The Road to Success for Asphalt Pavements

The name says it all. Superpave Superior Performing Asphalt Pavements.

Superpave provides pavement engineers with a rational method for selecting materials and designing an asphalt concrete mix. It establishes how to select the right type of aggregate, the right type of asphalt cement and how to design the mix so that the aggregate and asphalt cement work together optimally for better performance and greater durability under all types of traffic and climatic conditions.

Many people assume that Superpave is only for super roads like Highway 401 and the QEW but it is much more than that. It is a mix design system that can be used for every type of pavement from golf cart paths and parking lots to the 400 series highways.

The Ontario Ministry of Transportation started implementation of Superpave in the late 1990s and by 2006, Superpave mix design technology was standard practice on all MTO projects.

Ontario’s first municipal Superpave job was in Frontenac County in 1996. Since then, municipalities such as Toronto, Ottawa, Kingston, Hamilton, Mississauga, Stratford, Quinte West, Ingersoll and the Region of Durham have all used Superpave. Based on successful trials, many municipalities now use Superpave mix design technology for some or all their road projects.

Defining Traffic

Superpave accommodates a wide variety of traffic conditions. Knowing the traffic category, pavement engineers can tailor a mix using differing aggregate and mix performance characteristics to suit specific traffic loading.

The owner agency needs to establish the traffic category at the contract design stage and state it in the contract tender documents.

Traffic counts are the best way to establish a traffic category and confirm the number and weight distribution of trucks using the road. Typical traffic counts for provincial highways from 1989 to 2004 are available on the MTO web site¹ and designers can use the “Typical Application” from OPSS 1151, Table 1 as a simple guide.

Choosing correct traffic category for the road will ensure that the chosen mixes are the best value for the project.

How Superpave Works

An asphalt pavement has two basic components: aggregates to carry the load and asphalt cement to bind the aggregates together. Superpave provides pavement engineers with a rational method for selecting materials and designing the asphalt concrete mix.

Incorrectly designed HMA can manifest different stresses. Heavy traffic, especially slow moving trucks starting and stopping, can create ruts in the pavement; summer heat can soften the pavement and oxidize the asphalt; frigid winter temperatures can make pavements brittle and prone to cracking. Superpave takes a fresh look at how to select the right type of aggregate and the right type of asphalt cement and how to design the mix so that the aggregate and asphalt cement work together optimally for better performance and greater durability under all types of traffic and climatic conditions.

Asphalt Cement - Asphalt cement is the glue that binds the pavement together. Using a classification system called Performance Graded Asphalt Cements (or PGACs) asphalt cements are graded and selected based on their performance under climatic conditions and traffic loading. According to an Ontario Ministry of Transportation study, PGACs can extend the life of an asphalt pavement by at least two years.

¹ http://www.raqsb.mto.gov.on.ca/techpubs/TrafficVolumes.nsf/htmweb
A more detailed explanation of PGACs and how they should be specified in Ontario is found in the ABCs of PGAC posted on the OHMPA web site www.ohmpa.org

**Aggregates** - Aggregates, produced from gravel pits or quarries, are the backbone of a pavement. Superpave defines the key aggregate properties such as size, shape and angularity that give the pavement the strength and durability to meet a variety of traffic conditions. The aggregate combination used in hot mix pavement is a blend of aggregates from various sources that ranges in size from small grains of sand up to stones of about 50 mm in diameter depending upon the application. The final selection of the specific aggregates used for a mix depends on the traffic loading of the particular pavement. OPSS 1003 outlines the aggregate quality required for different traffic levels.

For high volume traffic conditions, pavement engineers want as much "stone on stone" contact as possible for strength and durability. With the Superpave system as the traffic level goes up (from Category A to E in Ontario) so too does the required quality of both the coarse and fine aggregates. The HMA near the surface (the upper 100 mm of the pavement structure) will need higher quality aggregates to meet higher pavement stresses than those deeper in the pavement structure.

For the lowest traffic category, Traffic Category A, local aggregates used in the past to make Marshall mixes can still be used. Traffic Category B mixes have some additional stipulations on aggregate properties but almost all aggregates used in the past for Marshall mixes should meet these criteria.

The additional coarse and fine aggregate quality requirements for Traffic Category C may result in a reduction in the amount of certain natural sands and rounded pit source stone and an increased use of manufactured sand or washed screenings together with quarried stone. (This will not apply to all parts of the province but may have some significance for aggregate from parts of southwestern Ontario). However, these additional requirements only apply to the surface 100 mm of mix. Superpave does allow local aggregates to be blended to meet specifications requirements.

Mixes for Traffic Category D and E are similar to the heavy duty mixes specified for higher volume roads in the past. Surface course mixes requiring superior

### Table 1 (OPSS 1151 - Nov 2006)
**Superpave and SMA Design Traffic Categories by ESALs**

<table>
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<tr>
<th>Ontario Traffic Category</th>
<th>20 Year Design ESALs</th>
<th>Typical Applications</th>
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<tbody>
<tr>
<td>A</td>
<td>Less than 0.3 million</td>
<td>Low volume roads, parking lots, driveways, and residential roads.</td>
</tr>
<tr>
<td>B</td>
<td>0.3 to 3 million</td>
<td>Minor collector roads.</td>
</tr>
<tr>
<td>C</td>
<td>3 to 10 million</td>
<td>Major collector and minor arterial roads.</td>
</tr>
<tr>
<td>D</td>
<td>10 to 30 million</td>
<td>Major arterial roads and transit routes.</td>
</tr>
<tr>
<td>E</td>
<td>Greater than 30 million</td>
<td>Freeways, major arterial roads with heavy truck traffic, and special applications such as truck and bus climbing lanes or stopping areas.</td>
</tr>
</tbody>
</table>

**Note:** Equivalent Single Axle Load (ESAL) for the projected traffic level expected in the design lane over a 20 year period, regardless of the actual design life of the pavement.
skid resistance are specially designated as 12.5 mm FC1 and 12.5 mm FC2 mixes (FC stands for Friction Course) and they are similar to the HL 1 and DFC mixes. Since the aggregates for these mixes come from designated sources as they have in the past, there is little change in the system.

The mix design, which takes all these technical requirements into account, ensures an optimum blend of the correct aggregates.

Mix Selection - Superpave uses a volumetric approach to mix design. A gyratory compactor simulates traffic conditions in the laboratory. Using Superpave mix designs, contractors can produce asphalt mixes to meet specific traffic loads and climates.

Superpave is about selecting the proper mix to suit the traffic and climatic conditions. This includes specifying that the lift thickness is at least 3 times (preferably 4 times) the thickness of the Nominal Maximum Aggregate Size of the blended aggregate to ensure adequate compaction and thus adequate long-term performance.

Ontario Provincial Specifications

MTO, municipalities and consultants use the Ontario Provincial Standards (a set of standard specifications and drawings) for the tendering of contracts in Ontario. The latest edition of the following OPS Specifications should be referred to when preparing tenders.

OPSS 1003 - Material Specification for Aggregates - Hot Mix Asphalt
OPSS 1101 - Material Specification for Performance Graded Asphalt Cement
OPSS 1151 - Material Specification for Superpave and Stone Mastic Asphalt Mixtures

Training

The Ontario Hot Mix Producers Association, in conjunction with the Asphalt Institute, provides Superpave mix design training courses for contractors, consultants, and municipal and provincial engineers from across Ontario. Private consultants have also developed training courses. The Canadian Council of Independent Laboratories has a certification program for Superpave mix testing to meet Provincial qualification requirements.

The Bottom Line

Using Superpave to select materials and design the mixes, asphalt engineers can design pavements that will routinely last for 20 years or more.

Superpave has come of age in Ontario. All municipalities can benefit from the use of Superpave mixes to extend the life of their pavements.

2 Refer to Appendix A of OPSS 1151 for an explanation of the NMAS and lift thickness.