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PERFORMANCE TRENDS IN AIRPORT RUNWAY PAVEMENTS

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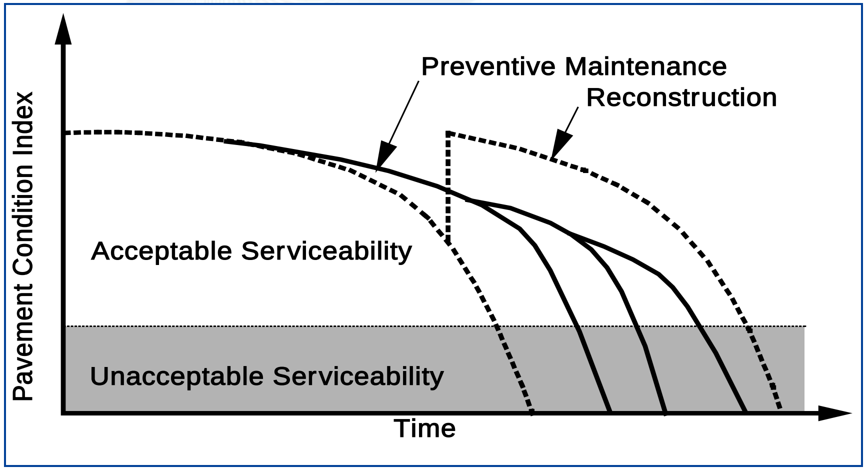
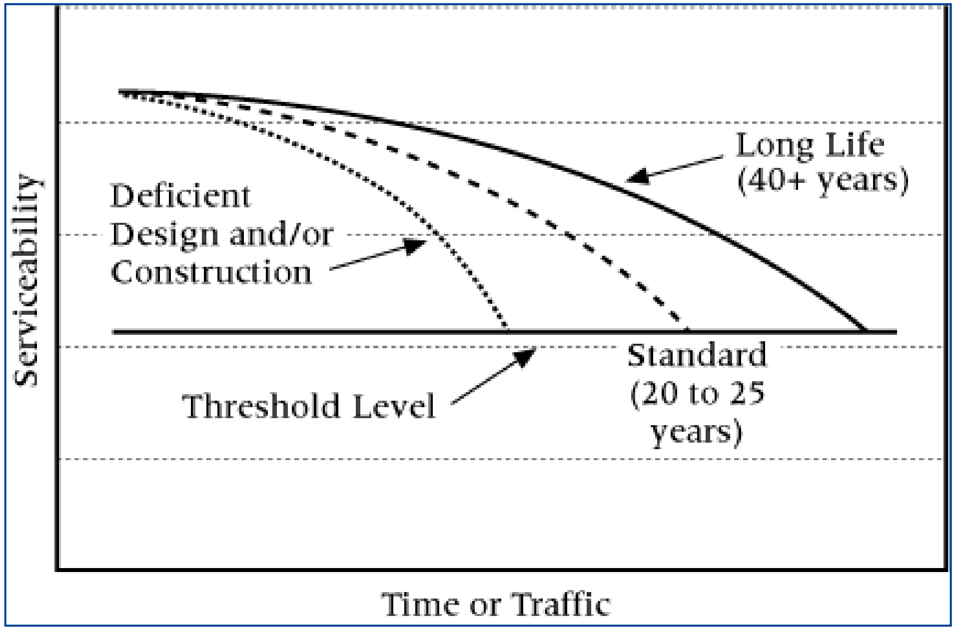
CONCEPT OF LONGER SERVICE LIFE



- Pavements deteriorate with time through development of a range of distresses
- Pavement life can be extended with proper maintenance
- Deterioration ultimately reaches a level of unacceptable serviceability

- Current FAA design is typically for a 20-year pavement life
- Some pavements last longer than 20 years while others fail prematurely
- What factors impact extended pavement service life?



ACKNOWLEDGEMENTS

PRESENTATION BASED ON FAA RESEARCH STUDY

- Extended Design Life for Airport Pavements
- Ongoing project

SPONSOR

- FAA William J. Hughes Airport Technology Research and Technical Center
- Dr. David Brill, Technical Coordinator

FAA SUPPORT CONTRACTOR

- SRA

SUBCONTRACTORS

- Applied Research Associates
- Gemini

40-YEAR PAVEMENT DESIGN LIFE

FAA RESEARCH FOR EXTENDED LIFE PAVEMENTS

- FAA Office of Airport Safety and Standards sponsorship
- Extend Design Life from current 20-years to 40-years
- Research to improve pavement performance at large hub airports

APPROACH

- Select runways for performance data collection
  - Major hub airports
  - < 3 years of age; PCC and AC
  - > 20 years of age; PCC and AC
  - New AIP runways for future performance monitoring
- Collect and analyze both historical data and new field/laboratory testing

RUNWAYS SELECTED FOR DATA COLLECTION

Site Number	Runway	Pavement Type	Pavement Age, yrs	Field Tests
1a	10L-28R	Flexible	>20	Yes
1b	10R-28L	Flexible	<3	Yes
2	4-22	Flexible	>20	No
3	9-27	Rigid	<3	No
4a	16R-34L	Rigid	<3	Yes
4b	16C-34C	Rigid	>20	No
5	5L-23R	Flexible	3	Yes
6a	10L-28R	Flexible	>50	No
6b	10R-28L	Flexible	>50	No
7	10-28	Flexible	>20	Yes
8	17R-35L	Rigid	24	No

HISTORICAL DATA COLLECTION

- **ORIGINAL DESIGN DATA**
  - Design Reports
  - Geotechnical Investigation Reports
  - Plans and Specifications Design
- **CONSTRUCTION DATA**
  - Quality Control Test Data
  - Mix Designs
  - Material Types and Properties
  - Subgrade Type and Strength
- **TRAFFIC DATA**
  - Aircraft Used in Original Design
  - Current Aircraft - Aircraft Types and Weights, Number of Operations, Take-off and Landing Directions
- **PAVEMENT MANAGEMENT/EVALUATION STUDIES AND DATABASES**
  - MicroPAVER Databases Converted To PaveAir
  - Structural Evaluations
  - Friction Measurements
- **MAINTENANCE RECORDS AND COSTS**
  - Maintenance activities, timing of maintenance, triggers for maintenance
- **WEATHER/CLIMATE DATA**

FIELD TESTING

- **DISTRESS SURVEYS**
- **CORE SAMPLING**
  - 24 cores on AC pavement
  - 20 cores (6-inch) on PCC pavement
  - Beam samples of PCC Pavements (where feasible)
- **HWD DEFLECTION TESTS**
  - HWD Loads of 15,000, 30,000, and 45,000 lbs
  - Four Lines Along Runways at 20 ft and 50 ft (or 1st and 3rd slabs) each side of centerline
  - Joint Tests at Transverse and Longitudinal Joints on PCC Pavement
- **PROFILE/ROUGHNESS**
  - SurPro device
    - 5 Profile Lines - Centerline and 10 ft and 17 ft Each Side
  - FAA Pavement Profiler (for groove data)

DISTRESS SURVEYS

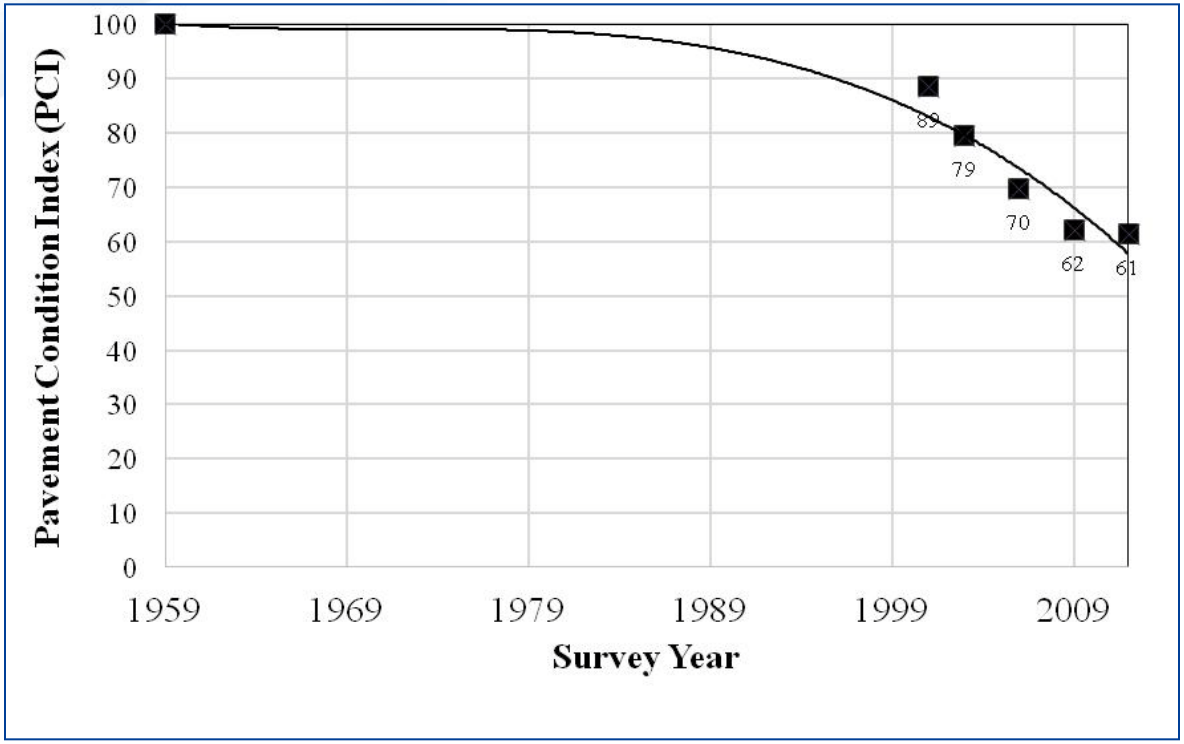
- **PAVEMENT SURFACE DISTRESS SURVEYS**
  - PCI in Accordance with ASTM D5340
  - 100 Percent Survey Entire Runway
  - Shoulders and Overruns Surveyed

FAA PAVEAIR PMS SOFTWARE

- **PAVEAIR USED FOR DATA STORAGE AND RETRIEVAL**
  - PaveAir Software for Data Handling
  - Special Version of Software Used to Store Collected Data
  - To Be Used in Analysis Phase

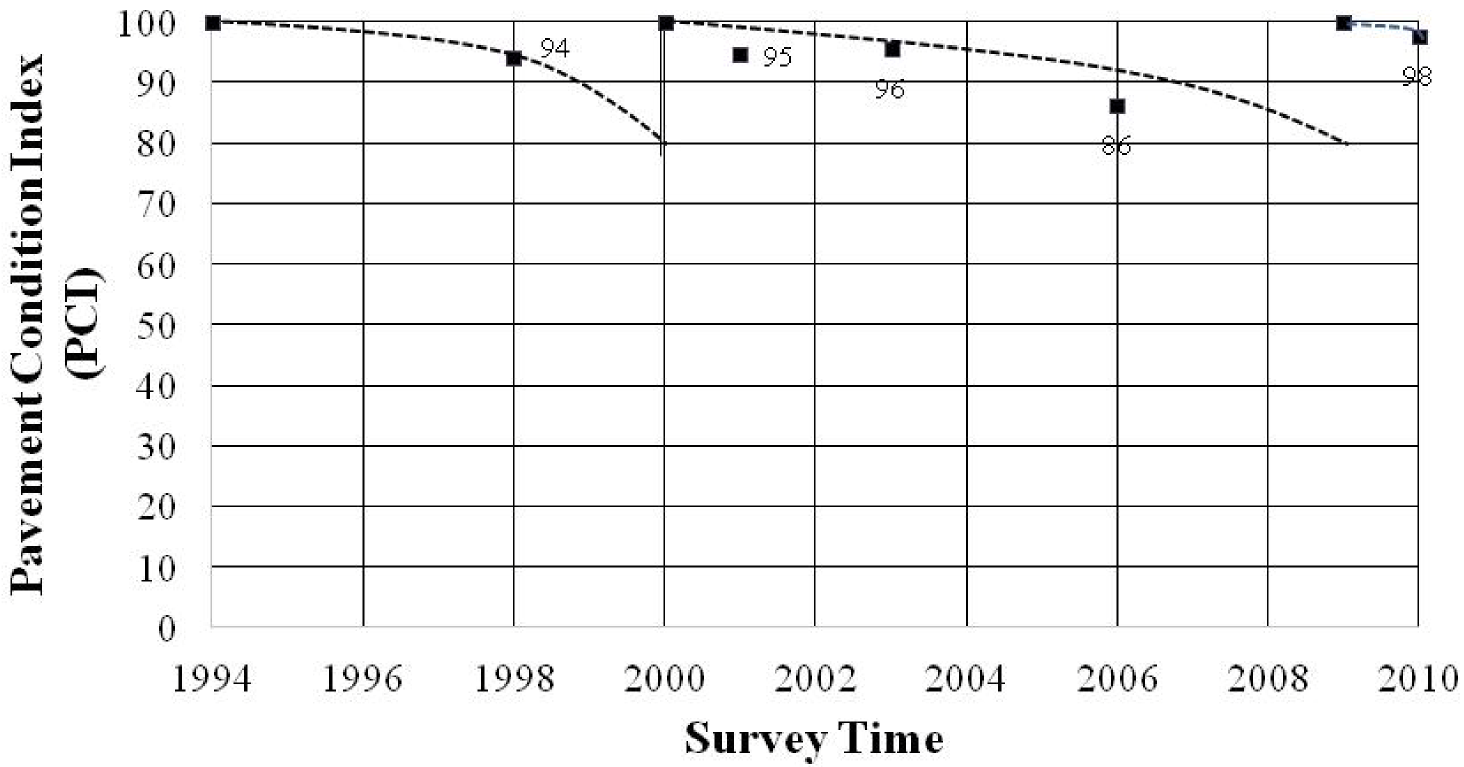
- **PERFORMANCE TRENDS**
  - PaveAir Used to Develop Performance Relationships

PCI PERFORMANCE TRENDS
Site 1b – Old Asphalt



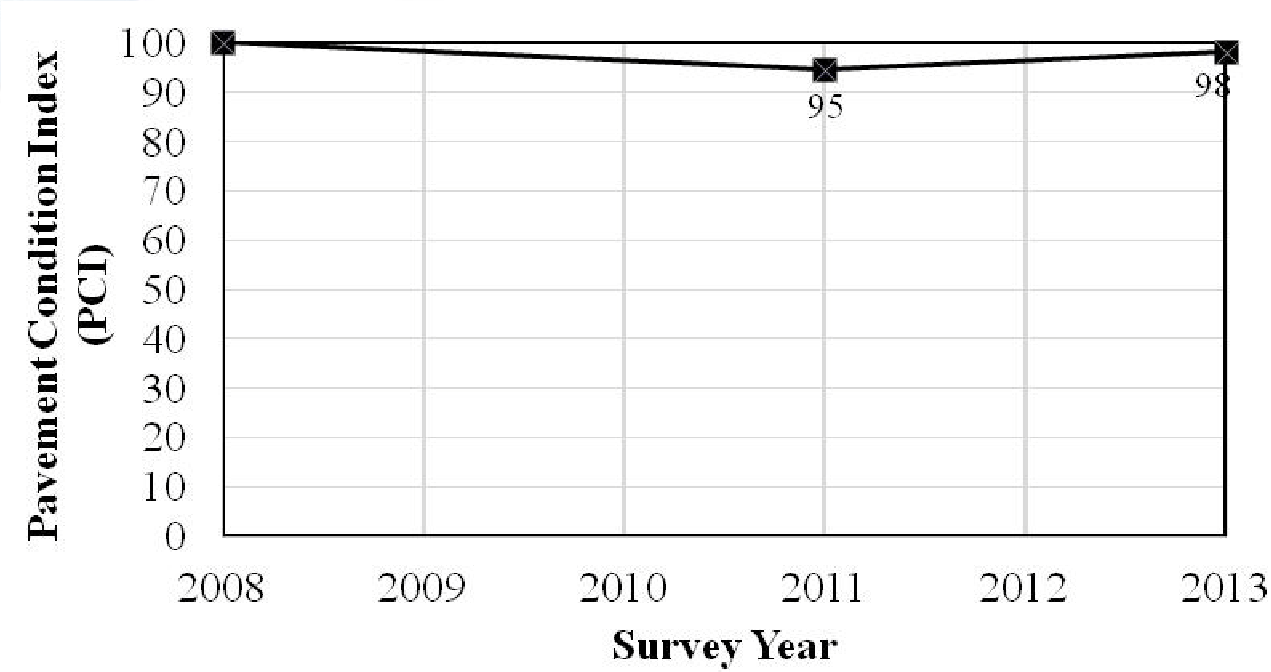
- 55 year old AC runway
- Major Rehabilitation in 1997
- Crack sealing in 2001 and 2006
- Partial depth patching in 2001 and 2006
- Deterioration Rate of 2.5 PCI points per year (2001 to 2012)

PCI PERFORMANCE TRENDS
Site 2 – Old Asphalt



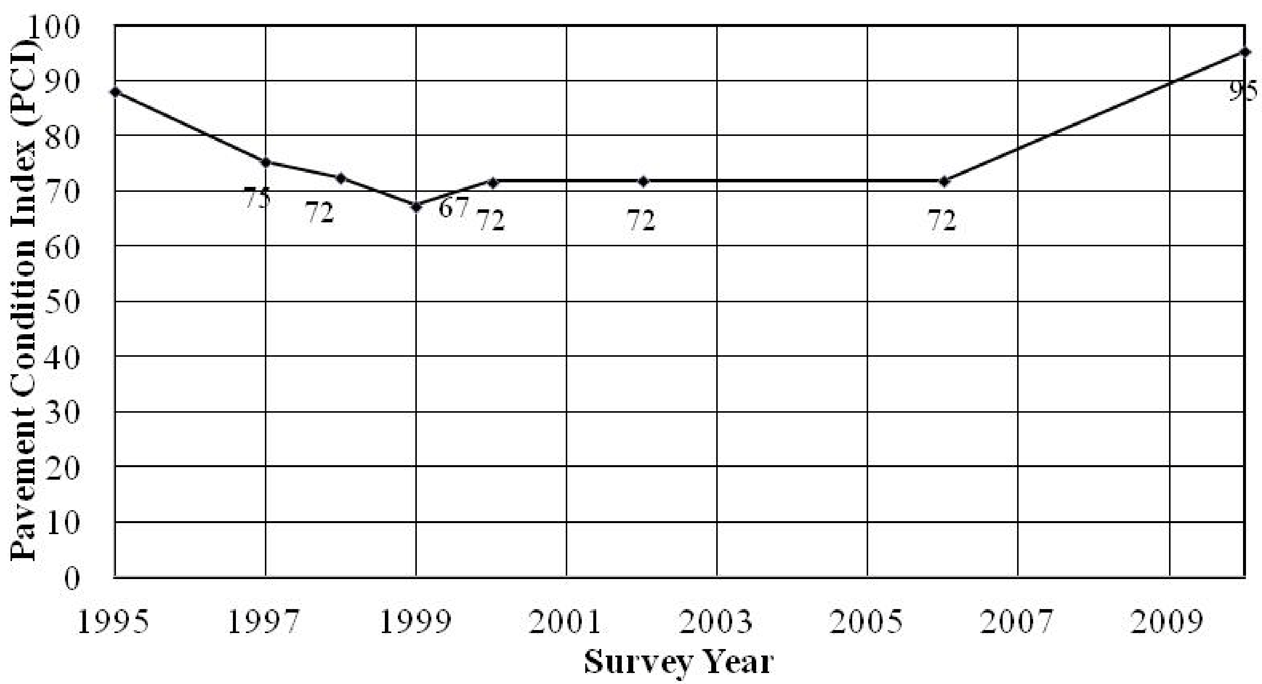
- 20 year old AC runway
- AC overlay in 2009
- Deterioration Rate from 1.5 to 2.0 PCI points per year

PCI PERFORMANCE TRENDS
Site 4a – New Concrete



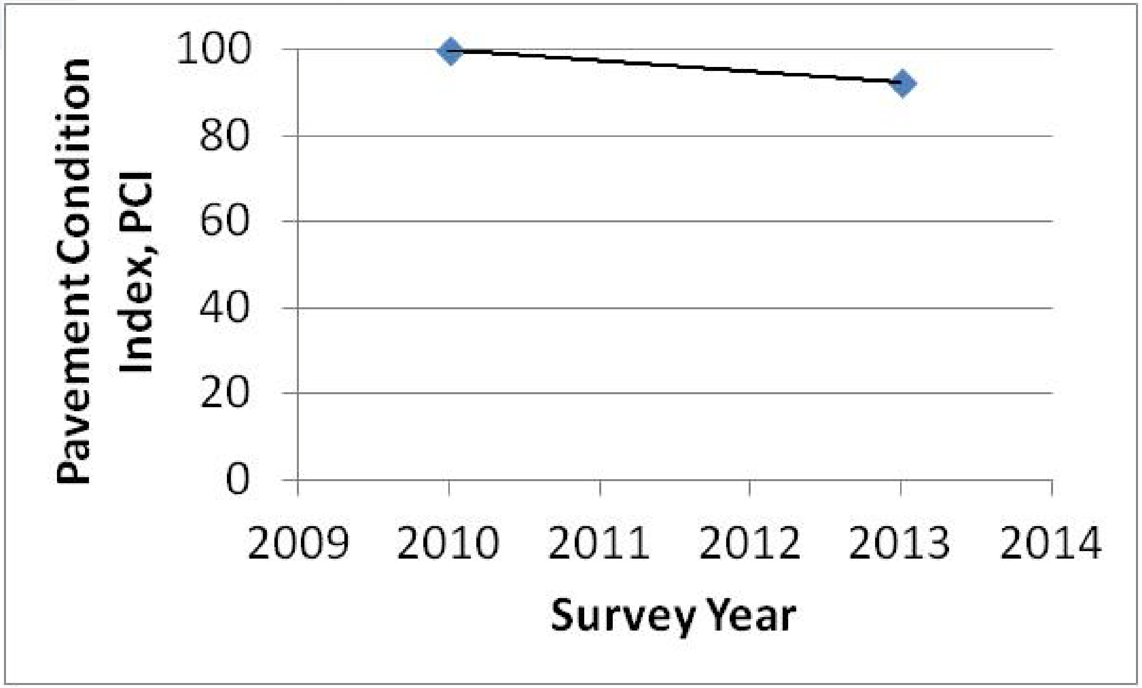
- 6 year old PCC
- Deterioration Rate of 0.4 PCI points per year

PCI PERFORMANCE TRENDS
Site 4b – Old Concrete



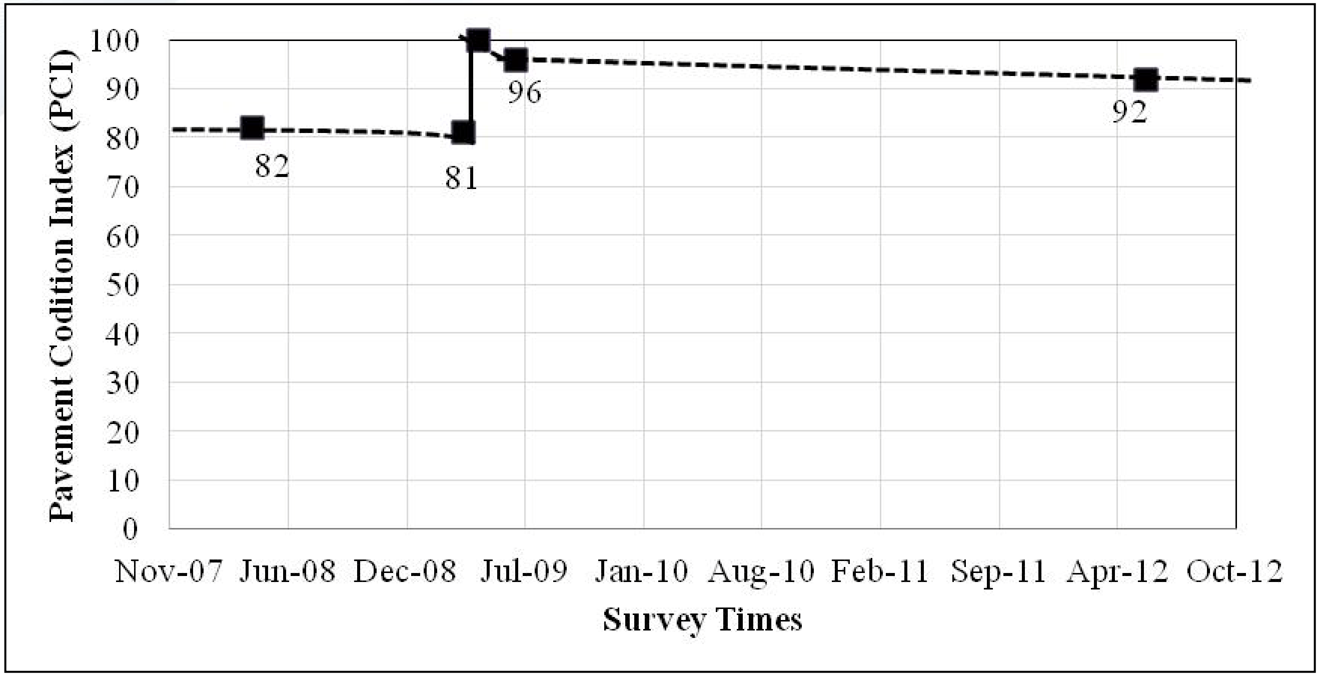
- 45 year old PCC (constructed in 1969)
- Major M&R in 2006 and 2010
- Deterioration Rate of 1.2 PCI points per year

PCI PERFORMANCE TRENDS
Site 5 – New Concrete



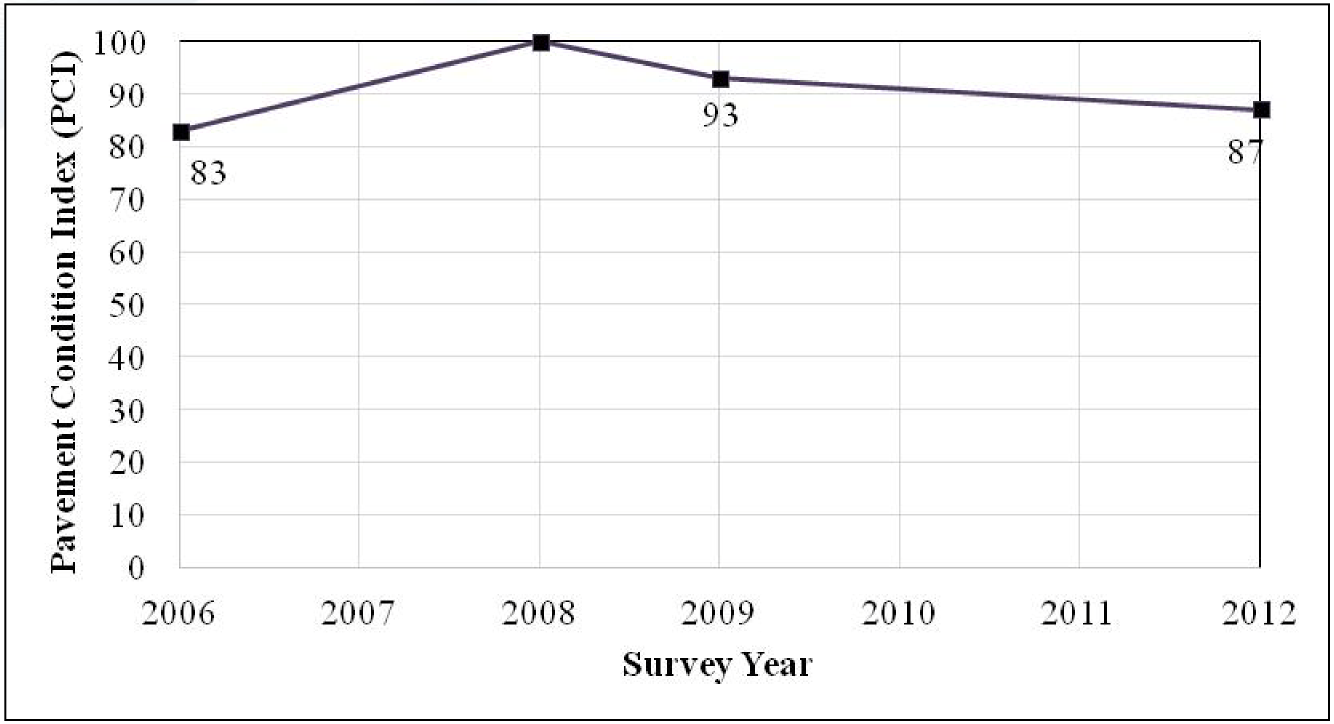
- 4 year old PCC (constructed in 2010)
- Deterioration Rate of 2.5 PCI points per year

PCI PERFORMANCE TRENDS
Site 6a – Old Asphalt



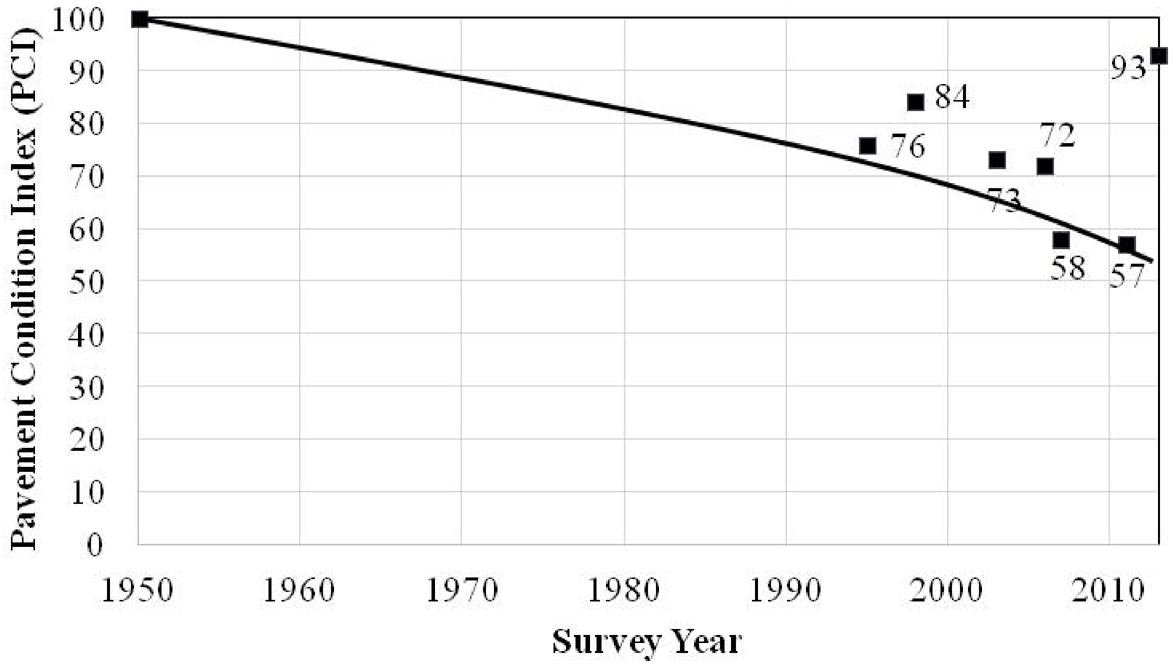
- 55 year old AC (constructed in 1959)
- 4-in AC overlay in 1971 and 2008
- Deterioration Rate of 0.5 PCI points per year from 1971 to 2008; 2.7 from 2009 to 2012

PCI PERFORMANCE TRENDS
Site 6b – Old Asphalt



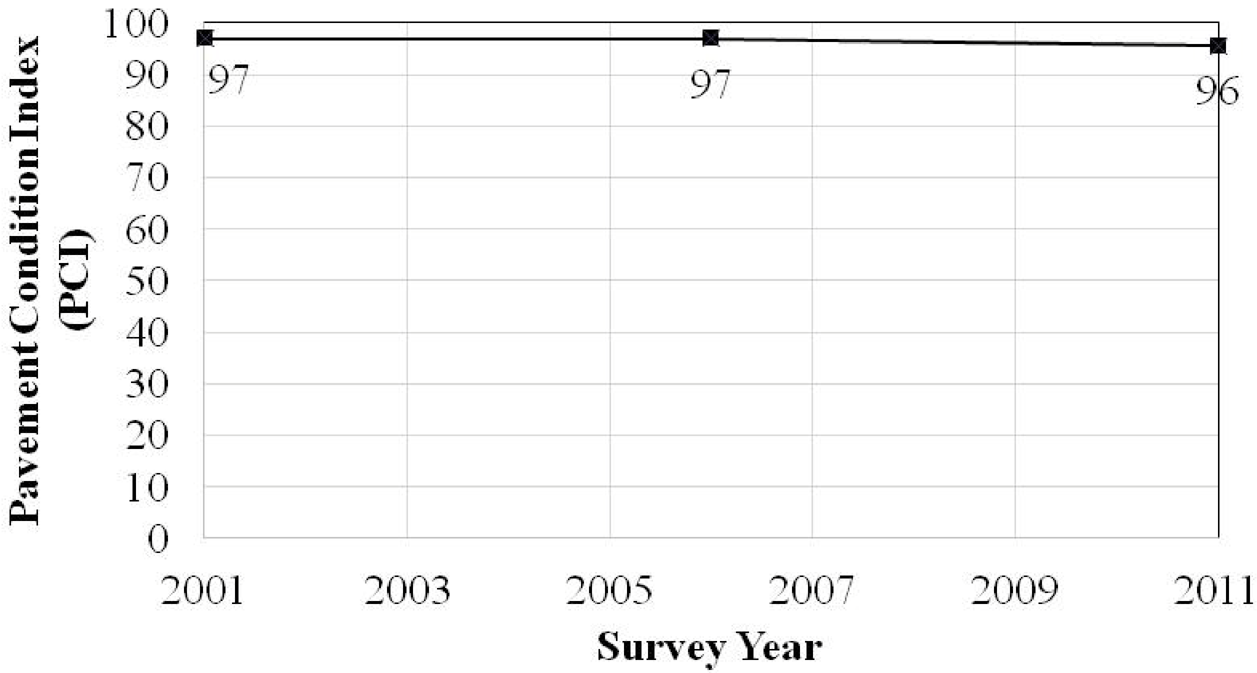
- 60 year old AC (constructed in 1954)
- 4 inch AC overlay in 2008
- Deterioration Rate of 3.3 PCI points per year (2009 to 2012)

PCI PERFORMANCE TRENDS
Site 7 – Old Asphalt



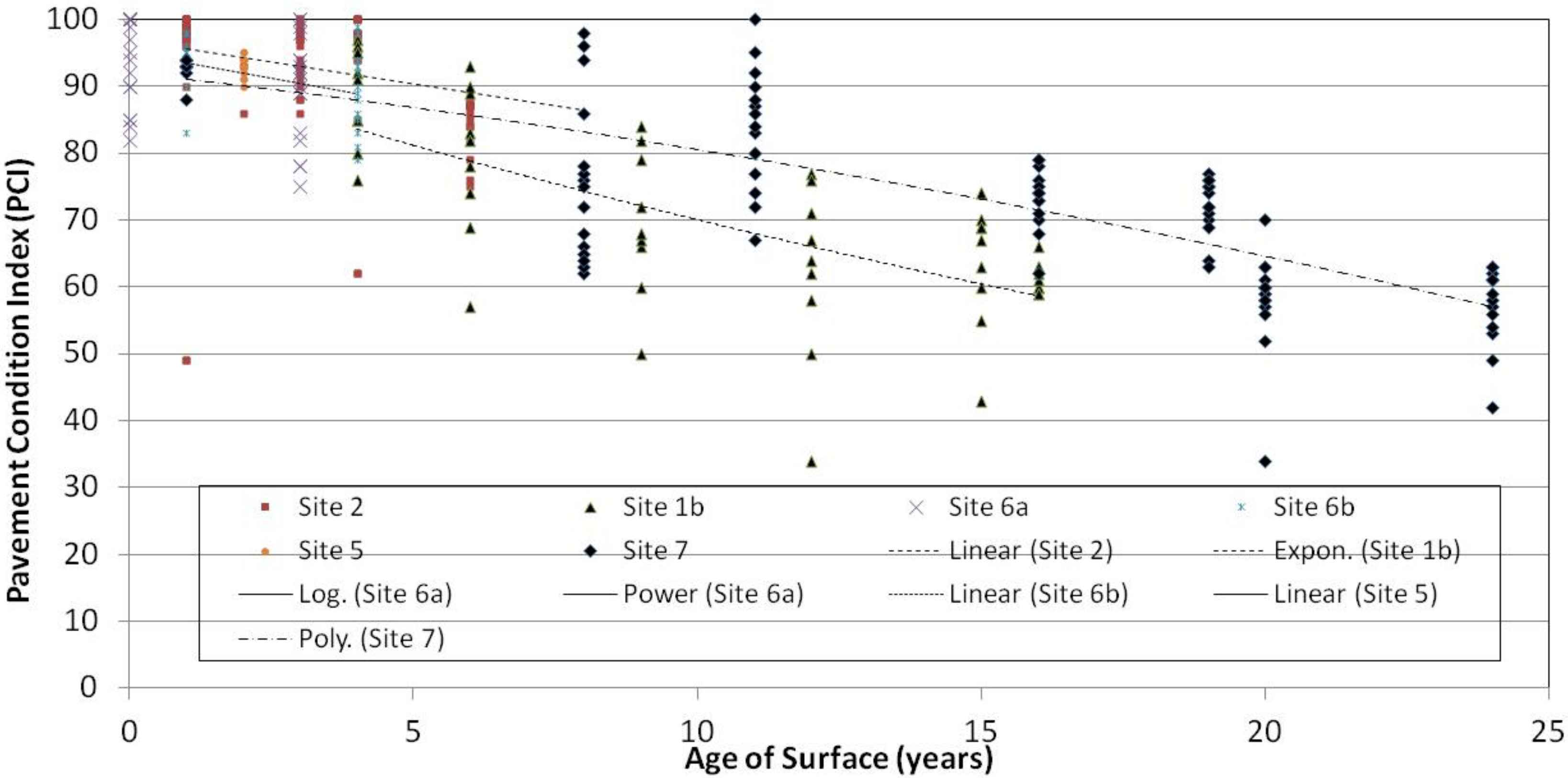
- 64 year old AC (constructed in 1950)
- Maintenance history unavailable
- 3-inch AC overlay in 1987 and 2011
- Deterioration Rate of 1.4 PCI points per year

PCI PERFORMANCE TRENDS
Site 8 – Old Concrete

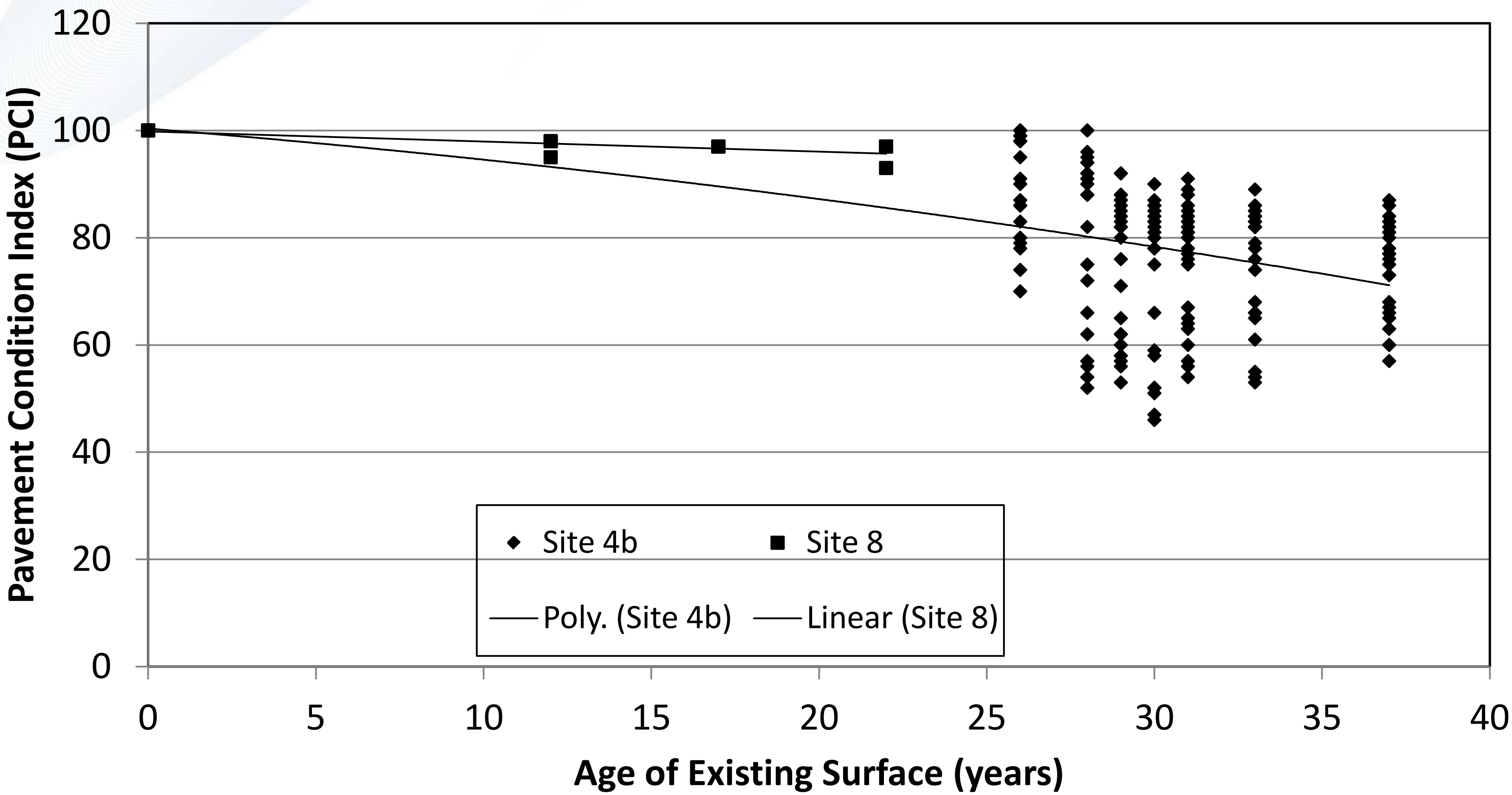


- 25 year old PCC (constructed in 1989)
- Major M&R including slab replacements at various times
- Deterioration Rate of 0.2 PCI points per year

COMBINED DATA FOR ASPHALT PAVEMENTS



COMBINED DATA FOR CONCRETE PAVEMENTS



DISTRESS TYPES OBSERVED

Airport	Age (years)	PCI (Survey Year)	Predominant Distress Type and Severity
Site 1a	1	100 (2013)	None
Site 1b	55	62 (2013)	Medium severity weathering, low/medium severity longitudinal and transverse cracking, low severity patches
Site 2	20	98 (2010)	Low severity longitudinal and transverse cracking
Site 3	5	100 (2009)	None
Site 4a	6	98 (2013)	Pop outs
Site 4b	45	95 (2011)	Low/medium severity spalling, low severity patching, low severity joint seal damage, and low severity longitudinal, transverse, diagonal cracking

DISTRESS TYPES OBSERVED

Airport	Age (years)	PCI (Survey Year)	Predominant Distress Type and Severity
Site 4b	45	95 (2011)	Low/medium severity spalling, low severity patching, low severity joint seal damage, and low severity longitudinal, transverse, diagonal cracking
Site 5	3	93 (2013)	Low severity weathering, low severity longitudinal and transverse cracking
Site 6a	55	92 (2012)	Low severity longitudinal and transverse cracking, low severity patching
Site 6b	60	87 (2012)	Low/medium severity longitudinal and transverse cracking, low and medium severity patching
Site 7	64	93 (2013)	Low severity weathering , low severity longitudinal and transverse cracking
Site 8	25	95 (2011)	Low severity Scaling/Map Crack/Crazing, low severity spalling, low severity patching, low severity shrinkage cracks, pop outs

PRELIMINARY CONCLUSIONS

- **BASED ON LIMITED DATA PRESENTED:**
  - Major Hubs maintain runways pavements at PCI levels of 65 to 85
  - Maintenance records not readily available; particularly for older runways
  - Asphalt runways reach PCI of 70 in 12 to 15 years
  - Concrete runways reach PCI of 70 in 30 to 40 years
  - Asphalt pavements deteriorate at rate of 1.5 to 2.5 PCI points per year
  - Concrete pavements deteriorate at rate of 0.5 to 1.2 PCI points per year
  - Most distresses are materials and climate related

- **MORE DATA NEEDED TO DEVELOP SPECIFIC CONCLUSIONS**

STATUS OF PROJECT

- **PHASES I AND II DATA COLLECTION AND FIELD TESTS COMPLETE**
- **PHASE III UNDERWAY (8 additional runways)**
- **PRELIMINARY ANALYSIS OF DATA COLLECTED**
- **FURTHER DATA COLLECTION AND FIELD TESTS PLANNED**
  - Complete Matrix Of Performance Variables
  - Climate, Traffic, Surface Condition, Concrete, Asphalt, Overlays, etc.
  - Groove Performance, Rubber Removal, Joint Spacing

Analysis

- Define failure
- Identify key factors related to extended life