graded or Dense Coarse Graded Mix would be appropriate

• Select 1 lift of 37.5 mm DCG mix for the base course at 100 mm

This represents only one possible solution to the problem given

Remember

• Not all mixes may be available in your location
• When using OGCF it does not count as part of the structural layer
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Summary

- Guide is intended to provide a rationale method for mix selection and to specify lift thickness.
- Guide provides a good basic foundation of information for those not familiar with HMA terminology to work from.
- Guide provides strategy for maximizing the effectiveness of Dense Graded, SMA, and OGFC mixes.

Guide is not intended to address every situation.
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Where to Obtain Your Copy

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