

# D-Cracking Rehabilitation at **Kansas City International**

Presented to the

## **2015 Airports Conference**

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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



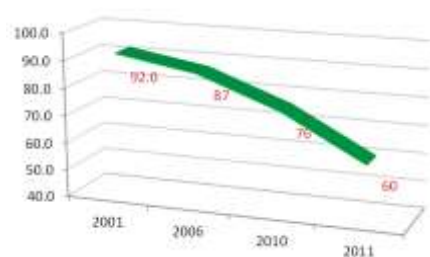
## Preliminary Investigations – RW1L-19R

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



## Preliminary Investigations – RW1L-19R

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



Historical  
PCI of RW 1L-19R

- 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



Photos Courtesy WJE Associates – Kansas City International Airport – Petrographic Studies of Twelve Concrete Cores – May 23, 2011



## 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



Photos Courtesy WJE Associates – Kansas City International Airport – Petrographic Studies of Twelve Concrete Cores – May 23, 2011



## Preliminary Investigations – RW1L-19R

### Drawing and Project Review

- Existing Pavement Section

- 15" PCC Un-Bonded Overlay
- 25' x 25' panels
- In-Pavement Lighting



Existing 15-inch Concrete Pavement (1998)

Existing 12-inch AC Base (Various Ages)

Existing 12-inch Concrete Pavement (1959)

- 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



## 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



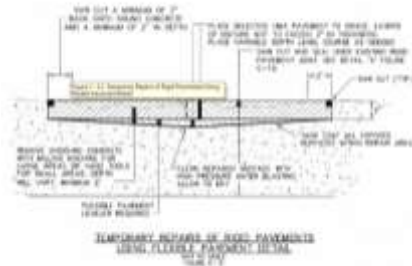
## Project Development

- Preliminary Review
  - FAARFIELD Review for Pavement Design
    - Stacked Pavement – 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

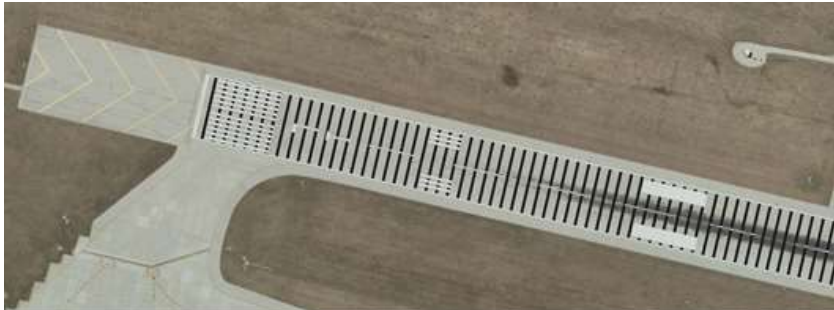


## Project Development

- **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



## Project Development



### 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



## Moving Forward

### 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**



## Acknowledgements

- **Federal Aviation Administration**
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- **WJE**



## Questions & Discussion



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