Use of Polyphosphoric Acid Modified Asphalt Cement
– Ontario Perspective -

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Presentation Objectives

- Share Ontario experience on developing ways to risk manage the use of PPA, with focus on the need to meet performance without stifling the technology.
- Steps involved:
  1. **Environmental scan – Ontario and other jurisdictions**
  2. **Identifying issues/concerns/benefits**
  3. **Industry consultation – consensus building**
  4. **Develop risk management plan**
  5. **Specs revision and implementation**
  6. **Monitoring and review options**

Environmental Scan - Why Taking Action?

- Other DOTs had pavement failure due to PPA
- Survey showed significant DOTs are banning the use
- Questionable long-term performance raised in multiple reports
- Ensuring Ontario is not at risk of building less than optimum quality roads
- Answer the fundamental question of if our concern warrants any actions.

Environmental Scan - FHWA Report

- High Temperature improvements were reversed by the reaction between the acid and hydrated lime or amine anti-strip
- Nullifies the effect of amine anti-strips
- Cracking of I-80 in Nebraska, 186 cracks/mile with acid, 6 without
- Responsible for road failures in KS, OK and MO?

Environmental Scan - DOTs Surveys

"Do you allow the use of acid modified binder?"

AASHTO - 2006	Nebraska - 2005
• 58% (18 DOTs) – NO	• 45% (14 DOTs) – NO
• 13% (4 DOTs) – Cond*	• 13% (4 DOTs) – Cond*
• 29% (9 DOTs) – Yes	• 13% (4 DOTs) – Yes
	• 29% (9 DOTs) – concerns

*** Conditional: have specifications to limit or eliminate the use of acid modified AC without a complete ban**

Environmental Scan – Ontario Pavements

- Ontario experienced a number of unexplained poor performance (rutting, flushing, instability, cracking) that may be linked to acid modified PGAC - 20 contracts identified since 2004
- 50 % of 2005 HMA may be impacted by PPA with ASA, lime, limestone

Environmental Scan – Ontario Supplier Survey

- 11 of 13 suppliers do not supply PPA modified PGAC
- 1% PPA increases T_h by 9°C and lowers T_L by 1°C
- Addition of lime reverses PPA mod/ Reversal may only occur when lime added at high temp.
- Don't support use of PPA because of reversibility
- PPA can interact with amine ASA and render it ineffective
- Too much PPA may adversely impact overall performance
- Important to use phosphate ester ASA. Phosphate ester ASA not effective with some siliceous agg.
- PPA can enhance ASA effectiveness
- Had handling issues with PPA at the plant
- Require supplier to state any compatibility issues

Issues/Concerns/Benefits

- Can neutralize or reverse effects of ASA, especially amine-based additives, increasing moisture damage
  - All Ontario's liquid ASA are amine-based
  - Phosphate ester ASA do not perform well with some Ontario siliceous aggregates
- Gain in T_h grade may be reversed with added lime/amine anti-stripping additive (ASA), resulting in pavement rutting
- Benefits may be negated depending on the aggregate type
- >1% PPA may adversely impact overall HMA performance
- Increases viscosity by accelerating oxidation of the resin, reducing durability and cracking resistance

Issues/Concerns/Benefits

- Can improve high temperature performance of PGAC with minimum effect on low temperature grading
- Can enhance moisture resistance of HMA
- Cheaper than polymer modification
- Low dosage can be used as a catalyst
- Stiffening of AC could be beneficial for lower pavement lift

Industry Consultation

- Set up a task group to develop options based on technical information.
- Do not want to stifle the technology, but to risk manage the potential problems associated with inappropriate dosages used, especially when not all facts are known to define the level of risk.

Industry Consultation

- Identify outstanding issues & mitigation methods
  - ***What are the long term mix and pavement performance issues?***
    - **Premature aging – cracking?**
    - **Reversal of benefits – rutting?**
    - **Nullifies effect of ASA – stripping?**
  - ***How can agencies identify, mitigate and monitor the optimum use of PPA?***
    - **Specs/protocol/administrative procedures to eliminate potential negative reactions with amine-based ASA and etc?**
    - **Test methods for acceptance?**
    - **Ensuring no orthophosphoric (green) acid?**

Risk management Plan – Short Term (1)

Special Provision to include:

- PGACs (70-28, 70-34, and 64-34) for heavy duty highways, not to be acid modified except 0.5% max as catalyst for polymer AC modification.
- Ministry will audit - testing by NMS
- PGAC for lighter traffic roads, max 1% to increase high temperature grade by one.
- Contractor to provide statement from AC suppliers that PGAC meets contract requirements when ASA is added at the suppliers' depots.

Risk management Plan – Short Term (2)

Designated Source Manual (DSM) to include:

- Protocol requiring suppliers to submit information confirming if their ACs were acid modified.
- QC plan submission for DSM to declare which AC contains acid with range of dosages and compatibility with ASA. Suppliers are to inform Ministry any changes made to their supplies in an ongoing basis.

Risk management Plan – Medium Term

- Monitor and conduct audit testing of ACs supplied to contracts and compile data on AC used and performance, particularly on problem contracts with potential AC related failures.
- Track developments and studies by other jurisdictions an organizations.
- Review all findings and policies, and revise specifications requirements when more information become available. **(*Winter 2009*)**

Concluding Remarks

- Proactive actions taking to tackle the issue.
- Actions were based on consensus building with full buy-in to the approach between user and suppliers.
- By limiting the dosage of PPA to certain grades of AC considered good way to risk manage the problem.
- Since implementation of the measures, less failure has been suspected.

Ontario

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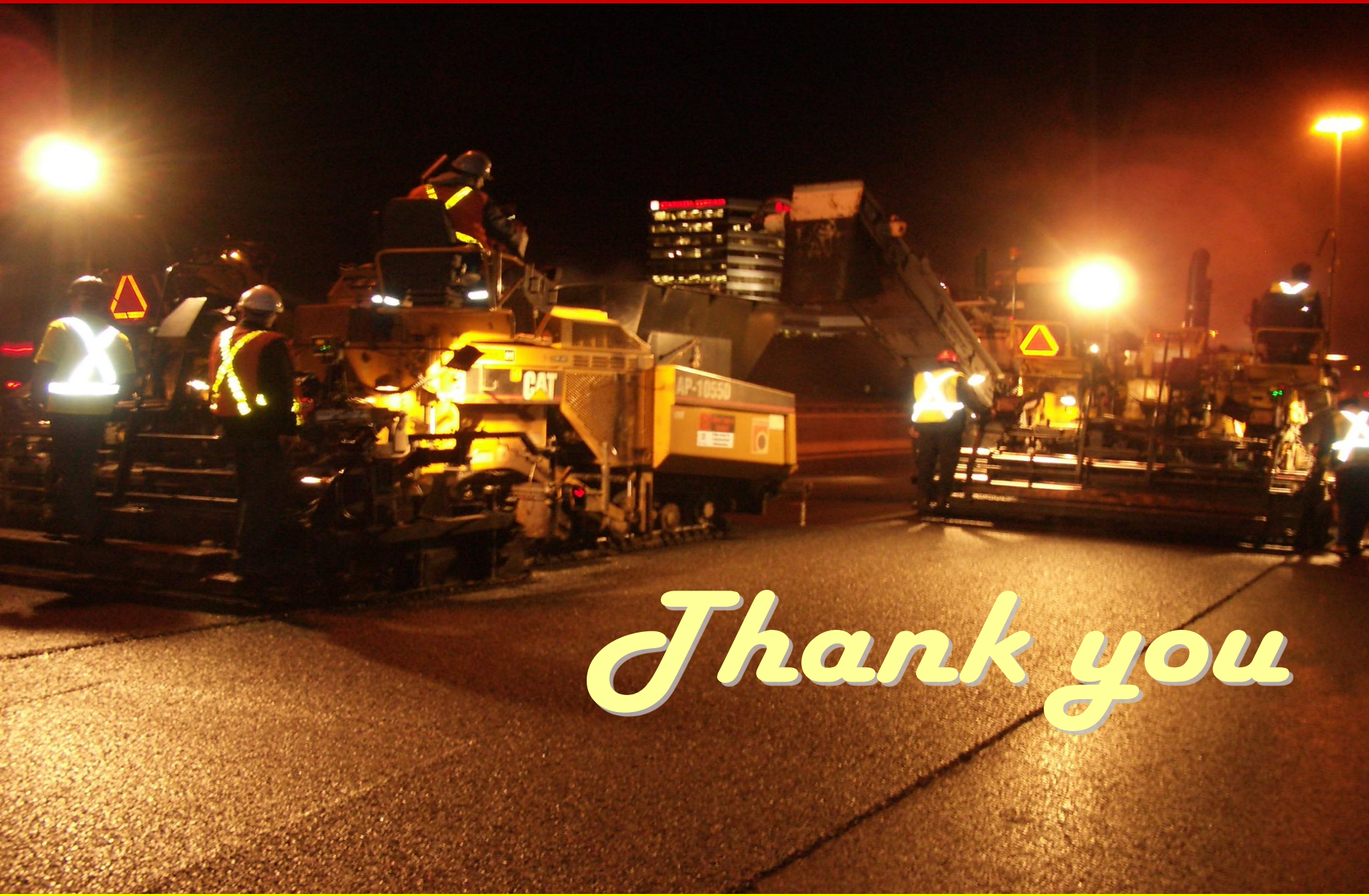

Thank you