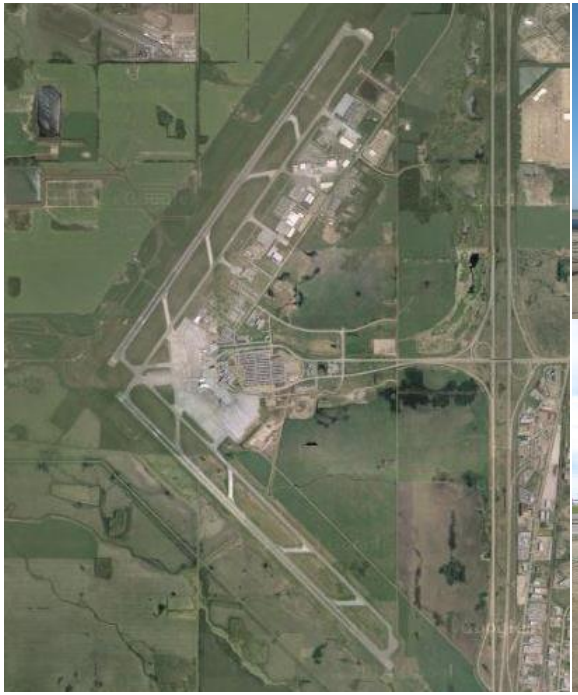
ADVANCED PAVEMENT TECHNOLOGY USED FOR REHABILITATION OF RUNWAYS AT EDMONTON INTERNATIONAL AIRPORT



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ACKNOWLEDGEMENTS

- Richard Hart, Park Paving
- Kris Bourgeois, P.Eng., MMM Group Limited
- Pearl Leung, EIT, MMM Group Limited

PRESENTATION OUTLINE

- Introduction
- Pavement Investigation and Design
- Specification Development
- Construction
- Conclusions

INTRODUCTION

- Located in Leduc, Alberta
- Serves about 7 million passengers each year
- Flights – domestic and international
- Airside pavements include:
  - Runways 02-20 and 12-30
  - Network of taxiways
  - Multiple aprons
- Project included multi-year rehabilitation of both runways

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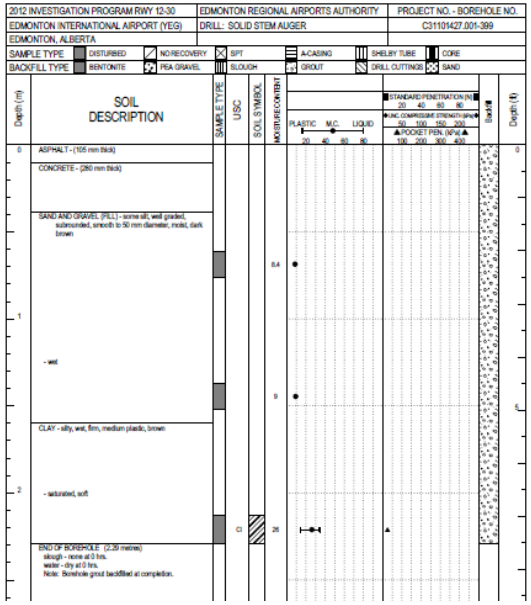
PAVEMENT INVESTIGATION

- Review information from previous investigations
- Limited new geotechnical investigation by others
- Pavement visual condition inspection
- Limited Falling Weight Deflectometer (FWD) testing
- Limited Ground Penetrating Radar (GPR) survey

RUNWAYS 02-20 AND 12-30

- Original old concrete pavement overlaid with asphalt

- Typical pavement structure
  - 70 to 120 mm of HMA
  - 280 to 310 mm of PCC
  - > 600 to 1000 mm of granular base/subbase
  - Clay and silty clay subgrade



VISUAL INSPECTION FINDINGS

- Pavement distresses
  - Medium to high severity reflective cracking of PCC joints and cracks
  - Severe map cracking
  - Spalling
  - Localized severe ravelling

VISUAL INSPECTION FINDINGS

- Pavement distresses
  - Pumping
  - Permanent deformation

VISUAL INSPECTION FINDINGS

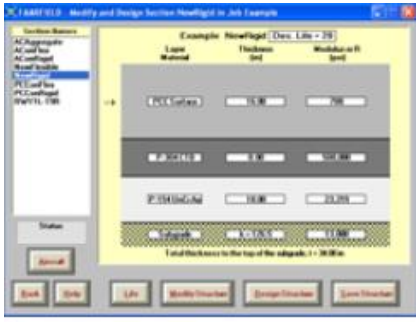
- Pavement distresses
  - Asphalt shoving

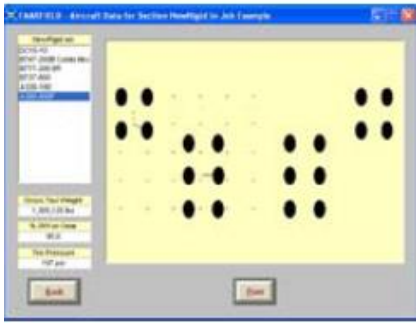
VISUAL INSPECTION FINDINGS

- Causes of distresses
  - Poor asphalt durability
  - Asphalt stripping
  - Poor condition of underlying concrete – joints and cracks
  - Drainage issues
  - Unsuitable asphalt mixes

REHABILITATION DESIGN

- Safety of the travelling public and minimizing potential for Foreign Object Debris (FOD)
- Minimize the need for emergency closures
- Staging of rehabilitation to minimize delays and impacts on airport operation;
- Time constraints
- Budget constrains





- FAA methodology

REHABILITATION DESIGN

- Rehabilitation sequence
  - End 02 of Runway 02-20;
  - End 12 of Runway 12-30;
  - End 20 of Runway 02-20;
  - End 30 of Runway 12-30;
  - Centre portion of Runway 12-30
  - Centre portion of Runway 02-20.

REHABILITATION DESIGN

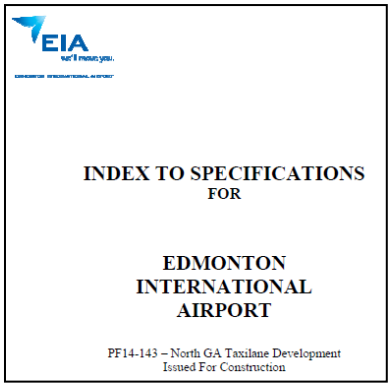
- First year of the multi year program
  - Rehabilitation of 900 m of Runway 02-20 starting from the Runway 02 threshold;
  - Limited treatment on the Touchdown Area 12 on Runway 12-30;
  - Limited treatment on the Touchdown Area 30 on Runway 12-30
  - Emergency repairs of localized areas on both runways posing imminent potential of FOD

REHABILITATION DESIGN

- Runway 02-20
  - HMA removal from 900 m
  - Removal and replacement of 12 m of PCC along CL
  - Repair PCC in Rows 2 and 3
  - Place new HMA
- Runway 12-30
  - Partial or full depth removal of HMA

SPECIFICATION DEVELOPMENT

- **Custom specifications** to meet budget, material, environmental and loading requirements at the airport
- **Specifications to address the causes of the distresses**
- Specifications for
  - Concrete slab replacement
  - Concrete slab repairs
  - Granular base materials and placement
  - Asphalt tack coat
  - Asphalt mixes and paving



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ASPHALT SPECIFICATION

- Customized Marshall mixes
- Focus on
  - Moisture susceptibility – TSR min 80
  - Crushed aggregates
  - PSV min 65
  - Tighter LA abrasion
  - Tighter gradation envelope
  - Polymer modified asphalt cements
  - Higher minimum asphalt cement content
  - Increased Marshall stability

PAVING REQUIREMENTS

- Tighter production tolerances
- Echelon paving to minimize number of cold longitudinal joints
- Joint heaters to improve quality of cold longitudinal joints
- Shuttle Buggy® to minimize thermal and gradation segregation, eliminate bumps during mix downloading

PAVING REQUIREMENTS

- Tighter compaction
- Joint construction and compaction
- Smoothness requirements
- Trial batches
- Test strip

ASPHALT MIX DESIGN

- Mixes developed using the 75 blow Marshall method
- Mix design submitted for review and acceptance
- Surface course mix
  - 100% crushed aggregate
  - 4.8% polymer modified asphalt cement (PG 64-37) in base course and 5.3% in surface course
  - 4.0% air voids
  - TSR 85% for base mix and 90.5 % in surface mix

CONSTRUCTION

- HAMA milling and slab repair and replacement

CONSTRUCTION

- Exposed PCC slabs evaluation

1	row	2 panel	6E,	approaching	LTE	83	
2	row	2 panel	6E,	leaving	LTE	63	73
3	row	2 panel	4E,	approaching	LTE	97	
4	row	2 panel	4E,	leaving	LTE	94	96
5	row	2 panel	14E,	approching	LTE	98	
6	row	2 panel	14E,	leaving	LTE	93	95
7	row	2 panel	19E,	approaching	LTE	66	
8	row	2 panel	19E,	leaving	LTE	62	64
9	row	2 panel	20E,	approaching	LTE	44	
10	row	2 panel	20E,	leaving	LTE	43	44
11	row	2 panel	27E,	approaching	LTE	84	
12	row	2 panel	27E,	leaving	LTE	86	85
13	row	2 panel	28E,	approaching	LTE	63	
14	row	2 panel	28E,	leaving	LTE	67	65
15	row	2 panel	29E,	approaching	LTE	41	
16	row	2 panel	29E,	leaving	LTE	35	38
17	row	2 panel	111E,	approaching	LTE	72	
18	row	2 panel	111E,	leaving	LTE	51	61
19	row	2 panel	112E,	approaching	LTE	77	
20	row	2 panel	112E,	leaving	LTE	80	79
21	row	2 panel	120E,	approaching	LTE	60	
22	row	2 panel	120E,	leaving	LTE	56	58
23	row	2 panel	121E,	approaching	LTE	36	
24	row	2 panel	121E,	leaving	LTE	40	38

CONSTRUCTION

- Concrete paving

CONSTRUCTION

- Concrete paving

CONSTRUCTION

- Concrete paving

CONSTRUCTION

- Selected slabs replacement and repair using cross stitching

TRIAL BATCH AND TEST STRIP

- Trial batch and test strip required
- Trial batch samples were tested and accepted
- Test strip for the surface and binder course placed on the runway in non major areas
- Asphalt samples obtained from the test strip placement
- Compaction pattern established during test strip

TRIAL BATCH AND TEST STRIP

- Asphalt cores obtained from test strip to calibrate nuclear gauge
- Test strip pavement surface inspected for
  - Segregation
  - Texture to ensure adequate friction
  - Flushing and bleeding

CONSTRUCTION

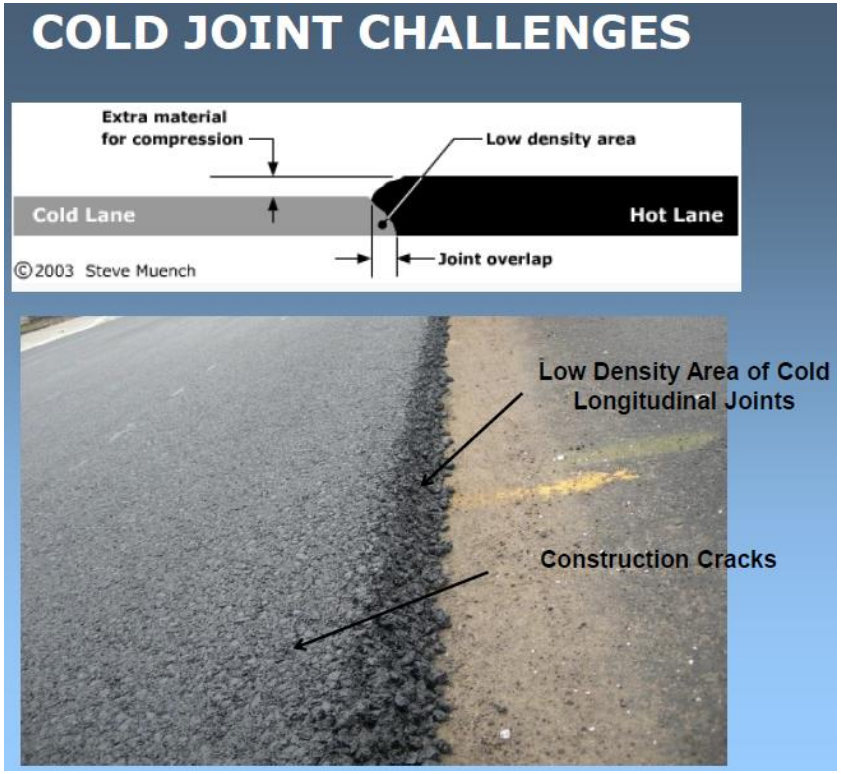
- HMA placement and compaction

CONSTRUCTION

- HMA placement and compaction

CONSTRUCTION

- HMA joint construction



Innovative Approach to Construction of Durable Longitudinal Joints

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CONCLUSIONS

- Critical aspects
  - Team work
  - Communication
  - Knowledge
  - Experience
- Proper pavement design
  - Field and laboratory investigation
  - Identify causes of distresses and address them
- Specifications
  - Customize to reflect local conditions

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2	row	2 panel	6E,	leaving	LTE	63	73
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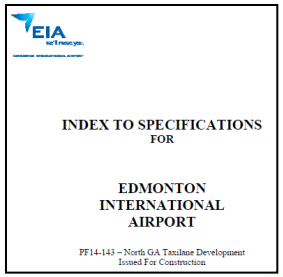

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CONCLUSIONS

- Mix designs
- Good construction practice
  - Trial batches
  - Test strips
  - Placement
  - Compaction
  - Joints
- No magic bullets available
- Good, advanced paving technology is available – use it!

THANK YOU!
QUESTIONS?

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