

ENCOURAGE MIXES THAT HAVE HIGHER ASPHALT CEMENT(AC) CONTENT

OAPC TOP 10 LIST #2

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Presentation Outline

- ❑ Asphalt Pavement Durability – What Does it Mean?
- ❑ Addressing Durability in Asphalt Pavements
- ❑ Asphalt Cement (AC) Content Impacts on Mixes
- ❑ Industry's Shortcomings
- ❑ Enhancing Asphalt Mix Durability
- ❑ Strategies for Improved Durability
- ❑ Summary & Conclusions
- ❑ Reminder – [Top 10 List/Factsheet\(s\)](#)
- ❑ Q&A

Asphalt Pavement Durability – What Does it Mean?

- ❑ For Asphalt Pavements, “**DURABILITY**” Simply Refers to the Ability to Resist Deterioration as it Ages.
 - The primary distresses associated with durability issues include:
 - Surface Initiated Cracks; and
 - Raveling.



Addressing Durability in Asphalt Pavements

- Key Practices in Addressing Asphalt Pavement Durability/Performance Problems Include Use of:
 - Asphalt binder specifications that limit changes in binder properties under simulated aging;
 - Aggregate specifications that limit the amount of clay and other deleterious materials to guard against breakdown of aggregates during production, under traffic and environmental effects during the service life of the pavement;
 - Limits on volumetric properties to provide a sufficient volume of asphalt binder in the mixture to properly coat the aggregates and to minimize aging during production and the service life of the mixture;

Addressing Durability in Asphalt Pavements

- Key Practices in Addressing Asphalt Pavement Durability/Performance Problems Include Use of:
 - Testing and requirements to ensure that the mixture is not sensitive to moisture; and
 - In-place compaction requirements to minimize permeability which minimizes water infiltration and slows the rate of age hardening in the mixture.




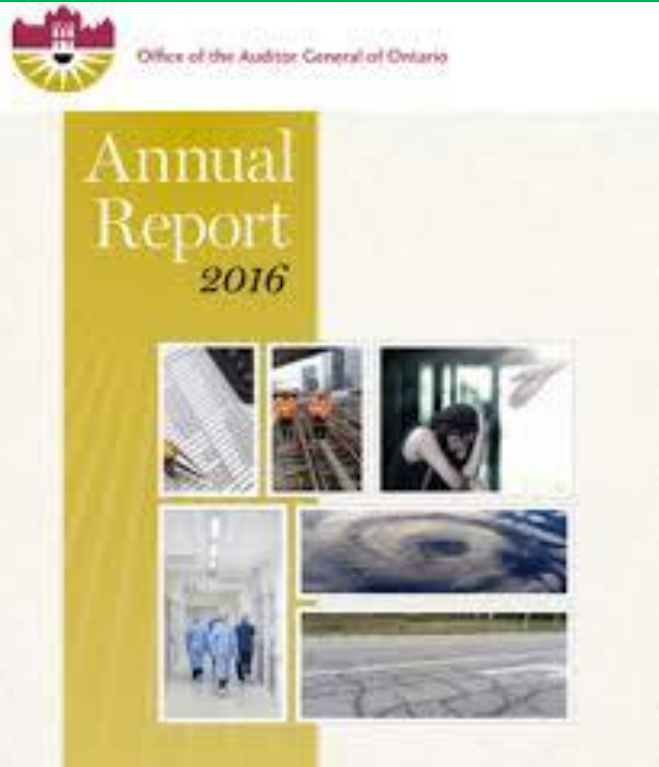
Asphalt Cement (AC) Content Impacts on Mixes

- ❑ Sufficient AC Ensures Durable Pavement
 - Low AC content results in fatigue cracking, dryness or raveling, and brown dull pavement appearance, and 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; and*
 - ❖ *Production automation problems: pumps, weigh bridge, asphalt meter, aggregate moisture, etc.*

Asphalt Cement (AC) Content Impacts on Mixes

- ❑ Sufficient AC Ensures Durable Pavement
 - 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; and*
 - ❖ *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*

Industry's Shortcomings – Quality of Asphalt Reports



Ontario Road Builders' Association


Quality of Asphalt Review

KPMG LLP
August 2018

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Ontario Road Builders' Association


A Review of Ontario Asphalt Industry Practices
Final Report



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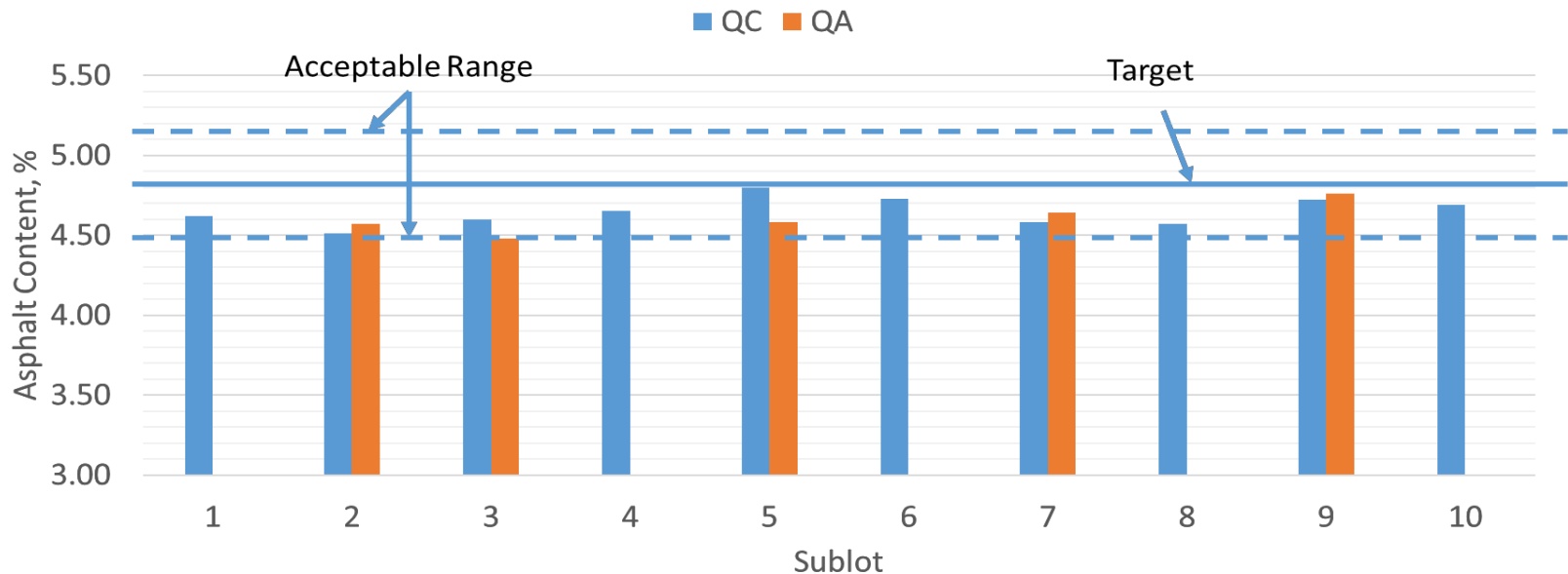


“PERFORMANCE PROBLEMS IN ASPHALT PAVEMENTS RARELY HAVE THEIR ROOTS IN A SINGLE CAUSE”

Industry's Shortcomings – Mix Problems

- ❑ Lack of Asphalt
- ❑ Lack of Room for Asphalt
- ❑ Coarse Gradations

Typical MN
5.0-5.5 for 12.5mm
5.5-6.0 for 9.5mm

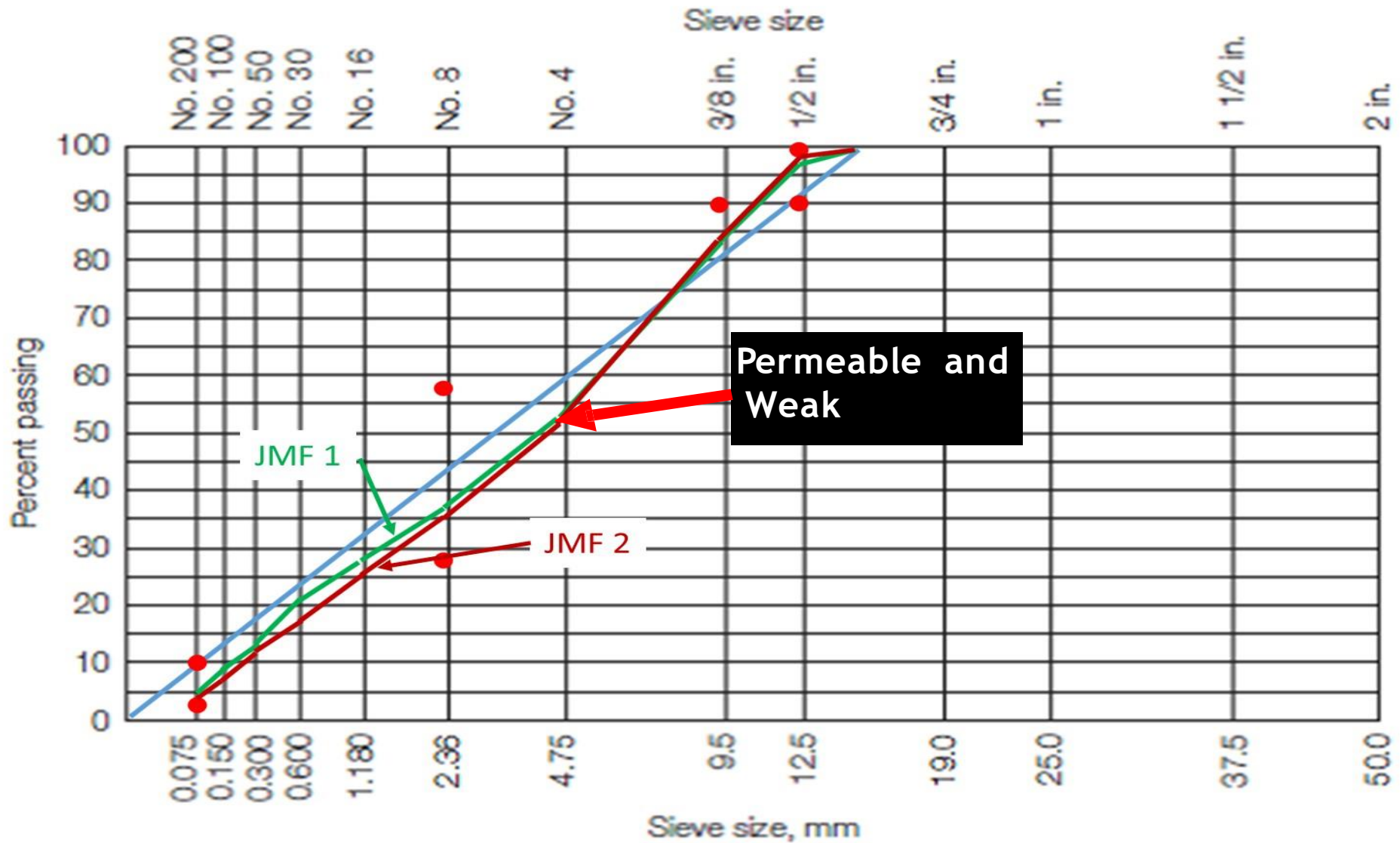


Industry's Shortcomings – Dense Gradation

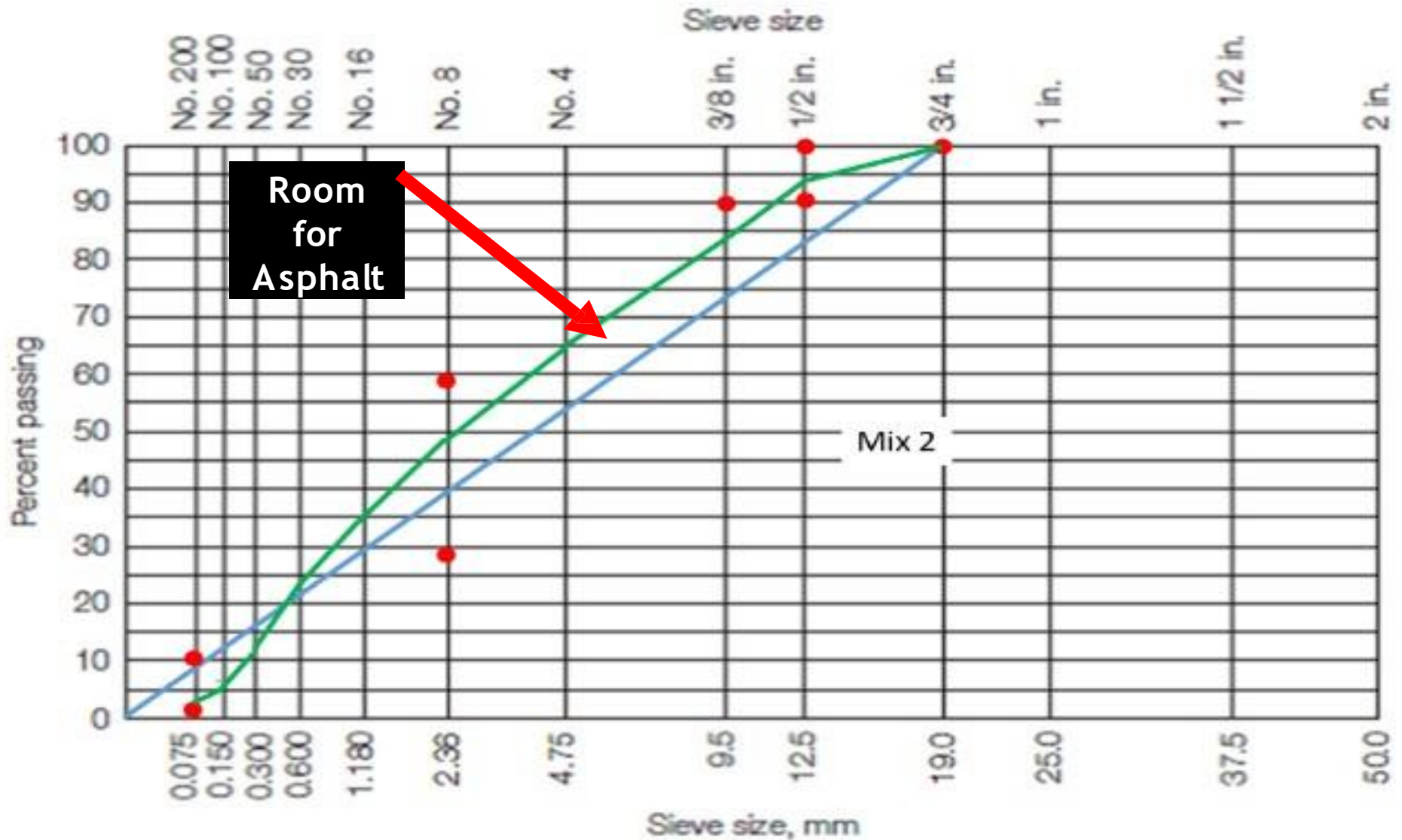
0.45 POWER GRADATION CHART



Industry's Shortcomings – Coarse Gradation



Industry's Shortcomings – Good Gradation!



Enhancing Asphalt Mix Durability

- ❑ To Enhance Durability vis-à-vis Performance, General Practice Recommends:
 - ❑ Designing the mix using a dense gradation of sound, tough, moisture-resistant aggregates;
 - ❑ Maximizing the asphalt film thickness on the aggregate; and
 - ❑ Compacting the mixture to be impervious

Strategies for Improved Durability

- ❑ Some Suggested Options to Address the Issues with Designing Asphalt Mixtures for Improved Durability Include:
 - ❑ Specifying a higher minimum AC content;
 - ❑ Lowering the laboratory compaction effort (number of gyrations);
 - ❑ Lowering the air void content of the mix to allow more asphalt;
 - ❑ Introducing cracking testing on the asphalt mixes prior to finalizing a mix design; and
 - ❑ Implementing the Superpave 5 Volumetric Mix Design Method.

Summary & Conclusions

- ❑ Increasing the AC content in asphalt concrete mixtures should be a high priority for improving pavement performance in Ontario. This can be encouraged by the suggested options discussed in the presentation.
- ❑ 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.

Reminder – Top 10 List/Factsheets

apc
ASPHALT PAVEMENT COUNCIL

TOP 10 LIST

WAYS TO GET MORE DURABLE HMA PAVEMENTS

- 1 DO YOUR HOMEWORK**
Evaluate the existing pavement condition and perform a proper pavement design to determine the appropriate thickness. Select the right mix and PGAC for the project.
- 2 ENCOURAGE MIXES THAT HAVE HIGHER AC CONTENT**
Studies have shown that mixes with higher AC out-perform those with lower AC contents. How to best do this in Ontario needs further evaluation.
- 3 SPECIFY A FINER GRADATION FOR YOUR MIX TYPE**
Finer Superpave mixes will typically have higher AC content and are more durable and less prone to segregation.
- 4 DON'T OVER HEAT THE MIX**
Overheating the mix will result in premature oxidation and cracking. Specifying WMA asphalt may help alleviate these concerns during late season paving.
- 5 INCLUDE ADEQUATE SURFACE PREPARATION IN THE PLANS**
Suitable surface preparation should be allowed for in the contract documents to ensure the construction of smooth roads.
- 6 ENSURE ADEQUATE BOND**
Proper tack coat application ensures that the pavement will perform as designed and mitigate premature cracking. Good tack coating will also improve compaction.
- 7 PROVIDE PROPER PAVEMENT DENSITY**
Compacting the mat to the required specification limits will ensure long term durability, lower oxidation (ageing) and reduced permeability.
- 8 PRODUCE MIX THAT IS UNIFORM AND CONSISTENT**
HMA that is produced to consistently meet the JMF and the specification requirements will perform better.
- 9 USE RAP RESPONSIBLY**
RAP should be utilized in accordance with the contract requirements. For higher percentages of RAP i.e. greater than 15-20 % a softer PGAC should be incorporated in the mix.
- 10 COMPLETE QUALITY ASSURANCE (QA) TESTING AND INSPECTION**
Proper QA and inspection conducted by qualified technicians and inspectors should be part of any HMA paving project to ensure long term performance.

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❑ Technical Articles and/or Factsheet(s) Available in Asphalttopics Magazine – see www.onasphalt.org

❑ Item(s) #1, 2, 5, 6, 7, 8 & 9 - Complete

❑ Look out for Item(s) #3, 4 & 10 – This Fall.

