Smooth Road Ahead - Applying Pavement Condition Data for Airports

July 7, 2020
2:00-3:30 PM ET

@NASEMTRB
#TRBWebinar
Learning Objectives

At the end of this webinar, you will be able to:

• List available pavement condition data collection methods and their advantages and disadvantages

• Identify how pavement condition data are used within airport organizations

• Apply guidelines for collecting pavement condition data depending on the use

• Describe possible advancements of pavement condition data collection tools
American Association of Airport Executives (AAAE)

1.0 Continuing Education Units (CEUs) are available to Accredited Airport Executives (A.A.E.)

Report your CEUs: [www.aaaee.org/ceu](http://www.aaaee.org/ceu)
Questions and Answers

• Please type your questions into your webinar control panel

• We will read your questions out loud, and answer as many as time allows
Today’s Panelists

Vivek Khanna, Woolpert

Casey Ries, Gerald R. Ford International Airport

David Peshkin, Applied Pavement Technology

Kyle Wanner, North Dakota Aeronautics Commission
Vivek Khanna, Ph.D., P.E.
Woolpert, Inc.

- Woolpert’s Practice Leader - Aviation Design based in Dallas, TX
- Expanding Woolpert’s Aviation practice in Texas
- Inaugural ACRP Ambassador (2012 – 2014)
- Regular contributor to ACRP - project panels, Graduate Student Mentorship
Five Ways to Get Involved!

1. Join the ACRP IdeaHub community
2. Volunteer for a project panel
3. Prepare a research proposal
4. Answer an ACRP survey
5. Apply the research results

Visit us online: www.trb.org/ACRP
Today’s Speakers

David Peshkin, Applied Pavement Technology, Inc.
Kyle Wanner, North Dakota Aeronautics Commission
and
Casey Ries, Gerald R. Ford International Airport Authority

Presenting

ACRP Report 203: Guidelines for Collecting, Applying, and Maintaining Pavement Condition Data at Airports
Smooth Road Ahead – Collecting, Applying, and Maintaining Airport Pavement Condition Data

David Peshkin, Applied Pavement Technology
Kyle Wanner, North Dakota DOT
Casey Ries, Gerald R Ford International Airport
David Peshkin, P.E.
Principal Investigator

Q Chief Engineer, Applied Pavement Technology, Inc.

Q 33 years of experience in pavement evaluation, design, maintenance, preservation, and rehabilitation

Q Airfield pavement forensics, training, and research
Additional Team Members

Applied Pavement Technology, Inc.
- Peter-Paul Dzwilewski
- Kyle Potvin
- Katherine Gauthier
- Monty Wade

Woolpert, Inc.
- Eric Risner
- Ryan Robinson
- Chris Snyder
- Marianne Cardwell

PMS Ltd. (Ireland)
- Kieran Feighan
ACRP Report 203 Oversight Panel

Casey W. Ries, Gerald R. Ford International Airport, Panel Chairman
Alexander K. Bernier, Stantec
Angela R. Newland, CCI Engineering Services
Owen K. Silbaugh, Jr., Massachusetts DOT
Dianne L. Walker, DW LLC
Kelvin C. P. Wang, Oklahoma State University
Gregory D. Cline, FAA Liaison
Albert Larkin, FAA Liaison
Theresia H. Schatz, ACRP Staff Officer
The Challenge

Q Collecting airfield pavement condition data can be expensive and time-consuming
Q Access to collect such data is increasingly challenging
Q Little guidance available on need for and uses of many types of condition data
Q Standards have not kept pace with new data collection technologies
Approach to the Solution

Q Review literature
Q Survey airport practices
Q Survey consulting engineering practices
Q Develop case studies
Q Create Guidelines
Types of Pavement Condition Data

Q Distress
Q Surface characteristics
Q Structural condition
Distress Data Collection

Q Visual (manual) condition survey
Q Light Detection and Ranging (LiDAR)
Q Two- and three-dimensional (2D and 3D) laser imaging
Q Vehicle-mounted camera survey
Q Unmanned-mounted camera survey (small unmanned aircraft system or unmanned aerial vehicle [sUAS/ UAV])
LiDAR Data Collection

MMS VEHICLE

LiDAR SENSORS AND CAMERAS

EQUIPMENT
Laser Imaging Data Collection

- Laser scanners
- Rear-facing ROW cameras
- GPS equipment
- Forward-facing ROW cameras
- Infrared lasers to measure longitudinal profile, transverse profile, and surface texture
sUAS/UAV Data Example
Longitudinal Profile Data Collection

- Rolling surface profilers
- Rod and level
- Autorod and level
- Inertial profiler (ASTM E950 Class 1)
- Accelerometer (smartphone application)
Surface Characteristics
(Friction and Grooves)

- Continuous Friction Measurement Equipment (CFME)
- Circular Track Texture (CT) Meter
- British Pendulum
- Sand patch
- Manual or automated measure of groove spacing/depth
Structural Condition Data Collection

- Falling Weight Deflectometer (FWD)
- Rolling Weight Deflectometer (RWD) and Traffic Speed Deflectometer (TSD)
Casey Ries, P.E., LEED AP
Panel Chair, Contributor

Q Gerald R. Ford International Airport
Q Engineering & Planning Director
Q Former airport consultant and civil engineer
Q ACRP panel member, project 09-17 chair
GRR – Who We Are

Gerald R. Ford International Airport Authority

Q 2nd Busiest Airport in Michigan
Q 3.58 Million passengers in 2019
Q Over 3,200 Acres
Q Over $3.2 Billion in Economic Output to West Michigan
8R/26L
- Originally built in 1962
- Reconstructed in 2001
- 10,000’ long x 150’ wide

17/35
- Originally built in 1963 as a GA runway
- Reconstructed in 1998
- 8,500’ long x 150’ wide

8L/26R
- Originally built in 1973
- Reconstructed in 2015
- 5,000’ long x 100’ wide
Runway = Essential

Value in staff engagement
Q Operations
Q Maintenance
Q Engineering

Value in data
Q Collect
Q Apply

Figure 24 (top)

EXISTING STRATEGIC PLAN®
Pavement condition data
STRUCTURAL DATA®
SOFTWARE ANALYSIS

INITIAL PLAN

MAINTENANCE & OPERATIONS
PLANNING & ENGINEERING

SECOND DRAFT
Figure 10. Transverse crack adjacent to structure on Runway 8R/26L
Runway/Runway Intersection Data
Runway/Runway Intersection Data
Runway/Runway Intersection Cores

- Surface crack sealed by field maintenance
- No vertical movement evident
- Reflective crack associated with CTB construction joint
- FWD = structural condition good
2020 Airfield Pavement Maintenance
Terminal Apron = Important

Value in staff engagement:
Q Operations
Q Maintenance
Q Engineering

Value in data:
Q Collect
Q Apply

Figure 24 (top)
Data Example – Terminal Apron
Value in Financial Planning
Q Multi-year construction
Q Project commitment

Value in Stakeholder Engagement
Q Priorities aligned
Q Grant commitments

Figure 24 (bottom)
Data Example – Terminal Apron
USES OF PAVEMENT CONDITION DATA

Q Compliance with FAA regulations
Q Network-level management
Q Strategic-level management
Q Project-level assessment
Q Maintenance and repair plans
Q Troubleshooting and forensics
Q Communication to stakeholders
Compliance with FAA Regulations

Q FAAAC 150/5200-18: daily, weekly, monthly, and quarterly to identify safety hazards

Q FAAAC 150/5380-7B: annual condition survey or triennial PCI survey

Q FAAAC 150/5320-12C or 12D (draft): friction measurements depending on operations

Q FAAAC 150/5335-5C: Pavement Classification Number (PCN) reporting
Network-Level Management

- High-level monitoring of overall conditions
- Based on sampling rather than 100% inspection

- Uses:
  - Document pavement performance
  - Set priorities
  - Predict future conditions and needs
Strategic-Level Management

- Augments network-level management
- Often iterative process
- Components:
  - Budget scenarios
  - Long-term planning
- Stakeholder input considered
Maintenance and Repair

Maintenance
Q Determine needs
Q Condition data used to match distress types and repair quantities

Repair
Q Design based on distress and structural capacity
Kyle Wanner, Executive Director
North Dakota Aeronautics Commission

Q University of North Dakota Aerospace & Business School Graduate
Q Private Pilot License
Q Airport Planning Experience
Q Airport Inspection Experience
Q State Director for 6 years
Q Experience leading 3 statewide PCI Study update efforts
North Dakota Aeronautics Commission

Q Airport Infrastructure Grant Funding
Q Airport Planning Support
Q Aviation Education Promotion and Funding
Q Update Aviation Publications and Planning Documents
Q Regulatory Functions to include:
Q Aircraft Registrations
Q Aerial Applicator Licensing
Q Aircraft Dealers
Q Aircraft Excise and Fuel Tax
Q Represent ND in aeronautical matters before other state and federal agencies
Q Update State Aviation Publications, Planning Documents, and Statewide Studies
North Dakota’s Airport System

- 89 Public-Use Airports in North Dakota
- 54 NPIAS paved Airports
- 19 Non-NPIAS paved Airports
- 72 paved primary runways
- 9 paved crosswind runways
- 65 miles of paved runway surfaces
- 57 million ft² of total pavement to maintain
North Dakota Pavement Data Collection History

Q North Dakota saw value in collecting pavement condition data in the 1980s
Q Began on a 3-year rotation which continues today
Q Paper reports provided to airports until 2012
Q Innovation & Technology led to pavement information transforming into an online interactive data portal
Project Management

Q Request for qualifications
Q Identify selection team
Q Scope development
Q Contract negotiations
Q FAA Grant Application
Q Determine inspection schedule & trips
  ß 7 trips planned for 72 airport inspections
Q Coordinate with Airports
North Dakota’s Pavement Management System

Benefits of online pavement management system:

• Interactive
• Portable
• Transparent
• Clearer Picture
• Time Savings
• System Management
Statewide & Individual Airport Summary Information

Q Inventory Area
Q Inventory Age
Q Condition Summary
Q Needs Analysis
Q Executive Summary
Statewide Summary Information

![Graph showing pavement area by PCI range (0-40, 41-55, 56-70, 71-85, 86-100). The categories are Reconstruction, Rehabilitation, Preventative Maintenance.](image)
Pavement History Reporting

AIRPORT PAVEMENT HISTORY UPDATE

INSTRUCTIONS: Please complete and submit this document for all completed pavement maintenance and construction projects that occurred at a North Dakota public airport.

Airport Name: 
Contact Person: 
Number: 
Engineering Firm: 
Telephone Number: 

Complete this section for History of Pavement Maintenance:
Provide the following information for all new pavement maintenance:
Project Name: 
Date Construction Completed: 
Briefly describe the maintenance performed:

Location/Job Description: 
Payment Type: 
Runway: 
Aisles: 
Asphalt: 
Portland Cement Concrete: 
Type of Maintenance: 
Patching: 
Mill and Overlay: 
Surface Treatment: 

Complete this section for History of New Pavement Construction:
Provide the following information for any new pavement construction, terminals, sidewalks, taxiways, or runways:
Project Name: 
Date Construction Completed: 
Briefly describe changes in pavement structures:

Drainage System Installed:
No 
Yes – Specify which system: 
Edge Drain: 
Under Drain System: 

Provide dated and labeled drawing titles of the following (See attached pages for CAD drawing examples):
For new pavements:
- Centerline of each runway must be shown and labeled on the CAD File
- Pavement boundaries
- Pavement section details with each layer thickness identified
- Joint Layout Information on all PCC Pavements
- Any other pertinent details for new pavements

For pavement maintenance:
- Areas maintained with description of what type of maintenance was performed
- Details of work performed
- Patching

Signature of Airport Authority Representative or Designated Employee: 
Date: 

VALLEY CITY AIRPORT
Training

Face-to-Face during initial roll-out

Online training materials available for each update

- Distress information
- Causes of distress
- Maintenance recommendations for distress types
North Dakota Prioritizes Preventive Maintenance

Q Preventive Maintenance receives high funding priority for state funds

Q Airports are trained and encouraged to maintain a good pavement maintenance programs
Benefits of Pavement Management System

- Prioritize Projects
  - Statewide and individual airport CIP

- Justify Funding Requests
  - Federal, State, and Local

- Complement to other Statewide Studies

- Historical Data

- Future Projections

- Cost Savings

- Enhances Safety

- Enhances Value & Meaning of PCI value

Citation Jet collapsing on overloaded pavement
## Improving the North Dakota Airport System

<table>
<thead>
<tr>
<th>Funding Scenario</th>
<th>Entire System</th>
<th>Runways</th>
<th>Taxiways</th>
<th>Aprons</th>
<th>T-Hangars</th>
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</thead>
<tbody>
<tr>
<td>2009 Condition</td>
<td>76</td>
<td>78</td>
<td>76</td>
<td>72</td>
<td>64</td>
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<tr>
<td>2012 Condition</td>
<td>77</td>
<td>81</td>
<td>77</td>
<td>70</td>
<td>64</td>
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<td>2015 Condition</td>
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<td>2018 Condition</td>
<td>79</td>
<td>82</td>
<td>79</td>
<td>73</td>
<td>76</td>
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<tr>
<td>2023 Overall Needs</td>
<td>88</td>
<td>89</td>
<td>88</td>
<td>88</td>
<td>86</td>
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<tr>
<td>2023 Anticipated Funding</td>
<td>80</td>
<td>82</td>
<td>84</td>
<td>76</td>
<td>75</td>
</tr>
<tr>
<td>2023 No Funding</td>
<td>71</td>
<td>75</td>
<td>72</td>
<td>66</td>
<td>66</td>
</tr>
</tbody>
</table>
Troubleshooting and Forensics

Q Addresses specific problem(s)
Q Considers several aspects of observed distresses
Q Used to link distresses and their causes to propose solutions
Q May be most detailed evaluation
Communication with Stakeholders

Q Explain current conditions
Q Support project or funding requests
Q Impact of actions or inaction
Communication with Stakeholders

Pavement Capital Planning
- Q Airport Operations
- Q Airport Maintenance
- Q Airport Engineering
- Q Airport Leadership
- Q Airport Board
- Q State Aeronautics Partners
- Q FAAADDO
Capital Program priorities, including taxiway geometric changes to be determined based on pavement condition data!
Value in Stakeholder Communication

Q Continued Engagement
  - Success in tenant and departmental engagement
  - Discussions and input early and often

Q Airlines
  - Data collection and maintenance/capital impacts
  - Staff changes – maintain cohesive management group

Q Airport
  - Multiple projects
  - Maintenance paired with capital projects
DATA STORAGE, MAINTENANCE, AND ACCESS

Q Data types
Q Staff level and experience
Q Ability to access and use data
Q Airport size
## Typical File Sizes of Different Data Types

<table>
<thead>
<tr>
<th>File Type</th>
<th>Description</th>
<th>Typical File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVER</td>
<td>Pavement management data, including PCI condition data, historical data, models, treatments</td>
<td>10 MB</td>
</tr>
<tr>
<td>FWD Deflection Data Network Project</td>
<td>Pavement response to impulse loading, providing measure of pavement structural integrity</td>
<td>45 MB</td>
</tr>
<tr>
<td>LiDAR</td>
<td>Point cloud of data</td>
<td>128 GB</td>
</tr>
<tr>
<td>Profile</td>
<td>Transverse (rutting) and longitudinal (roughness) profile data</td>
<td>12 MB</td>
</tr>
<tr>
<td>3-dimensional laser image</td>
<td>Laser imaging of pavement surface</td>
<td>37 GB</td>
</tr>
<tr>
<td>Video</td>
<td>Video images of pavement and right-of-way</td>
<td>45 GB</td>
</tr>
</tbody>
</table>

1 4,000,000 square feet of pavement used to determine typical file size
**Matching Condition Data Types And Use(s)**

- **Q** Goal is to collect appropriate data that will be used effectively by airports
- **Q** Date use controls which collection methods are implemented
- **Q** Decision trees provide guidance to match condition data types and use(s)
Decision Tree Categories

- Organized by purpose (use), airport size, and user

- Data use categories:
  - FAA compliance
  - Airport or agency management
  - Engineering or other technical departments
  - Other data uses
**Decision Tree Steps (1 of 2)**

1. Decide how the data will be used
2. Based on the decision trees, select the possible data collection methods
3. Record the total occurrences for each data collection method
Decision Trees Steps (2 of 2)

Evaluate the most common available data collection methods

Q Will most common data collection methods meet all the specific uses?

Q Will combination of data collection methods be required?

Q Identify other factors impacting data collection and use

Q Estimate the cost for data collection and value of associated condition data
Decision Tree - Engineering (APMS)

DATA COLLECTION FOR ENGINEERING / OTHER TECHNICAL DEPARTMENTS

APMS (Simple)

AIRPORT TYPE:
- Multiple Airport System
- Large Hub
- Medium Hub
- Statewide System

- PCI manual inspection at less than 95% confidence level
- PCI manual inspection at or above 95% confidence level
- Non-PCI pavement condition rating system by aerial survey

APMS (Detailed)

AIRPORT TYPE:
- Multiple Airport System
- Large Hub
- Medium Hub
- Statewide System

- PCI manual inspection at less than 95% confidence level
- PCI manual inspection at or above 95% confidence level
- Non-PCI pavement condition rating system by aerial survey

AIRPORT TYPE:
- Small Hub

- PCI manual inspection at 100% sampling with distress mapping
- PCI manual inspection at 100% sampling
- Non-PCI pavement condition rating system by 3D laser imaging
- FWD/HWD collection at network level

AIRPORT TYPE:
- IGA

- PCI manual inspection at less than 95% confidence level
- PCI manual inspection at or above 95% confidence level
- CFME friction data collection
- FWD/HWD collection at network level
- FWD/HWD collection at project level
Practices associated with airfield pavement condition data collection and use have been relatively stable for years.

Today the situation is fluid, with the need for changes driven by airports and supported by developing technology.

Change is coming.
FOR ADDITIONAL INFORMATION

David Peshkin
dpeshkin@appliedpavement.com

Casey Ries
cries@grr.org

Kyle Wanner
kcwanner@nd.gov

NDAC PCI Website:
aero.nd.gov/app/pavement/index.html

ACRP Report 203:
http://www.trb.org/Publications/Blurbs/179612.aspx
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Report 202: *Developing Innovative Strategies for Aviation Education and Participation*

Report 214: *Building Information Management (BIM) Beyond Design Guidebook*

Synthesis 108: *Characteristics of the FBO Industry 2018-2019*

Web-Only Document 46: *Recovering International Recyclables from In-Flight Service*

Web-Only Document 47: *Commercial Space Operations Noise and Sonic Boom Measurements*

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