Concrete Pavement – the Design Perspective

Gary L. Mitchell, P.E.

Vice President

Airports and Pavement Technology

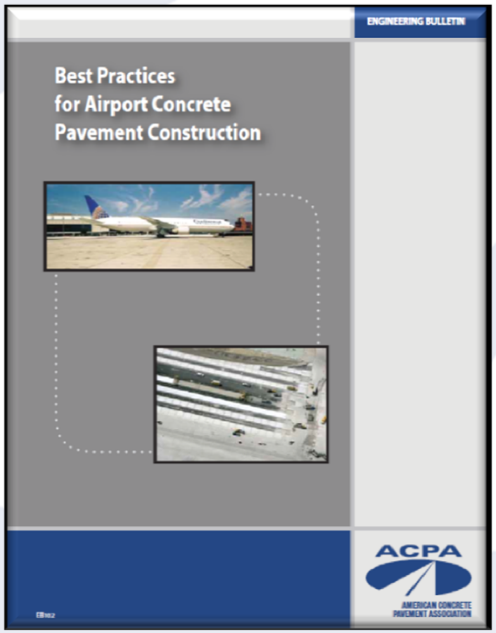
Count on Concrete PAVEMENT

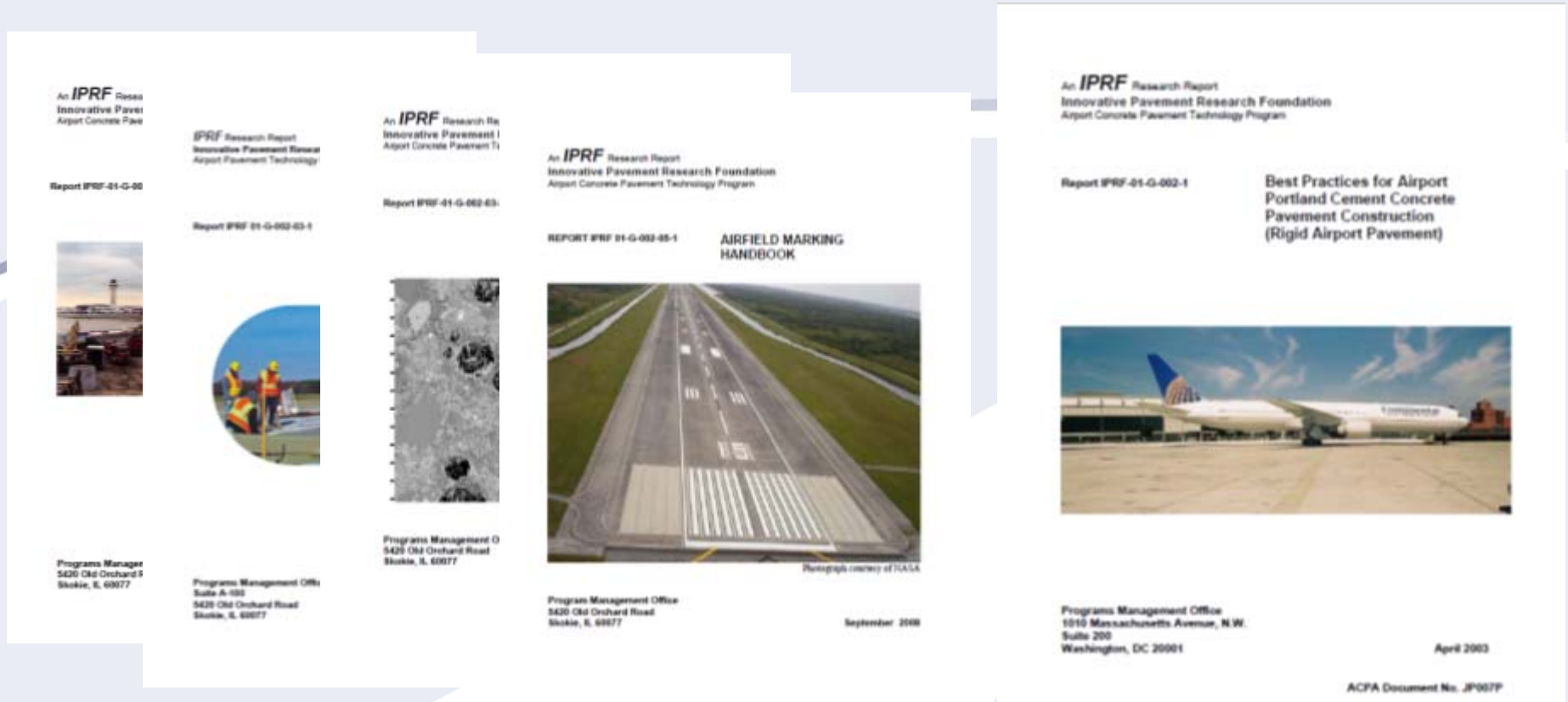
Introduction

- **Planning**
- **Procurement & Contract**
- **Design**

Resources

- Innovative Pavement Research Foundation
- ACPA Publication
- FAA (or applicable agency)





Innovative Pavement Research Foundation

www.iprf.org

Other Great Resources:

www.cptechcenter.org

www.acpa.org/bookstore

Planning Considerations:

- Coordination with stakeholders
- Identify Key Personnel
- Eliminate the Unknowns

Geotechnical

Utilities

Weather

Procurement and Contracts

- Deliver Options
- Require Minimum Quals
- Pre-Qualify Bidders Early
- Early Procurement of Long Lead Items
- Early NTP
- Set Aside Funding for Contingencies
- Bonus for Early or “on-time” Completion

Phasing and Scheduling

Security Fencing

Time of Year/Week/Day

Minimize the Number of Phases

Overlap Phases

Alternate Facilities

Partial Use of Runway/Taxiway

Affects on Other Work

Solicit Contractor Input

10 vs. 1

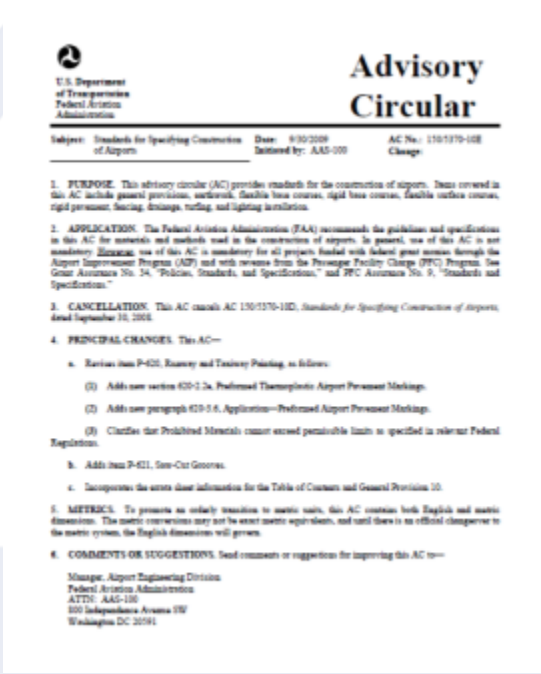
10 versus 1 Rule

Project Staging Areas

- Level
- Well drained (throughout construction)
- Size
- Access

Construction Specifications

- Establish the acceptable parameters
- Easy to understand
- May be prescriptive and/or end-result based
- Provide guidance/requirements for:
  - Materials
  - Construction methods
  - Methods of measurement for compliance with specs
  - Testing requirements
  - Basis of payment



U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Standards for Specifying Construction of Airports | Date: 9/30/2009 Initiated by: AAS-100 | AC No.: 150/5370-10E Change:

1. **PURPOSE.** This advisory circular (AC) provides standards for the construction of airports. Items covered in this AC include general provisions, earthwork, flexible base courses, rigid base courses, flexible surface courses, rigid pavement, fencing, drainage, turfing, and lighting installation.

2. **APPLICATION.** The Federal Aviation Administration (FAA) recommends the guidelines and specifications in this AC for materials and methods used in the construction of airports. In general, use of this AC is not mandatory. However, use of this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charge (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standards and Specifications."

3. **CANCELLATION.** This AC cancels AC 150/5370-10D, *Standards for Specifying Construction of Airports*, dated September 30, 2008.

4. **PRINCIPAL CHANGES.** This AC—

a. Revises item P-620, Runway and Taxiway Painting, as follows:

(1) Adds new section 620-2.2a, Preformed Thermoplastic Airport Pavement Markings.

(2) Adds new paragraph 620-5.6, Application—Preformed Airport Pavement Markings.

(3) Clarifies that Prohibited Materials cannot exceed permissible limits as specified in relevant Federal Regulations.

b. Adds item P-621, Saw-Cut Grooves.

c. Incorporates the errata sheet information for the Table of Contents and General Provision 10.

5. **METRICS.** To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

6. **COMMENTS OR SUGGESTIONS.** Send comments or suggestions for improving this AC to—

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue SW
Washington DC 20591

Pre-Bid, -Award, and –Construction Meetings

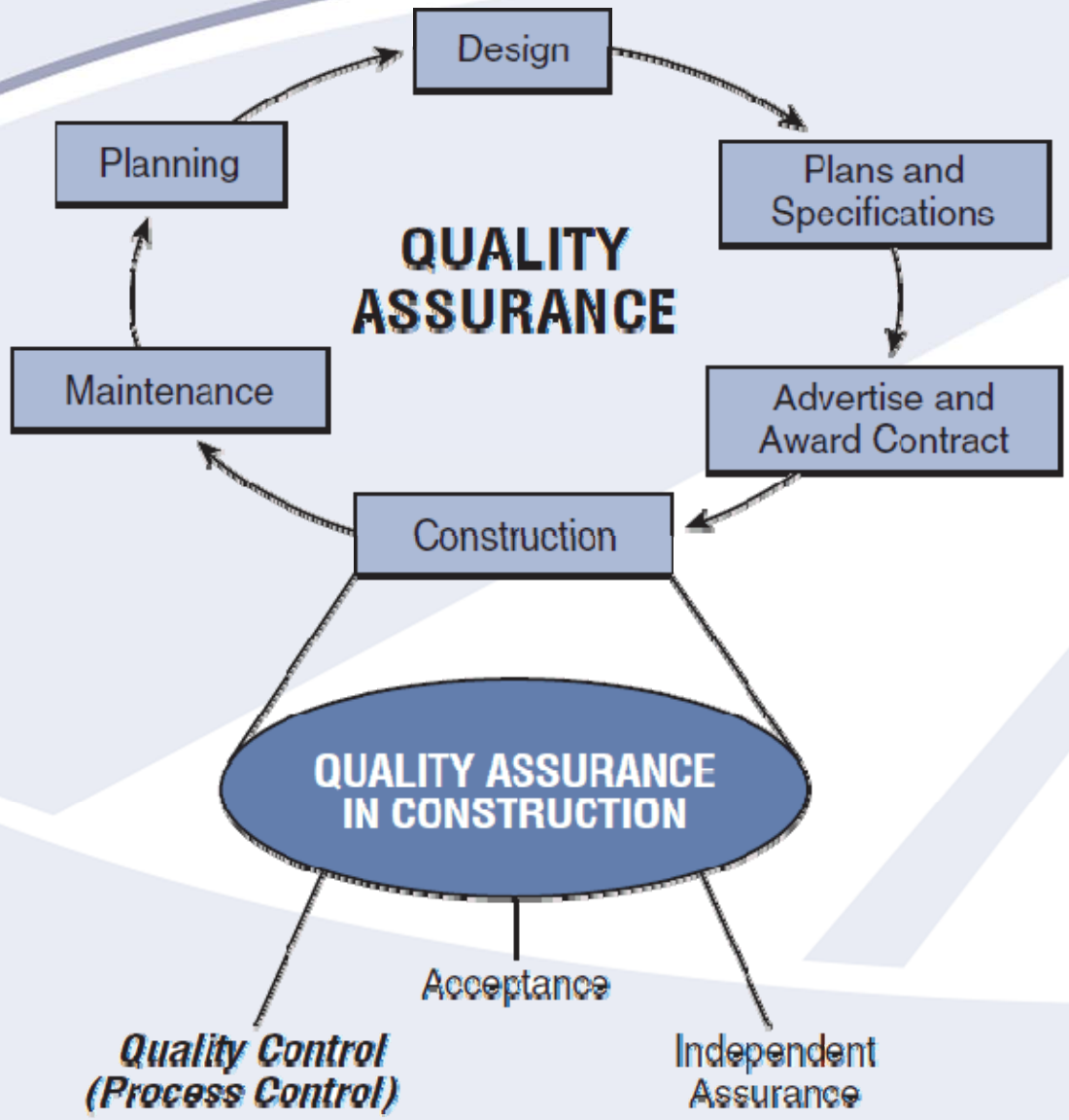
- Project overview
- Administrative/contractual details
- Construction scheduling & phasing
- Contractor's access to site & staging area
- Addendums to plans & specifications, if any
- Detailed review of project scope of work
- Bidder's questions
- Site visit

(THIS IS THE TIME TO RESOLVE ANY CONTRACTOR QUESTIONS/CONCERNS)

Partnering Pays Dividends!

- A joint meeting between QC and QA reps before construction starts
  - Review project requirements
  - Review action and suspension limits
  - Identify & clarify gaps and ambiguous items
  - Review handling of non-conforming test results
  - Review chain of command for decision making
  - Establish QA/QC data management & data review plan
- Designer, Owner, Program Manager, Contractor

QC versus QA



Quality Assurance (QA)
Ensures that the end product is of the proper quality (checks that things are done properly)
Responsibility of the specifying agency
Motivates proper QC practices

Quality Control (QC)
Makes the product of the proper quality through QC processes (ensures that things are done properly)
Responsibility of the producer and/or contractor
Motivated by QA and acceptance procedures

Cost of Poor Quality

- For airport owner
  - Operational delays & loss of revenues
  - Cost of claims (litigation)
  - Reduced service life
- For contractor
  - Corrective measures
  - Partial payments
  - Cost of claims (litigation)
  - Liquidated damages

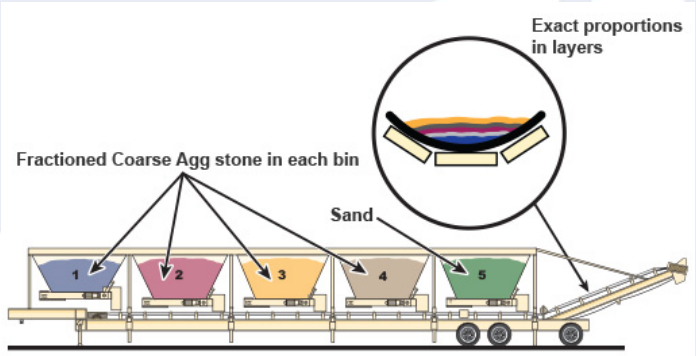
Acceptance Criteria

- (Slump and air content) **
- Flexural strength
- Thickness
- Smoothness
- Grade: lateral & vertical deviations
- Edge slump
- Dowel bar alignment

Manual Paving

- Labor intensive
- Used for small areas only
- Reinforcement in odd shaped panels (only)

Fillet Details



Each bin has live, calibrated bin gate
Feeds are variable speed
Material is collected in layers
Exact proportions, in layers, of the required mix design

Mixer works to blend cement paste with fractioned aggregates and sand

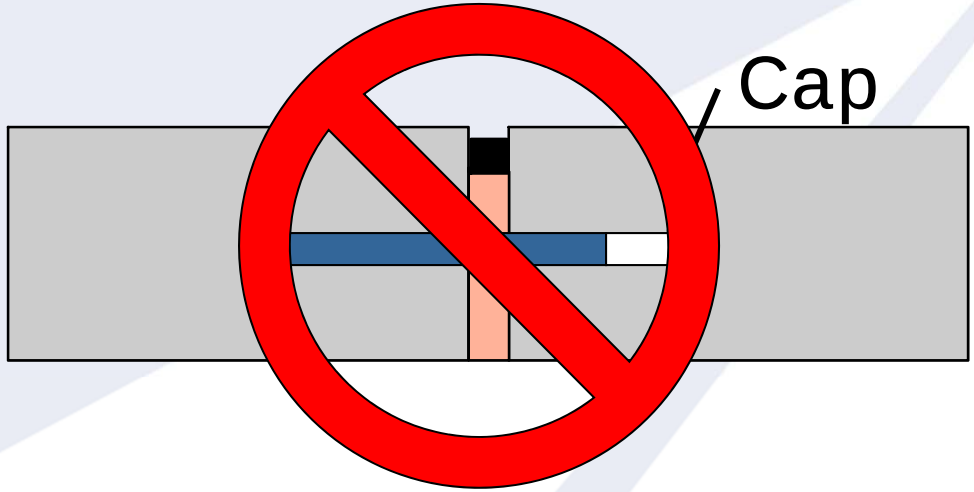
Best Practices for Airport Pavement Construction

Concrete Mixture

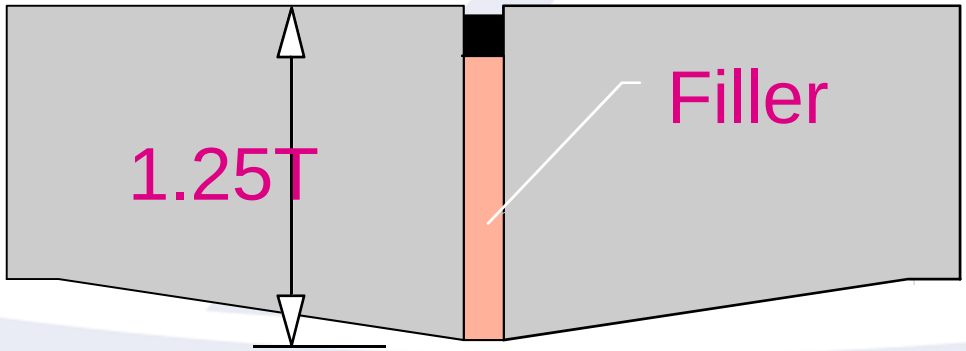
Attention to Detail

Isolation/~~Expansion~~ Joints

Doweled

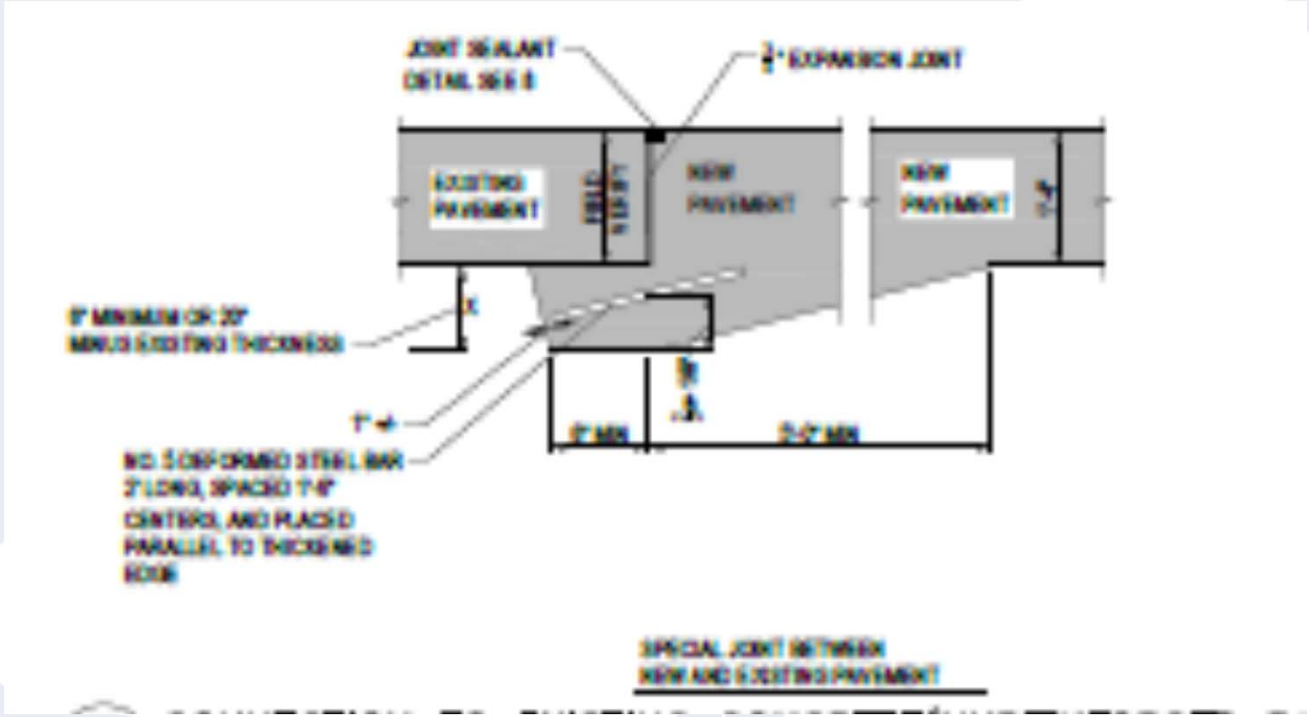


Thickened Edge



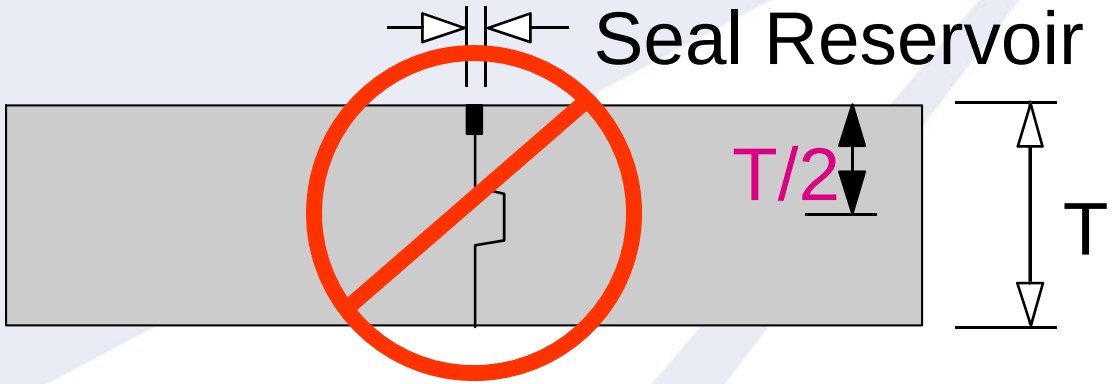
Details

Poor hard to construct details



Keyed Construction Joint

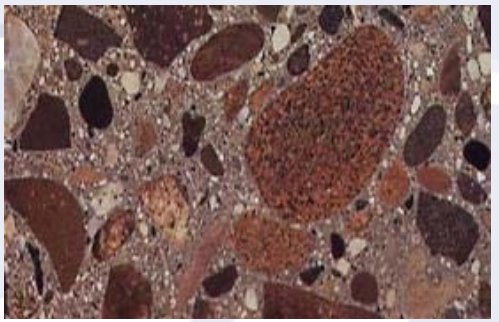
Keyed

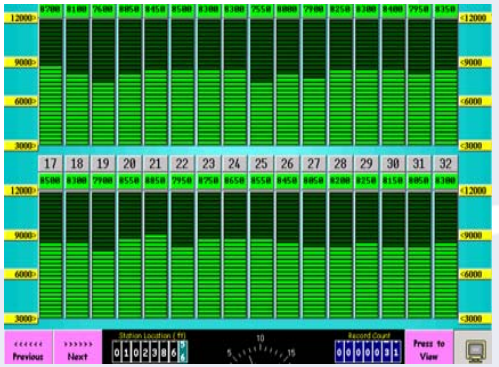


FAA AC/150-5320-6E: Detail has been removed

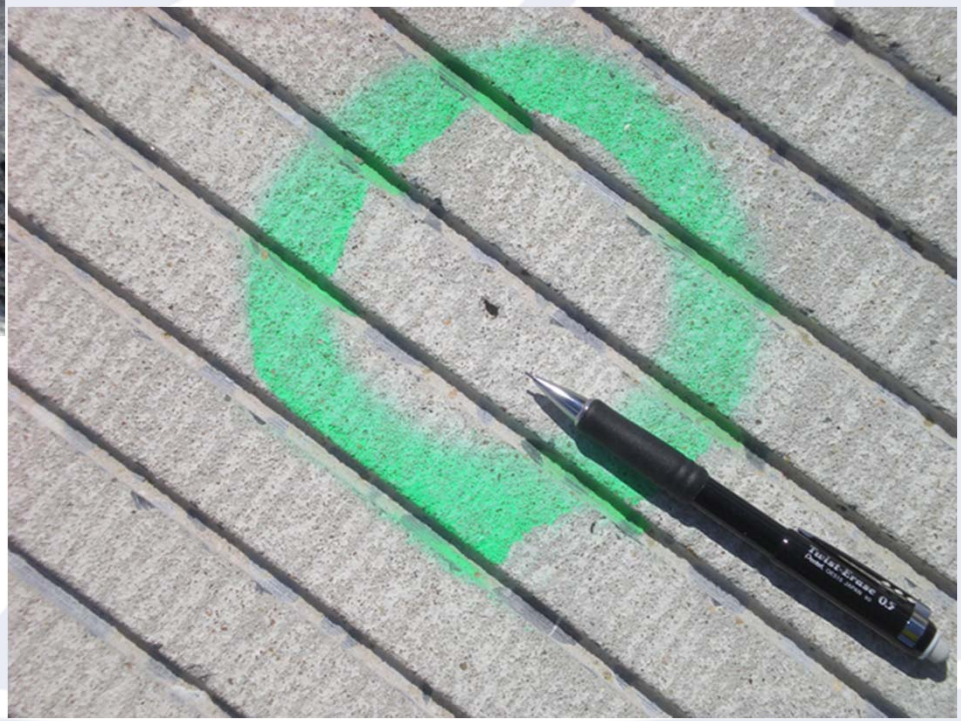
Concrete Consolidation

- Inadequate consolidation
  - Lower in-place concrete strength
  - Honey-combing
- Over-consolidation
  - Poor air void system
  - Less durable concrete
- Monitor vibration effort regularly
  - vibrator smart system recommended – continuous monitoring





What is reasonable?



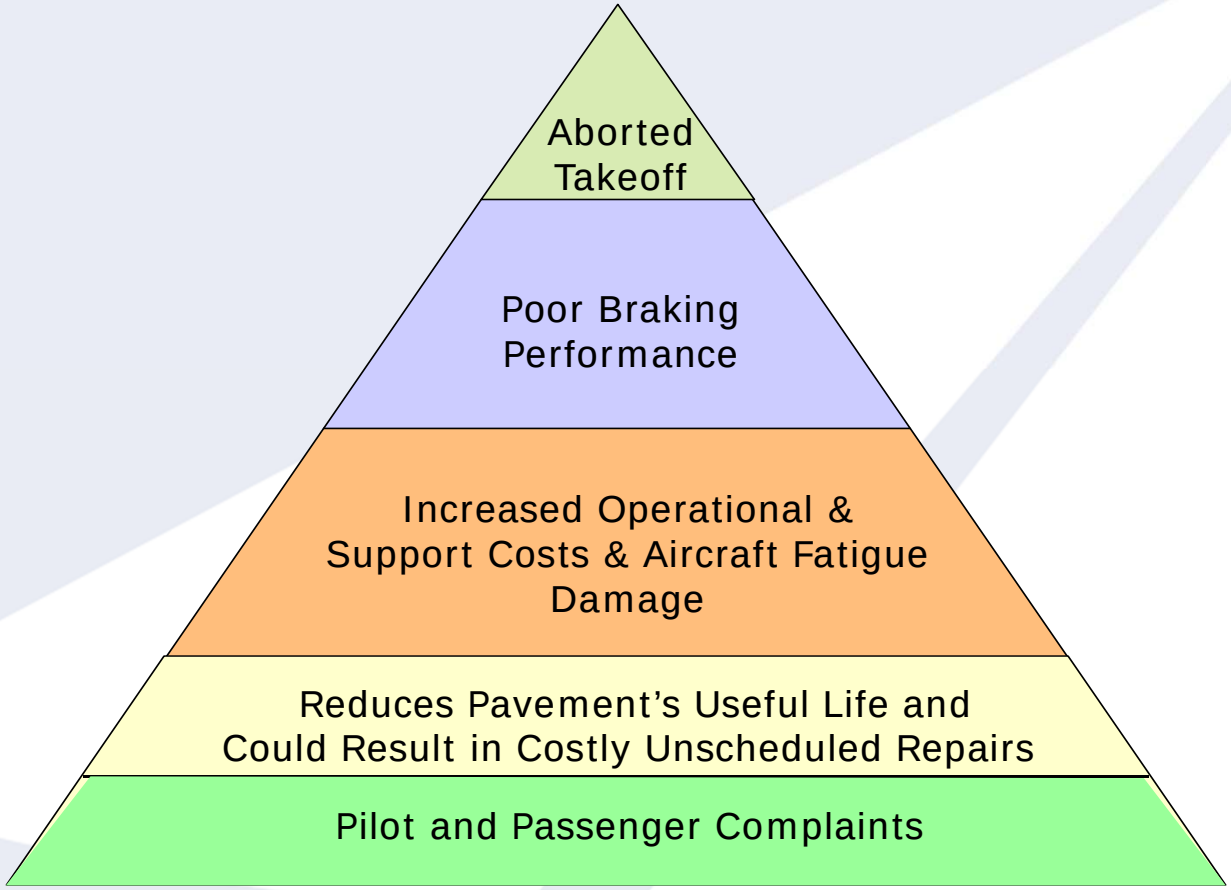
Paving Around In-Pavement Structures

- Lights, hydrant pits, utility manholes & drainage structures (trenches)
- Properly planned for and executed – consider during design phase
- For light cans, methods include
  - Blockouts
  - Split can & coring

Runway Roughness Evaluation: A Unique Problem

- Landing Gear Spacing of nearly 100 Feet
- Speeds up to 150 Knots
- Aircraft will Respond to Bumps 300 Feet Long or Longer
- Multiple Bumps in Succession; Non-Linear Effect
- Struts are Primarily Designed for Landing Impact

Why Be Concerned About Runway Roughness?



What is the goal for smoothness?

FAA Advisory Circular 150/5380-9
(Based on Boeing Bump Criteria)

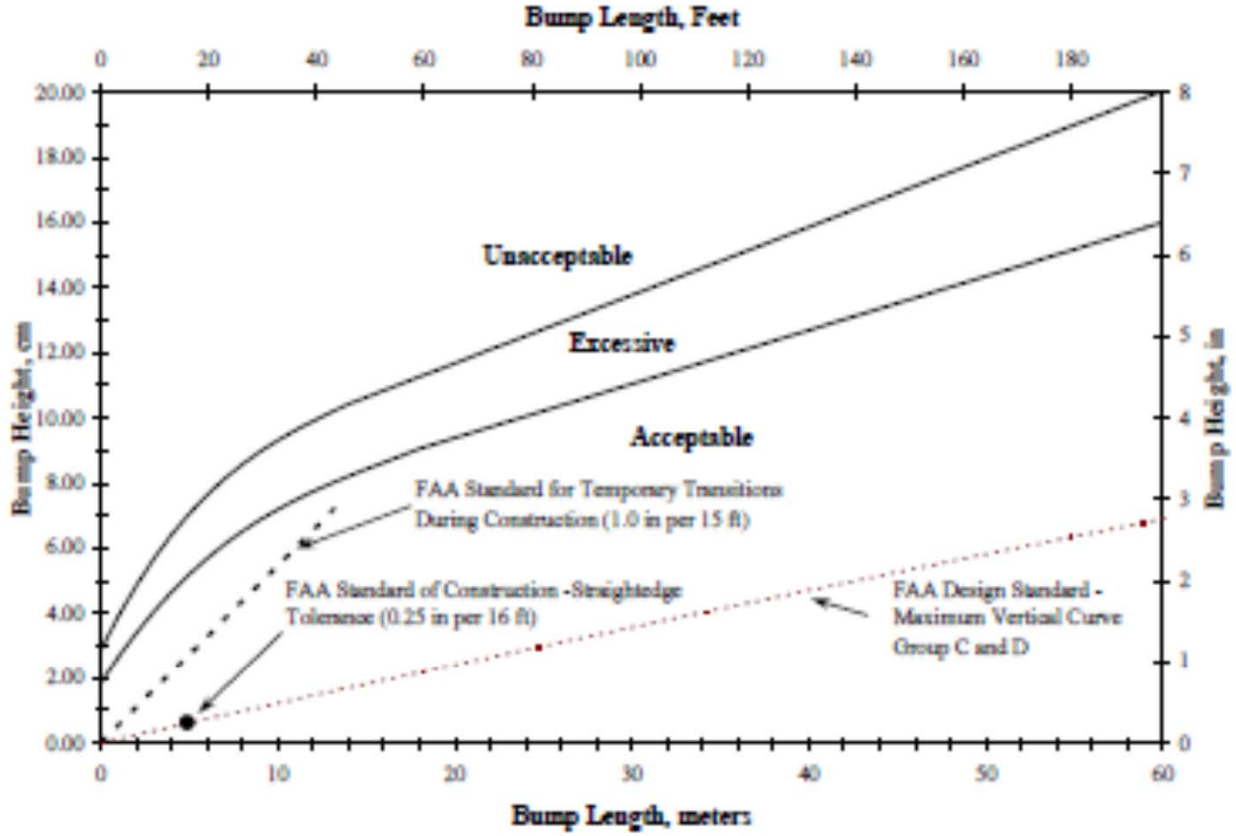


FIGURE 2-3. SINGLE EVENT BUMP - ROUGHNESS ACCEPTANCE CRITERIA

Current Smoothness Criteria

- 12 feet straightedge
- Threshold of Acceptability – ¼ inch measured anywhere between two high points of the straightedge
- No criteria for long wavelength profile of a pavement feature
- Therefore no criteria exist for smoothness of an entire pavement feature
- This issue is drainage and aircraft safety

Best Practices for Airport Pavement Construction

There’s More!

Thank You!

Questions?

Gary L. Mitchell, P.E.

gmitchell@acpa.org

ACPA

www.acpa.org

Pavements 4life

www.pavements4life.com