The durability of an asphalt pavement is seen through its ability to resist factors such as aging of the asphalt, disintegration of the aggregate and stripping of the asphalt film from the aggregates. Asphalt pavements perform well when they are designed, produced and constructed to provide desired properties such as durability, impermeability, strength, stability, stiffness, flexibility, fatigue resistance, and workability.

The following checklist highlights provides best practices and recommendations for increasing the Asphalt Cement (AC) content, including strategies to address the issues with designing asphalt mixtures for improved durability.

WAYS TO GET MORE DURABLE HMA PAVEMENTS

ENCOURAGE MIXES THAT HAVE HIGHER ASPHALT CEMENT (AC) CONTENT

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The OAPC developed the TOP 10 List, from results of the Quality of Asphalt Review, which commenced in September 2018. The Quality of Asphalt Review was commissioned in the fall of 2017 and was managed by KPMG and consisted of analysis conducted by Texas A&M Transportation Institute (TTI).

In summary, increasing the AC content in asphalt concrete mixtures should be a high priority for improving pavement performance in Ontario. This can be encouraged by increasing the minimum VMA requirement, lowering the Ndesign requirements to increase in-place pavement density, exploring the air void regression mix design method, implementing mixture performance tests for “Balanced Mix Design” and quality assurance, or by advancing the Superpave 5 mix design system. Regardless of the method adopted, differences between the desired properties of the Job-Mix Formula (JMF) and the properties of the plant-produced asphalt mix MUST be checked and verified for compliance, and necessary adjustments should be made to minimize any variations and mitigate against consequent negative effects on the in-service pavement performance.
AC CONTENT IMPACTS ON MIXES

- Low AC content results in fatigue cracking, dryness or raveling and a brown dull pavement appearance, while excess AC content leads to bleeding, fat spots and low skid resistance. For virgin mixes, low AC contents are typically caused by one of the following:
  - asphalt absorption problems
  - increase in dust content, thus decreasing VMA
  - the loss of VMA during production and thus decreasing the AC content to meet the air voids requirement
  - production automation problems: pumps, weigh bridge, asphalt meter, aggregate moisture, etc.

In recycled mixes, low AC contents can be caused by above-mentioned problems, but can also be related to:
  - increased total dust percentages due to RAP fines, thus decreasing VMA
  - improper RAP proportions due to inaccurate RAP moisture content
  - high moisture contents in RAP, hampering the softening of the RAP binder required to blend with virgin binder, thus coating "black rocks" and reducing the total binder content for the recycled mix

ENHANCING MIX DURABILITY

- The objective of any asphalt mix design process is to select materials in the right proportion and within economic parameters to obtain desired qualities and properties depending on purpose and other project requirements.
  - designing the mix using a dense gradation of sound, tough, moisture-resistant aggregates: This enhances impermeability due to closer contact among aggregate particles. Sound, tough aggregates provide resistance to disintegration under traffic loading.
  - maximizing the asphalt film thickness on the aggregate; and
  - compacting the mixture to be impervious.

INDUSTRY’S SHORTCOMINGS

- Figure(s) 1 and 2 illustrate design shortcomings in practices with gradation selection of specific Superpave mixtures revealed from the “Quality of Asphalt Review (QAR)”. The gradation of the aggregate, shown in green, follows the line of maximum packing and there is little room left for the AC. This practice also allowed mix designers to sometimes bend the gradation to go below the line of maximum packing, effectively limiting room for the asphalt binder in the mixture, and leading to mixes that were more susceptible to pre-mature cracking. All the mixtures examined in the "Quality of Asphalt Review (QAR)" had asphalt content values ranging between 4.5 and 5.0%. For a cold climate like Ontario, the report expects to see asphalt contents of 0.5 to 1.0% higher at least.