Airfield Pavement Smoothness: Leveraging the Latest Technologies

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Airfield Pavement Smoothness: Leveraging the Latest Technologies

- Background
- Methodologies
- “New” Technology
- Gaining Perspective
- New Applications
- Added Benefits
Background

• Smoothness or Roughness
• Lots of attention lately
• Evaluation criteria – around for years
• Disputes and debates
  • Performance
  • Payment Issues
• Lessons Learned
  • Runways are not Roads
Background

- Smoothness matters
- Not a ride quality issue – not entirely

- Aircraft Response Issue
  - Equipment fatigue or failure
  - Stress and wear
  - Operational Safety
Background

- Smoothness defined
- Finite bumps (single event)
  - 328 feet or less (FAA AC 150/5380)
  - Equipment fatigue
  - Affect passenger comfort
  - One and done type reactions
Background

• Smoothness defined

• Profile Cycling
  • Longer patterns within the profile
  • Equipment fatigue
  • Reduces braking action
  • Impair cockpit operations
  • Affecting passenger comfort
Background

• Smoothness defined

• Typical Causes
  • Material placement
    • Paver issues
    • Finish flaws
    • Material flaws
  • Grade Control
    • Base grade / leveling course
    • Paver issues
Methodologies

• Traditional Evaluation

• 16-foot straight edge
• California profilograph
• Non-contact profiler
• Various other inertial profilers
  • Vehicle mounted
  • Hand carts
  • Data noise issues

• Pros/Cons
Methodologies
Methodologies

- Reporting Metrics
- Profile Index (inches/mi)
  - Profilograph
- International Roughness Index (IRI)
  - Models an idealized suspension
- Boeing Bump Evaluation
  - Virtual straight edge
  - Max deviation
Methodologies
Methodologies

- Standard practices
- Profiler/profilograph data at intervals
  - 500’ +/-
  - Good for short wavelength/finite
  - Moderate for long wavelength cycling
- Usually linked to paving lane length
- Can splice results – rarely done
Methodologies

• Better practices

• Develop a continuous profile
• Close-up viewing (Finite)
• Macro viewing (Cycling wavelengths)
• Most options produce ‘relative’ data
• Ideal case
  • Surveyed profiles
  • Desktop review
Methodologies

- Best practice
- Leverage the design data
- Engineered profiles and grading
- Designed to meet criteria
- Designed to minimize issues
- Leverage design technology
  - Improve grade control
  - Reduce smoothness issues
“New” Technology

- Advanced DTM Development
- Laser scanning/LiDAR

- Scanning since early 90’s
- Current technology
  - Static scanning
  - Mobile scanning
- Produces data fields
  - Point Clouds
- Challenges
Gaining Perspective

• The Story of the Dots

• Every survey point is a dot
• X, Y, Z data – more is always better
• DTMs are simply connecting the dots
• Everything else is interpolated
• Assumptions

• String lines, grade stakes or joints
Gaining Perspective

• Imagine the dots getting closer…

• Less interpolation
• Less assumption
• More reality

• More data, more reliability
Gaining Perspective
Gaining Perspective
Gaining Perspective
Gaining Perspective
New Applications

• What does this all amount to?

• Leverage the available technology
  • Leverage the design data

• Potential for
  • Improved grade control
  • Improved smoothness testing
New Applications

- Improved Grade Control
- Engineered design – surface as basis
- Construction grade verification
  - Simple ASCII scan
  - No classification required
  - Develop interim surface
  - Compare interim to design surface
New Applications

- Improved Smoothness Testing

- Simple ASCII scan – Point Cloud
- No classification required
- Develop interim surface
- Cut continuous profiles
  - Aircraft dependent – CL, 10’, 17.5’
  - Crossings/Connections
New Applications
New Applications
New Applications
New Applications

- Evaluating profiles
- Import profiles into software (model)
- ProFAA (Boeing Bump Evaluation)
- ProVAL (IRI Index)
New Applications
Added Benefits

- Secondary benefits of point cloud data
- As-built Data/Drawings
- Contractor quantity verification
- Asset management
- GIS Mapping
Questions?
Thank You

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