Why Ontario Lands On Us! HMA is the Standard for Runways Everywhere

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PRESENTATION OUTLINE

- Introduction
- Asphalt runways in Canada
- Why is HMA so widely used for airside pavements?
- Basics of HMA in airport application
- Improvements in design, materials and construction
- Importance of proper specifications
- Effective maintenance and preventive treatment
- Pavement sustainability
- Summary

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INTRODUCTION

- Airside pavements include runways, taxiways, aprons

- 90 % of airport pavements in North America are asphalt
- In Canada the proportion is between 80 – 85 %

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ASPHALT PAVEMENTS IN NORTH AMERICA

- Asphalt works well in all climatic zones
- Wide application across Canada and North America
  - Hot regions – California (Oakland, Sacramento) and other States in the US
  - Moderate regions – Southern Ontario (GTAA, Waterloo Airport, Hamilton Airport), British Columbia (Vancouver)
  - Cold regions – Northern Ontario (Sudbury), Alberta (Edmonton), Labrador (Churchill Falls), Alaska (Anchorage)
  - Arctic condition – Nunavut (Iqaluit)

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AIRSIDE ASPHALT PAVEMENTS IN CANADA

- In the past the guidance for pavement and materials technology was provided by Transport Canada
- Since privatization this practice has gradually been changed
- Current practice involves mixture of
  - Previous guidance from Transport Canada
  - Provincial technology
  - Some influence from US Federal Aviation Administration
- AAPTP program
  - Pavement construction, maintenance and rehabilitation activities for airfield pavements

Airfield Asphalt Pavement Technology Program

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WHY IS HMA SO POPULAR?

- Extensive design and construction experience
- Good contractors available
- Good quality of materials - aggregates, asphalt cements and mixes
- Good quality of final product
- Proven history of long-term performance
- Cost effective – initial and life cycle
- Significant improvement in technology
- Easy maintenance and preventive treatments
- Sustainable

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HMA IN AIRSIDE PAVEMENTS

- Study/comparison of airside asphalt practice in Canada by Golder for SWIFT in 2008
  - Included PWGSC and DND practices and large and medium size airports
- Mainly Marshall mixes
- Superpave PGAC system widely used
- Aggregate type and quality selected for anticipated traffic loading
- In surface course target laboratory air voids reduced to 3.5% - channelized traffic and less traffic sealing action
- Limited use of RAP

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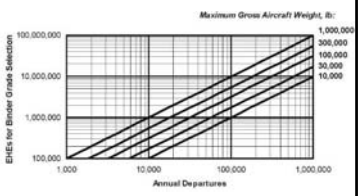
HMA IN AIRSIDE PAVEMENTS

- Construction
  - Echelon paving commonly required
  - Few airport required material transfer vehicle (MTV)
- Smoothness requirements in specifications
- Friction characteristics specified by very few airports
- Acceptance
  - Asphalt cement content
  - Gradation
  - Laboratory air voids
  - Marshall stability
  - Field compaction
  - Joint compaction – very few airports
  - Smoothness

TECHNOLOGY IMPROVEMENTS

- Pavement Design
  - Originally TC ASG 19 sometimes verified using FAA and ICAO methodologies
  - FAARFIELD
  - FAA methodology for rehabilitation and overlays
- Asphalt Cement
  - Performance Graded Asphalt Cement
  - Binder grade selection for airfield pavement based on equivalent highway ESALs (EHE)
    - address tire pressure and wander
  - Polymer modification
  - Improved testing



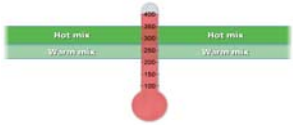
TECHNOLOGY IMPROVEMENTS

- Aggregates
  - Move from LA abrasion to MicroDeval
  - High quality aggregates specified for heavy aircraft traffic

- Mixes
  - Superpave and SMA – near future?
  - Mechanistic properties testing
    - dynamic modulus
    - rutting resistance
    - fatigue endurance
    - low temperature cracking resistance

TECHNOLOGY IMPROVEMENTS – MIXES

- Warm Mix Asphalt
  - Benefits – reduced fuel use; late season paving; better workability and compaction; less oxidation; reduced GHG; improved working conditions



  - Technology Categories
    - Organic additives (Sasobit)
    - Chemical additives (Evotherm, Hypotherm)
    - Water bearing additives (Advera)
    - Water based processes (Foaming)

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TECHNOLOGY IMPROVEMENTS – MIXES

- Warm Mix Asphalt
  - OPSS Special Provision for mix design
  - NCHRP 9-43 WMA Mix Design process
    - Material selection
    - Design aggregate structure
    - Design asphalt binder content
    - Evaluate moisture susceptibility
    - Rutting resistance
    - Mix performance

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TECHNOLOGY IMPROVEMENT – CONSTRUCTION PRACTICE

- Echelon Paving
  - Eliminating cold joints
- Use of MTV
  - Eliminating gradation and temperature segregation
  - Continuous paving operation
  - Improved smoothness
- Joint Construction
  - Golder's 2009 paper on Innovative Durable Joint Construction
  - Specified joint compaction
  - Eliminating cold joints
  - Infrared heaters
  - WMA
  - Better construction practice for cold joints

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TECHNOLOGY IMPROVEMENT – LATE SEASON PAVING

- Main issues to address
  - Hard to get compaction
  - Hard to get good joints
- Solutions
  - Plan for late season work
  - Technical solutions
    - Thicker lifts
    - Tarps to retain heat
    - Heated and insulated truck boxes
    - Preheating screed and rollers
    - MTV
    - Infrared heaters
    - WMA

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AIRSIDE ASPHALT PAVING SPECIFICATIONS

- Critical importance
- Address major aspects of airside pavements
  - Climatic zones – AC grade and mix moisture susceptibility
  - Asphalt cement availability
  - Locally available aggregates
  - Local practice
  - Mix strength
  - Frictional characteristics
- Specific requirements and challenges for airports in far north and in the arctic

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EXAMPLE OF RECENT RUNWAY ASPHALT PAVEMENTS

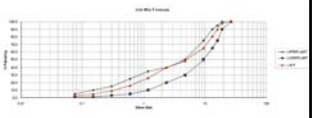
- Waterloo International Airport, Ontario
- Edmonton International Airport, Alberta
- Greater Sudbury Airport , Ontario
- Price Rupert Airport , British Columbia
- Churchill Falls Airport, Labrador

WATERLOO INTERNATIONAL AIRPORT

- Carried out geotechnical and pavement investigation on Runway 08-26
- Provided recommendations for rehabilitation based on existing pavement condition, climate and traffic
- PLR 9.8
- Tire pressure > 1.0 MPa

WATERLOO INTERNATIONAL AIRPORT

- Developed custom specifications for materials and construction
  - PGAC 70-28 PM to provide good resistance to permanent deformation and durability
  - High AC content to minimize oxidation
  - Gradation to provide good texture and frictional properties
  - Paving in echelon to minimize cold joints
  - Infrared heaters for good quality joints
- Construction monitoring and materials testing to ensure quality product
- Good cooperation between all team members to resolve issues in a timely manner



CHURCHILL FALLS AIRPORT

- Very difficult soil and climatic conditions
- Remote location with limited availability of good quality materials
- Various rehabilitation alternatives and life cycle cost analysis
- Custom specifications
  - Granular materials with good drainage characteristics
  - AC grade to accommodate extreme cold temperatures
  - Polymer modified AC to provide good durability
  - Mix gradation to provide good texture

CHURCHILL FALLS AIRPORT

- Experienced pavement specialist on site full-time to monitor paving and address concerns immediately
- Do not compromise on material and mix quality due to remoteness
- Final quality of pavement was excellent

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MAINTENANCE AND PREVENTIVE TREATMENTS

- Very extensive experience
- Simple and effective
- Works best when the right treatment is applied at the right location and time
- Main distresses to be addressed:
  - Structural – rutting (rare) and fatigue cracking
  - Environmental – thermal and block cracking, frost heaves and depressions
  - Construction related – longitudinal cracking, raveling
  - Other distresses – asphalt shoving and joint sealant debonding

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MAINTENANCE AND PREVENTIVE TREATMENTS

- Treatments Include
  - Crack sealing/filling
  - Surface grooving
  - Patching
  - Surface rejuvenating
  - Micro milling
  - Thin surfacings – surface treatments, slurry seals, micro surfacing, thin overlays
  - Hot in-place and cold in-place recycling




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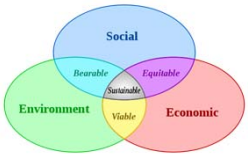
AIRSIDE ASPHALT PAVEMENT SUSTAINABILITY

- What is sustainability?

Sustainable development is defined in the Brundtland Report in 1987 as:

> "….. development that meets the needs of the present without compromising the ability of future generation to meet their needs"

- Triple bottom line
  - To achieve sustainability three aspects need to be considered
    - Economic – associated costs
    - Environment – impact to our surroundings
    - Social – impact on the general public
  - Technical aspects also need to be considered in addition to the triple bottom line to achieve sustainability



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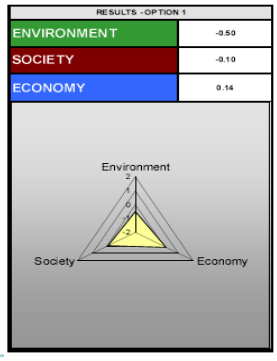
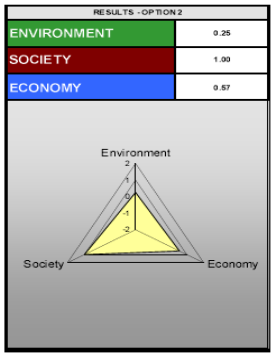
Sustainable Pavements

- Sustainable Pavements – safe, efficient, durable, minimum impact on environment
- Criteria
  - Minimize use of natural resources
  - Recycling – asphalt is 100% recyclable
  - Reduced energy consumption
  - Reduced GHG emissions
  - Limiting pollution
  - Improving safety and risk prevention
  - Reduced user delay and increased comfort
  - Longer lasting
  - Innovative
- Cannot compromise pavement performance

ASPHALT PAVEMENT SUSTAINABILITY

- Long lasting (perpetual) pavements
  - Red Hill Valley Parkway in Hamilton
  - GoldSet system used for sustainability analysis
  - 5 years after construction pavement condition is excellent





SUMMARY

- More than 80% of airside pavements in Canada are asphalt
- Well established technology that provides good pavement performance
- Important recent improvements have significant impact on performance
- Proper paving specifications are critical
- Importance of proper and timely application of maintenance and preventive treatments
- Asphalt pavements are sustainable

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THANK YOU!

QUESTIONS?

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