D-Cracking Rehabilitation at Kansas City International

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Introduction

- Kansas City International
- Majority was PCC
- All PCC pavements constructed within 1998-2004 timeframe
- Two Parallel runways and all associated taxiways
- Runway 1L-19R – 10,800’ x 150’
- Experienced Heavy Durability Cracking along the PCC Joints
- Unbonded PCC overlay System
- Spalling / FOD issues
- Petrographic Analysis
Preliminary Investigations – RW1L-19R

• Site Investigations
• Continuous Repairs
• 5+ Gallons of FOD/ Day
• Stretched Resources

• PCI / Materials Related Distress Rating (MRDR) inspections
• Once distress was found to be widespread- 100% inspections on airfield

• Dropped 32 points in 10 years and 27 points in 5 years
Preliminary Investigations – RW1L-19R

- Petrographic Analysis
- Strategic Core Locations – Mid Slab and On Distress
- Confirmed D-Cracking as Distress, Not ASR
- Freeze-Thaw Induced Microfractures
- Marginal to Poor Air Content
- Large Variation in Aggregate Size

Preliminary Investigations – RW1L-19R

Core Analysis

- Distress in Top 4-inches of Core ONLY
- Not Caused by Saturated Base
- Top-Down D-Cracking, Not Bottom-Up
Preliminary Investigations – RW1L-19R

Drawing and Project Review

• Existing Pavement Section
  – 15” PCC Un-Bonded Overlay
  – 25’ x 25’ panels
  – In-Pavement Lighting
  – In 2011, Existing Runway Pavement - 13 years old

• Series of Pavement Repairs Performed
  – 2008/2009
  – Included Full / Partial Depth Repairs
  – Distresses Continued Past Repairs
  – Where do you stop?

Preliminary Investigations – RW1L-19R

Project Location Considerations

Major Cargo Carriers
Terminal B
Runway 1L-19R
Project Development

In Review
- Durability Cracking - ↓ Top Down↓
  - Every cut, crack, joint, or pop out results in moisture accumulation and PCC disintegration related to the coarse aggregates primarily found in the Kansas City Area
- Runway 1L Generating FOD at an alarming rate – Safety Hazard
- In 2011, Existing Runway Pavement - 13 years old
- Funding Challenge – Current Design not at 20 years (Unplanned Project) / During Federal Shutdown
- Significant Base Structure in Good Condition
- Project Location in a Critical Area

Project Development

- Preliminary Review
  - FAARFIELD Review for Pavement Design
    - Stacked Pavilion – Can Handle Any Aircraft
  - Existing Elevation / Grade – Fixed
    - Connector Taxiways and Proximity on the Airfield
  - Primary Runway – Preferred (Commercial Carriers and Cargo)
  - Robust In-Pavement Lighting System (TDZs / CL / High Speed Intersections)
  - Funding Limitations
    - Impact an entire Region for one project
Project Development

- Temporary Solution:
  - Fast Tracked to Repair Each Transverse Joint, Location of Primary Manifestation
  - Use FAA Standard Detail for Mill / Remove / Replace on AC Joints
  - DTW Example

Concerns:
- 2 new cut lines at each joint (Cuts from 2010 Repairs Deteriorating)
- Longitudinal Joints not addressed
- Internal Slab Pop-outs and Spalls not addressed
- Smoothness
- Look of the Runway
Project Development

- "Permanent" Solutions:
  - Remove & Replace Existing 15" PCC Surface with New AC or PCC
  - Reconstruct Entire Section
  - Remove Existing 15" PCC Surface & Existing Variable AC Depth & Rubblize 1959 PCC prior to Reconstruction

Considerations:
- Condition of Underlying Base Materials – Great Shape
- Reuse of Existing Pavement in Surrounding Areas (i.e. Taxiways, Shoulders & Blast Pads)
- COST!

Project Development

- Final Selected Solution:
  - Mill 4" of PCC / Replace with 4" of AC
  - Depth of D-Cracking (4") – Cores and Petrographic Analysis
  - Structural Verification Indicated Adequate Section (Super Base)
  - No NAVAID adjustments – No In-Pavement Lighting Adjustments
  - No Surrounding Pavement Adjustments
  - Preliminary Estimate at Approx. $20 Million
Design and Construction

• Design Schedule = Preliminary in April 2011 / Final June 2011
• Design included All of Runway 1L-19R and its 10 Connector Taxiways out to the Edge of RSA
• 4” of P-401 AC – 2-2” Lifts – All Surface Course Pavement
• Phasing – Brought to 90 Calendar Days and A Single Phase. Attempting to avoid another freeze / thaw cycle
• Bid – July 2011 – No Grant Approval until Early September 2011 – Increased Risk for Contractor
• Construction Cost Bid at $11 Million

Design and Construction

• Construction Challenges
  – In-Pavement Lighting
  – Variable Depth D-Cracking
  – Reinforcing Steel Depth
  – Very Late in the Year for the Midwest Construction Season
Design and Construction

• Final Product
  – Extremely smooth pavement
  – National Asphalt Pavement Association (NAPA) Quality in Construction Award

Moving Forward

• Reflective Cracking
• Longitudinal Seam
• Expansion Joints
• Hi-Speed Exits
• Crack-Seal Program
Moving Forward

Maintenance and Repairs on Concrete Elsewhere on the Airfield

PCC Solutions
- Specifications – Local Municipalities Updated Aggregate Specifications to deal with D-Cracking
- Sealant Material – Silicone was Standard, but not maintained – Move towards a compression seal
- Joint Spacing – Move away from 25’ x 25’ Slabs
- Quality Assurance Testing – Where do we test for Air? How often are we testing aggregate? Etc.
- Verify dowel bar spacing and locations
Lessons Learned

• Maintenance Focus – What and How are Performing?
• PCI – How Close to Falling Off the Edge?
• Steel Depth – Prior to Milling – GPR or some Method to Find Steel
• Quality Assurance – Specifications Need to be Followed!
• FAA 20 to 40 Year Pavement Design – Going to be Material Dependent
• In-Pavement Lighting – Field Solutions are Often Best

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