

## Selecting the Proper Asphalt Concrete Mix Types and Pavement Build-ups

Presented by  
Flexible Pavements of Ohio

### ODOT Pavement Design Manual

[www.dot.state.oh.us/Divisions/Engineering/Pavement/Pages/Publications.aspx](http://www.dot.state.oh.us/Divisions/Engineering/Pavement/Pages/Publications.aspx)

Section 400 contains guidance on proper mix applications and layer build-ups.

We recommend using ODOT standard mixes

### Selecting The Mix Type

The designer must select the appropriate mix types, and layers for:

- >Stress conditions of traffic speed and loads,
- >Layer thickness, for the mix type and structural build-up
- >Function - course (base, intermediate or surface) and functional characteristics, and
- >to obtain smoothness and economy.

Heavy loads, stopping, starting and turning traffic (High Stress conditions) are more severe loading conditions that require very stable mixes to resist deformation

ODOT standard mix types and characteristics

Function: surface, intermediate or base, functional characteristics

Gradation: Aggregate top size

### Standard ODOT Mixes, Rev. July 2014

#### Item, Description, Type

#### Surface Course Mixes

- 441, Asphalt Concrete Surface Course, Type 1, (446/8), PG64-22\*
- 442, Asphalt Concrete Surface Course, 9.5 mm, Type A or B, (446/8)
- 442, Asphalt Concrete Surface Course, 12.5 mm Type A or B, (446/8)

#### Intermediate Course Mixes

- 441, Asphalt Concrete Intermediate Course, Type 1, (446/8)
- 441, Asphalt Concrete Intermediate Course, Type 2, (446/8)
- 442, Asphalt Concrete Intermediate Course, 19 mm Type A or B, (446/8)

#### Base Course Mixes

- 301, Asphalt Concrete Base
- 302, Asphalt Concrete Base

\*(we'll discuss binder grade options later)

#### Mixtures for High Stress Pavement Applications

Item	Description	Type
442 (446/8)	Superpave (type A)	12.5 mm
442 (446/8)	Superpave (type A)	19 mm
443 (446/8)	Stone Matrix Asphalt	
SS 826 (446/8)	Asphalt Concrete w/Fibers	
SS 857 (446/8)	Asphalt Concrete w/Gilsonite	

### Mixes for Preventive Maintenance/ Surface Treatments

- ITEM 424, FINE GRADED POLYMER ASPHALT CONCRETE, Type A or B
- ITEM 404LVT (Low Volume Traffic) ASPHALT CONCRETE (FPO specification)

### Mixture functions

- Surface course mixes – are generally fine graded w/ relatively higher binder contents to provide smooth texture, low permeability for durability and to be placed thinner for economy
- Base course mixes – are generally coarse graded with larger aggregates to provide structural strength and to be placed in thicker layers for economy
- Intermediate course mixes – are generally graded between the surface and base to provide a transition for smoothing the base while providing strength and economy.

### Loading Conditions

- **Applicable to Surface and Intermediate Course Mixes**
- **Based on # of B and C trucks using pavement**

**Light (LT) - Residential Street <50 B+C vehicles/day**

**Medium (MED) - Res. / Collector**  
– **Note: sometimes referred to as Normal (NOR)**

**Heavy (HY) - Arterial or higher >1500 B+C vehicles/day**

**High Stress – heavy trucks, stopping, starting and turning**

### ODOT traffic application usage

- 441, Type 1 and 2 for medium or normal traffic
- 442 Type B for heavy traffic
- 442 Type A for high stress traffic
- Choice of 301 or 302 is usually based on the thickness of the base course with 302 used for thicker bases

### Binder grades

- Binder grade has a very significant impact on the performance and durability of asphalt pavement
- ODOT specifies PG binder grades
- PG binders are characterized for performance under normal traffic conditions for the prevailing climate
- Example: PG 64-22 is graded to resist deformation at a high pavement temperature of 64 degrees Celsius (147 F) and to resist cracking at a low temperature of -22 degrees Celsius (-8 F)
- Binder grades with an M designation are polymer modified for improved performance

### Selecting the binder grade

- **ODOT now has default grades for all mixes in the specifications (as of 7/18/2014)**
- **High Temperature grades are bumped up for heavy traffic and/or high stress conditions**
- **Polymer modified M binders are used for heavy traffic and High stress traffic applications**

## Traffic Conditions\*

### Recommended Asphalt Binders

- Normal, fast moving Traffic PG 64-22
- Heavy, fast moving Traffic PG 70-22M
- High Stress Traffic PG 76-22M, PG 88-22M

*\*Applicable to pavements exposed to heavy vehicles (i.e. truck traffic)*

## ODOT Specifications

- 2 Lane System PG 64-22, PG 70-22M
- 4 Lane System
  - Surface Course PG 70-22M
  - Intermediate Course PG 64-28
  - Base Course PG 64-22
- High Stress\* PG 76-22M, PG88-22M
- \* Not default grades

## Specifying a non-standard binder grade

- If it is necessary to specify a different binder grade than the default:
- Use an “as per plan” item
- Specify the needed binder grade by plan note
- Example:
  - 442, Asphalt Concrete Surface Course, 12.5 mm Type A or B, (446) as per plan
  - (Use PG 76-22M per 702.01)

## Selecting the Layer Thickness

- Aggregate Size
- Compaction Restrictions
- Economies of paving
- Total structural thickness needed

## Selecting the Layer Thickness

- **Aggregate Size** - affects the minimum layer thickness being specified
- **Compaction Restrictions**
- **Economies of paving**

## Aggregate Size

- **Uniformly Graded Mixes**
  - The design thickness for any layer should be at least **two to three times greater than the maximum size of the aggregate being incorporated into the layer**
- **Gap Graded and Heavy Duty Mixes**
  - At least **3 to 4 times greater than the maximum size of the aggregate being incorporated into the layer**

**Note!** Make provision for variability in the existing surface by increasing overlay thickness.

### ODOT General Purpose Mixes (441) – w/ gradation (aggregate top sizes)

- 446/448, Type 1, surface or intermediate, 1/2 or 3/8"
- 446/448, Type 2, intermediate or surface, 1-1/2 or 3/4"
- 442 (446/448), 9.5 mm, Type A or B, intermediate or surface, 1/2 or 3/8"
- 442 (446/448), 12.5 mm, Type A or B, surface or intermediate, 3/4 or 1/2"
- 442 (446/448), 19 mm, intermediate, 1-1/2 or 3/4"
- Base mixes
- 301, 2 or 1"
- 302, 2 or 1-1/2"

### Typical HMA Layer Thickness

Table 1 – Layer Thickness Guidelines

HMA Material	Thickness (inches)
<b>Surface Courses</b>	
Type 1	1¼ - 1½
Type 1H	1½ - 2½
Type 2	1¾ - 4½
Superpave 9.5 mm	1¼ - 1½
Superpave 12.5 mm	1½ - 2½
<b>Intermediate / Leveling Courses</b>	
Type 1	1 - 1½
Type 2	1¾ - 4½
Superpave 9.5 mm	1 - 1½
Superpave 19 mm	1¾ - 4½
<b>Base Courses</b>	
301	3 - 10
302	4 min.

### Compaction Restrictions

To ensure compaction of the mixture can be attained, minimum layer thickness should be 2 to 4 times the maximum aggregate size in the mix. (3 to 4 X preferred)

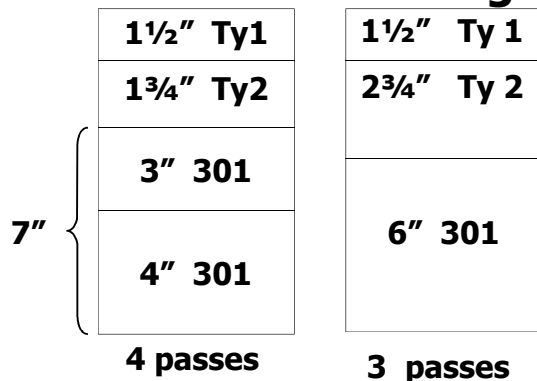
the following maximum placement thickness have been established by ODOT:

- **302 – 7-3/4" (4"min.)**
- **301 - 6"**
- **All others - 3"**

### Economy

- **Mix selection will be influenced by the availability of materials. ex. crushed agg.**
- **For economic reasons, locally available materials will typically be used except where performance dictates**
- **Small quantities are more costly to produce than larger quantities (economy of scale)**
- **High cost, higher performance materials may lower life cycle cost, ex. polymer binder**

### Economies of Paving



### Typical HMA Pavement Sections

	Typical Maximum Aggregate Size	Course Thickness*
<b>Normal</b> Surface (Type 1) Leveling (Type 2)  Base 301	½"	1" to 3"
	1"	1¾" to 3"
	1" to 2"	3" to 6"
<b>Heavy Duty</b> Surf. 442, 12.5mm, ty. A Inter. 442, 19 mm, ty. A  Base (302)	¾"	1½" to 3"
	1"	1¾" to 3"
	1½" to 2	4" to 7.75"

\*These can vary according to available aggregate size, mix preference, and agency philosophy.

## References

- FPO, Technical Bulletin – Specifying Asphalt Pavements in Ohio --  
[www.flexiblepavements.org/sites/www.flexiblepavements.org/files/specifying\\_asphalt\\_in\\_ohio\\_30nov2012.pdf](http://www.flexiblepavements.org/sites/www.flexiblepavements.org/files/specifying_asphalt_in_ohio_30nov2012.pdf)
- Criteria for specifying Asphalt Concrete --  
<http://www.flexiblepavements.org/sites/www.flexiblepavements.org/files/guidelinesforusev2.pdf>
- ODOT, Pavement Design Manual,  
[www.dot.state.oh.us/Divisions/Engineering/Pavement/Pages/Publications.aspx](http://www.dot.state.oh.us/Divisions/Engineering/Pavement/Pages/Publications.aspx)