Practical Approach to Rehabilitation of Aged Airport Concrete Pavements

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PRESENTATION OUTLINE

- Introduction
- Aged airside concrete pavements
- Distresses
- Maintenance, repairs, rehabilitation
- Case study
- Summary

INTRODUCTION

- **Objectives**
  - Sharing observations from airports in Canada
  - Sharing practical experience and solutions

INTRODUCTION

Based on observations at airports in Canada

- Saskatoon
- Edmonton
- Toronto (Pearson)
- Thunder Bay
- London
- Sudbury
- Vancouver

INTRODUCTION

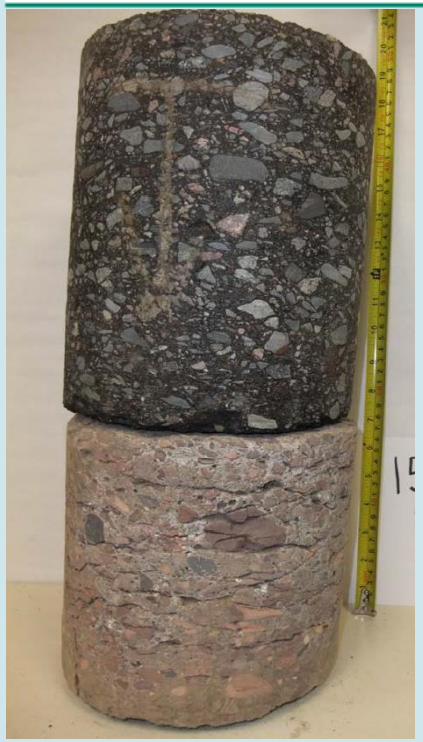
- Part 1 – Aged concrete pavements condition, distresses, applied maintenance/repairs and rehabilitation

- Part 2 – Case Study from Saskatoon International Airport
  - Engineering
  - Rehabilitation design
  - Construction

AGED CONCRETE PAVEMENTS

- Typical expectation – PCC pavements to last 30 years
- Numerous pavements significantly older
- Transport Canada
- Engineering, design, QA, acceptance
- Exhibit extensive distresses mainly in heavily loaded areas
- Pavements originally designed to carry much lower aircraft traffic than currently

AGED CONCRETE PAVEMENTS



Engineering required

- Pavement visual condition inspection (ASTM D5340)
- Borehole and coring investigation
  - Soils, moisture, layers type and condition
- Laboratory testing
- FWD Load Transfer Efficiency (LTE) testing
- Drainage inspection

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DISTRESSES

Typical distresses

- Longitudinal and transverse cracks of various severity (low to high)
- Corner breaks, joint and crack spalling, D-cracking, scaling, faulting, pumping of fines
- Low to severe Alkali Silica Reactivity (ASR) damage
- Typically poor drainage

MAINTENANCE, REPAIR, REHABILITATION

- Low severity distresses, mainly cracking
  - Do nothing or stop gap
  - Monitoring condition
  - Checking for FOD potential

MAINTENANCE, REPAIR, REHABILITATION

- Medium severity
  - Crack filling
  - Crack routing and sealing
  - Crack epoxy repair
  - Crack repair with HMA
  - Joint spall repairs – partial depth
  - Corner breaks
  - Joint resealing

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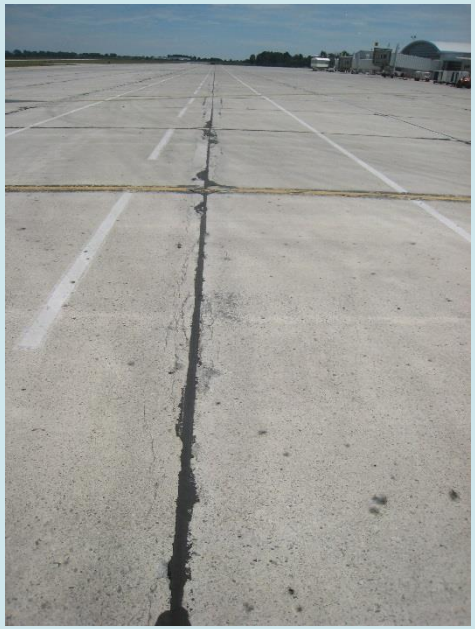
MAINTENANCE, REPAIR, REHABILITATION

- High severity
  - Structural failure
  - Very severe cracks
  - Shattered slabs
  - Severe faulting
  - Severe corner breaks
  - Severe D-cracking and scaling

MAINTENANCE, REPAIR, REHABILITATION

- Identify the cause of distresses
- Determine LTE
- Pavement rehabilitation
  - Soil and moisture condition
  - Granular layers, CTB or fillcrete
  - Stitching
  - Dowel bars retrofitting
  - Slab replacement (the same thickness)
  - Structural HMA overlay
  - Bonded concrete overlay (?)
  - Reconstruction

MAINTENANCE, REPAIR, REHABILITATION



- Joints
  - Keyway
  - Sawcut
  - Dowel and tie bars
- Specifications
  - As covered in morning's presentation
  - Based on practice and experience in Canada
  - Some aspects from FAA specifications

MAINTENANCE, REPAIR, REHABILITATION

- Taxiway and apron yellow line versus joint locations

MAINTENANCE, REPAIR, REHABILITATION

- ASR damage
  - Low severity
  - High severity
  - Current concrete mix design
  - Action required in old pavements

MAINTENANCE, REPAIR, REHABILITATION

- Drainage
  - Surface
  - Subsurface – subdrain systems

CASE STUDY

Saskatoon International Airport

- Aprons 2, 3 and 5
- Concrete pavement repairs and rehabilitation
- Years 2015 to 2017

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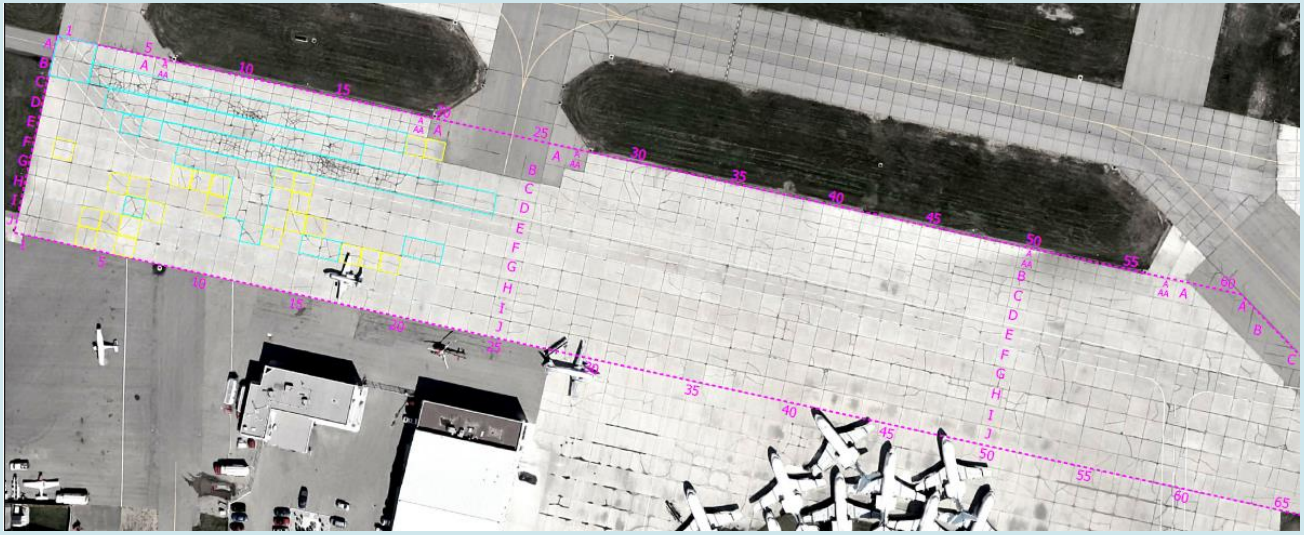
CASE STUDY

Engineering

- Pavement visual condition inspection
- Borehole and coring investigation
- Laboratory testing
- Pavement rehabilitation design



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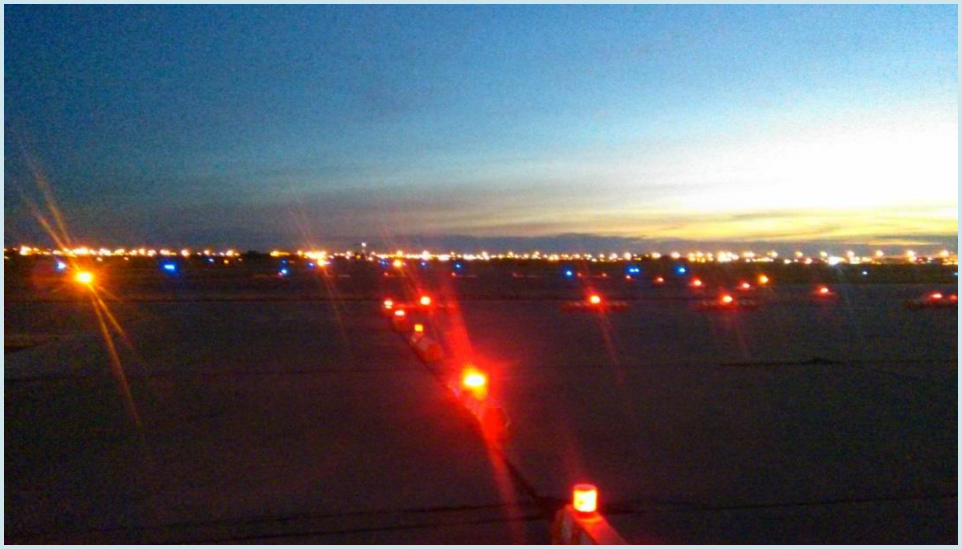
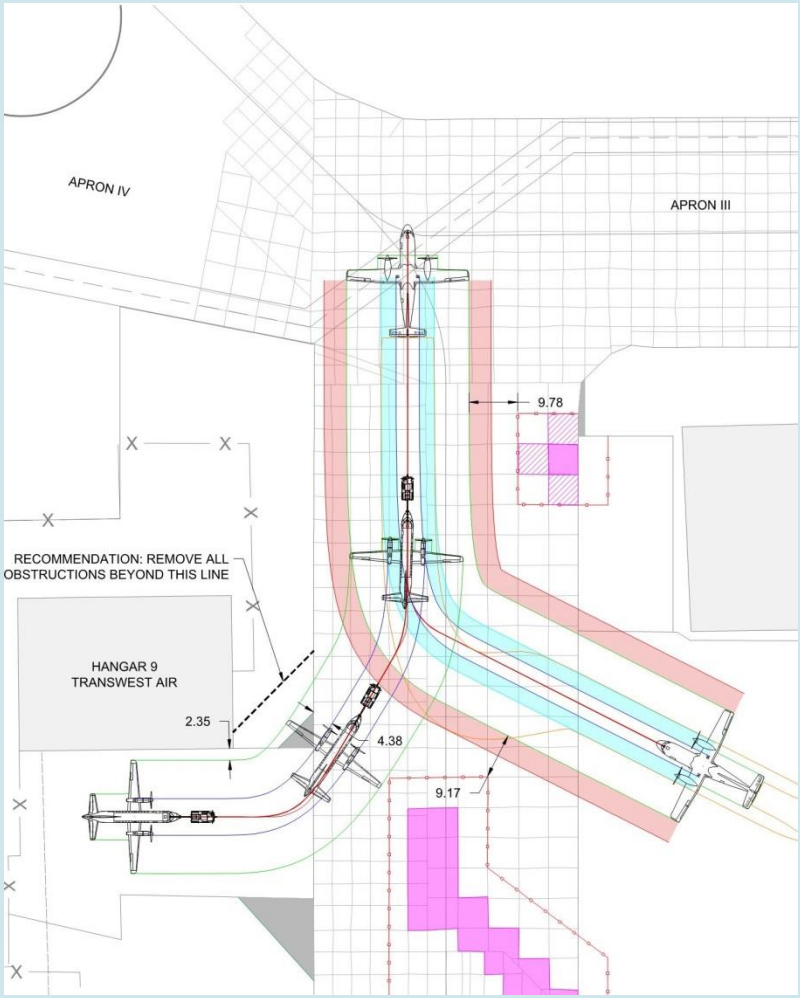
CASE STUDY

Operational Considerations

- Closures are disruptive
- Need to accommodate scheduled and irregular operations

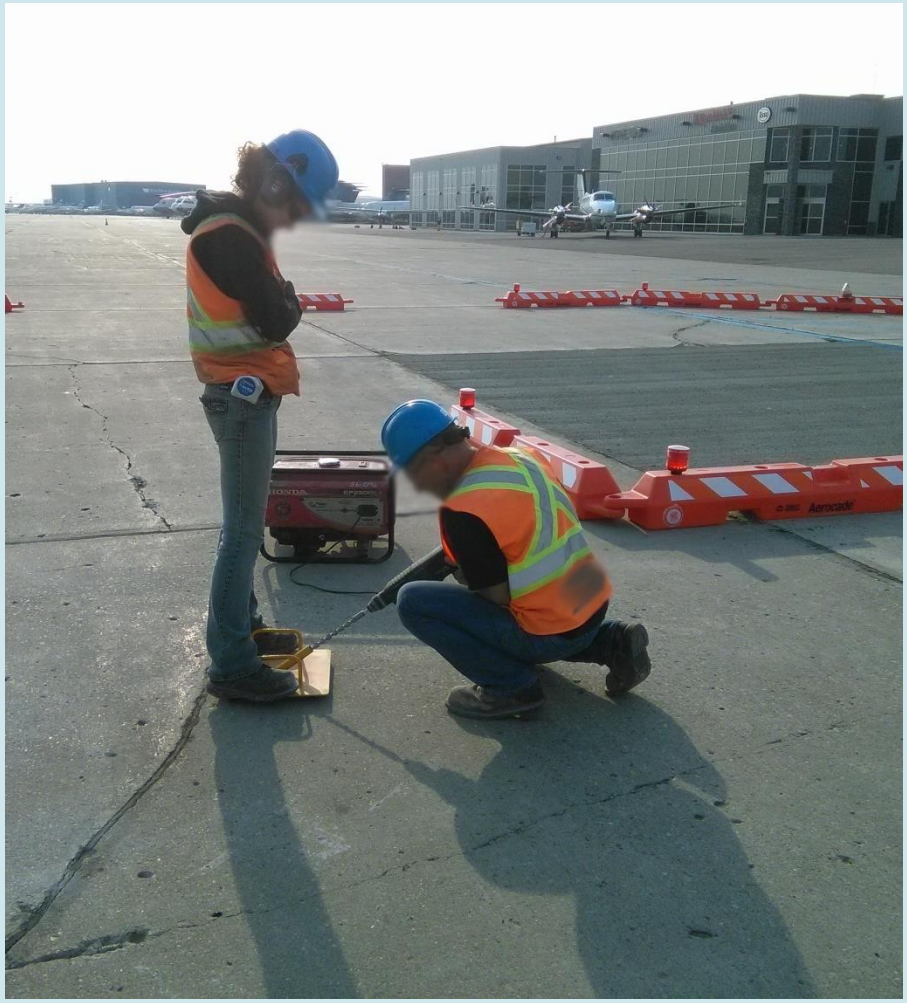




CASE STUDY

Cross Stitching

- Helps to immobilize low and medium severity cracks
- Low cost and low operational impact
- Part of a larger long term solution



CASE STUDY

Concrete Removal

- Requires brute force
- Avoid damaging more areas with sawcutting

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CASE STUDY

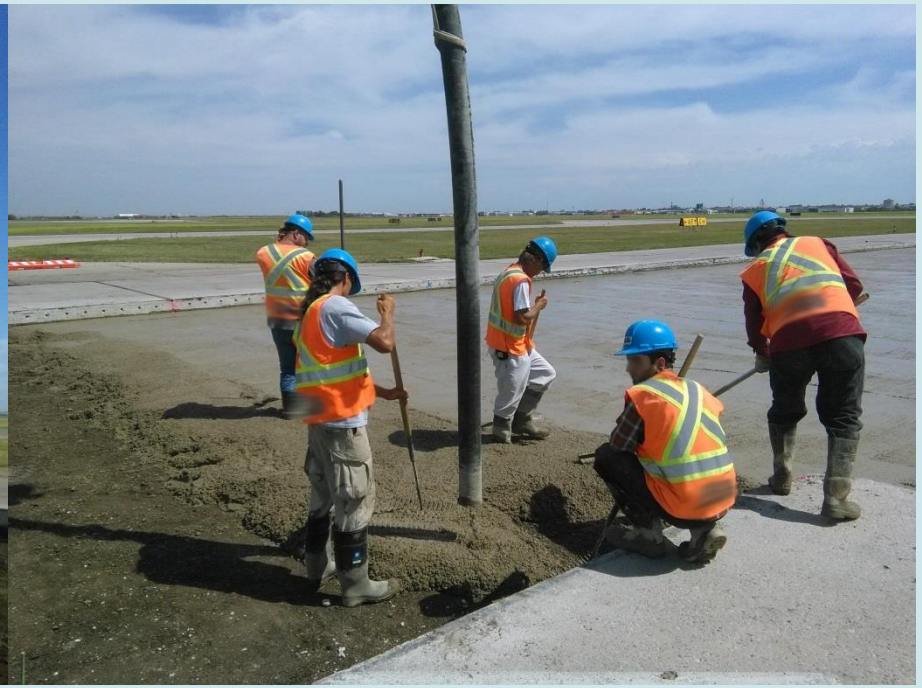
Poor Granular Base

- Hydrocarbon contamination
- Soft subgrade and granular

CASE STUDY

Poor Granular Base

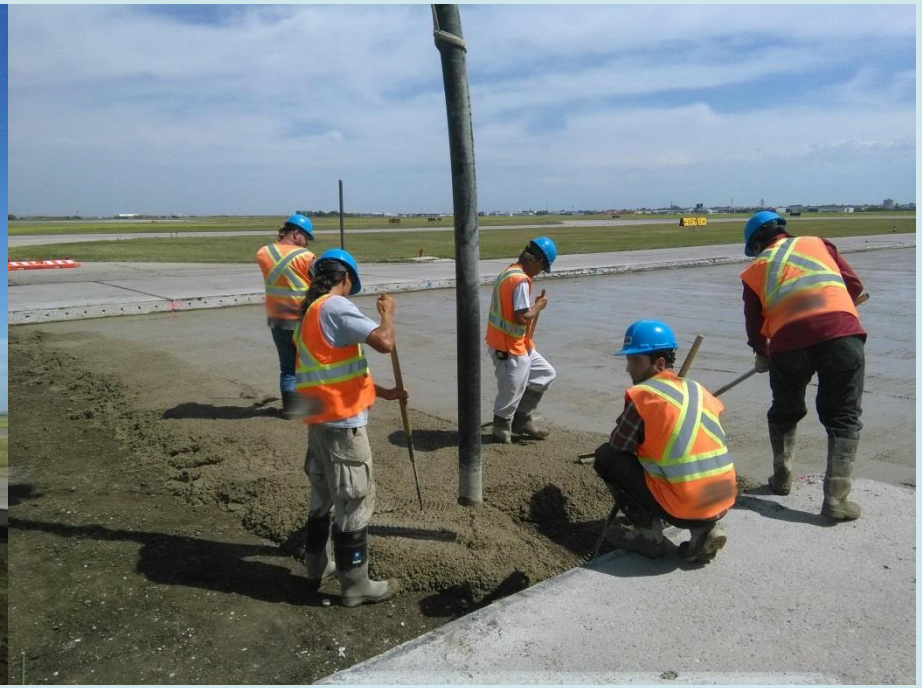
- Fillcrete replacement
- Grade control is critical



CASE STUDY

Poor Granular Base

- Fillcrete replacement
- Grade control is critical



CASE STUDY

Dowel Installation

- Important that dowels are level and square

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CASE STUDY

Formwork

- Alignment and Grade control is critical

CASE STUDY

Concrete Placement

- Pump trucks can accelerate work
- Important to manage concrete supply rates
- Finishing is time sensitive

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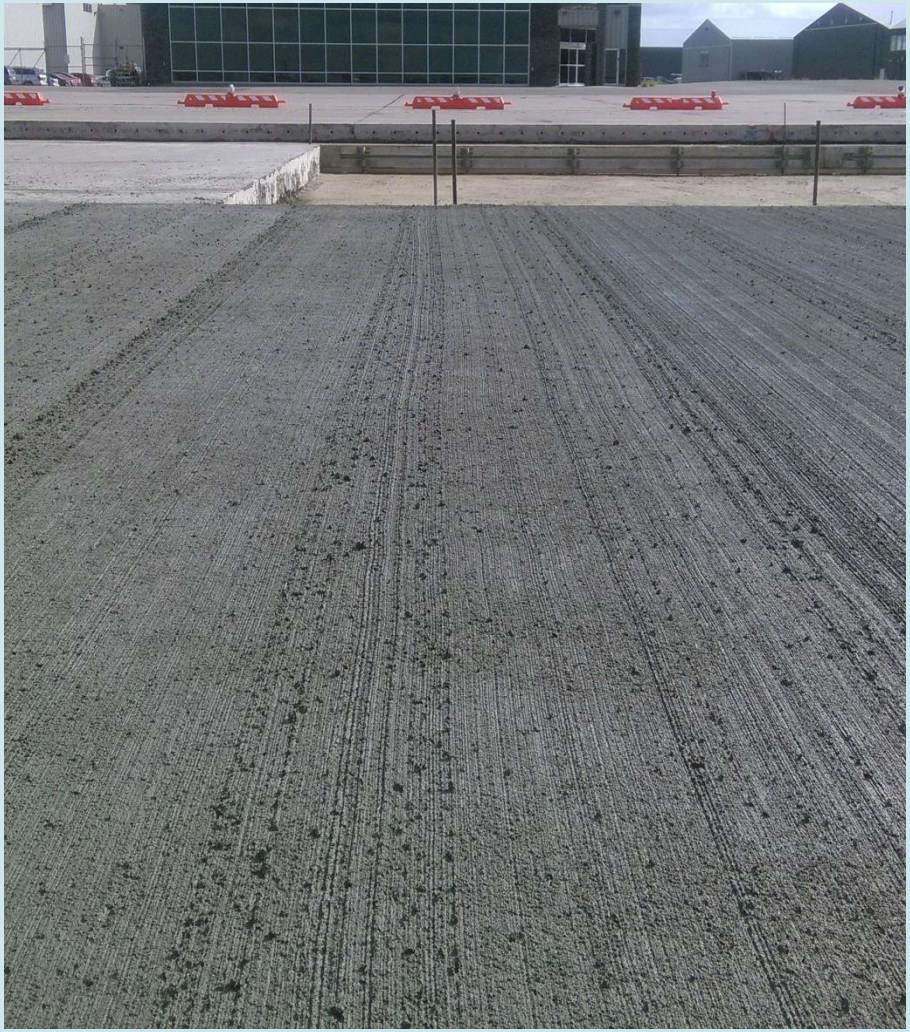
CASE STUDY

Finishing and Curing

- Curing needs to match the conditions
- Finishing is very time sensitive



CASE STUDY

Green Cutting

- Time is of the essence
- Great variability due to weather and mix design

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CASE STUDY

Joint Sealing

- Alignment is crucial
- Consider fuel resistance and curing times

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CASE STUDY

Finished Product

- 128 panels replaced on Aprons II, III & V since 2015

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SUMMARY

- Numerous airports have 40 to 60 years old concrete pavements
- They typically exhibit extensive distresses
- Full reconstruction rarely an option due to the extent of work, cost and impact on airport operation
- Extensive experience with repairing of low, medium and high severity distresses and pavement rehabilitation
- Include proper engineering

SUMMARY

- In PCC pavements rehabilitation
  - Realize they were originally designed for lower traffic than they are carrying now
  - Yellow line versus joints location
  - Check for ASR damage and protect
  - Take care during pavement construction
  - Many factors and details can affect the service life of replacement pavements

THANK YOU!

QUESTIONS?

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