# Paving with the new P-501 Specification

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# FAA Airport Construction Guide Specifications

- Advisory Circular 150/5370-10 – Guide Specification for Construction
- Now version "H" (i.e. –10H)
- Issued December 21, 2018
- Errata issued to fix type error and to clarify provisions
- P-501 is part of 10H

# Why Update

- ‘Scheduled’ 3 – 5 years
  - Update References (ASTMs, etc)
  - Improve, Clarification, etc.; general comments received
  - Stay current; policies, processes, etc.
- State of Practice
  - Material, process maturing
  - Advancement in Technology
- Issues, Concerns, Guidance
  - Minor Issue becoming ‘Persistent’
  - Local/Regional expanding Nationally
    - Modification to Standard
  - Improvement for Quality Pavement

# What to Update is Based On

- Comments & Discussions (email, phone, conferences, etc.)
- Modification to Standards (2010-present)
- Research & Evaluations (FAA-NAPTF, ERDC, Web, etc.)
- Collaboration with Industry (i.e. "industry meetings")
  - Asphalt Institute (AI)
  - American Concrete Paving Association (ACPA)
  - National Stone Sand Gravel Association (NSSGA)
  - Geosynthectic Materials Association (GMA)
  - Airports Consultant Council (ACC)
  - American Society of Civil Engineers (ASCE)
  - Others

# Update Overview

- Updated References
- Extensive technical and editorial edits
- Parts renamed/reorganized (including Items)
- Added  6 New Items
- Additional guidance in Engineer Notes on use of individual specifications
- Clarified what 5370-10 is intended to be for (airfield pavement >30,000 lb aircraft)
- Material properties (requirements) in table format
- Focus on Quality Control throughout

# ACPA' Role?

- Collaboration with Headquarters Engineers
  - On-going basis
- Help Resolve issues during design
- Help Resolve issues during construction
- Participate together with FAA in training
- Support the Regions when necessary
- Airport Task Force Involvement
  - Sub-group red-lined 5370-10G Item P-501
  - Acknowledgement

  Martin Holt (IHC)

  Harold Honey (Michael Baker Int.)

  Angela Folkestad (CO/WY ACPA)

  Many others, GTP, MCI, K-5, ACPA Chapters, IGGA, PCA

# Provisions Important to ACPA

- C-100 Contractor Quality Control
- P-207 Full-Depth Reclaimation
- P-209 Aggregate Base Course
- P-219 Recycled Concrete Aggregate Base Course
- P-304 Cement Treated Base
- P-307 Cement Treated Permeable Base Course
- P-501 Cement Concrete Pavement

# Base Courses

- P-209 Aggregate Base Course:
  - Dust Ratio (#200/#40 < 50%) Now allow to 66.67%
- P-219 Recycled Concrete Aggregate Base Course
  - A new Item
  - Allowed as subbase for AC or PCC
  - No longer needs MOS
  - Based on IPRF

# Stabilized Base Courses

- P-304 Cemented Treated Base
  - Acceptance no longer on Lot basis, which is tied to PWL—uses area
  - Density testing accordance with ASTM D558—requires moisture-density curves per sublot; has been changed to as needed during production (daily, weekly, or as necessary).
  - Thickness acceptance based on 3" diameter cores; now uses core hole depth or survey.
- P-307 Cement Treated Permeable Base Course
  - New item
  - Based on IPRF work

# Item P-501 Cement Concrete Pavement

- Paragraph 501-2.1.(a) Reactivity – **No Significant Changes**
- Paragraph 501-2.1 Aggregates
  - Refined requirements to mixture optimization
  - Engineer specifies largest size aggregate-–contractor selects the aggregate
  - Table added for gradations based on contractor's approved mixture after control strip
  - Minus #200 material allowed to increase if shown to be fracture dust

# Item P-501 Cement Concrete Pavement

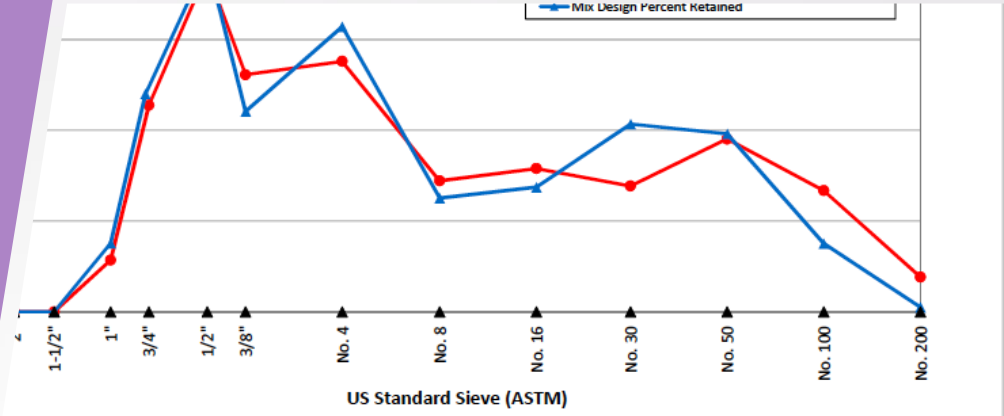
- Paragraph 501-2.3 Cementitious Materials—allowable Fly Ash CaO content increase from 13% to 15%
- Paragraph 501-2.12 Material Acceptance—removed; unnecessary because each material has acceptance requirements in relevant sections.
- Paragraph 501-2.12 Now is Bond Breaker
  - Choke stone #89—based on IPRF research
  - Fabric is allowed—certificate of compliance from manufacture saying can be used as a bond breaker

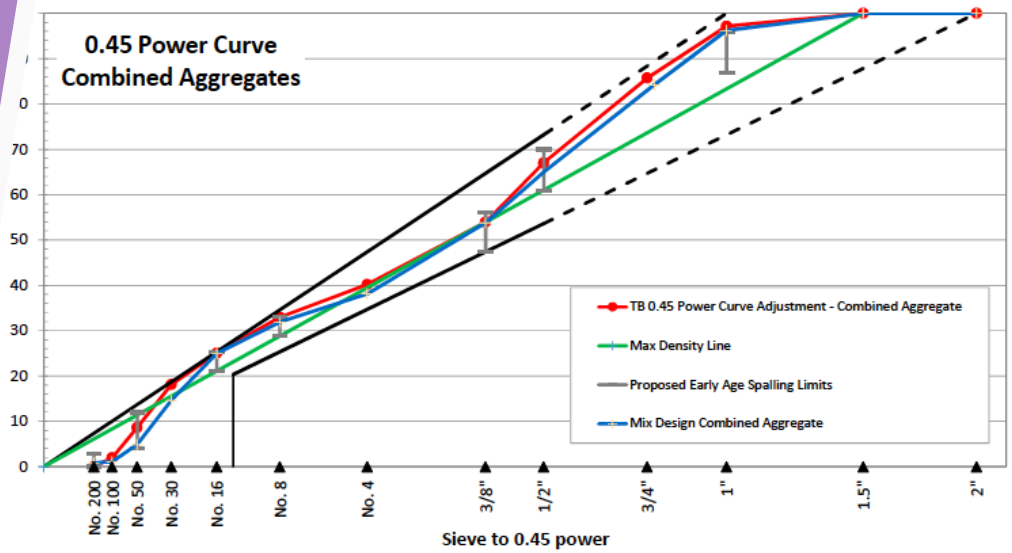
# Item P-501 Cement Concrete Pavement

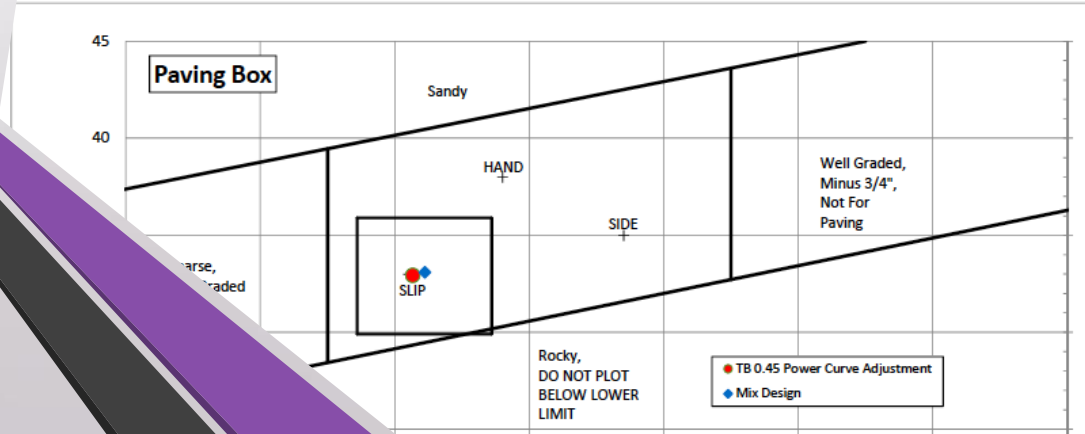
- Paragraph 501-3.2 Concrete Mix Laboratory—accredited lab required; Moved to the front of Concrete Mix section
- Paragraph 501-3.3 Concrete Mix Proportions
  - Slump requirement changed—removed 1-1 ½ inch slip form requirement (Up to 2")
  - Slump allowed to 3" for forms; 4" for hand pours
  - For aircraft 60,000 or less; allows compressive strength for acceptance

# Item P-501 Cement Concrete Pavement

- Paragraph 501-3.4 Concrete Mix submittal
  - Moved to its own paragraph
  - Contains clarification
- Age changed from 90 to 180 days



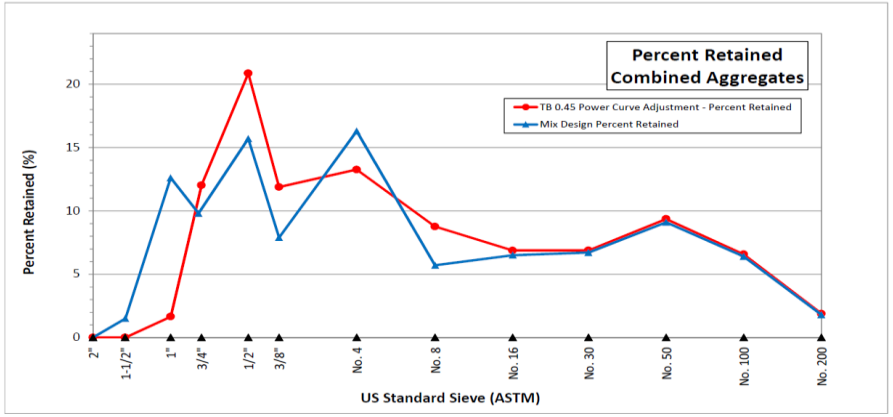



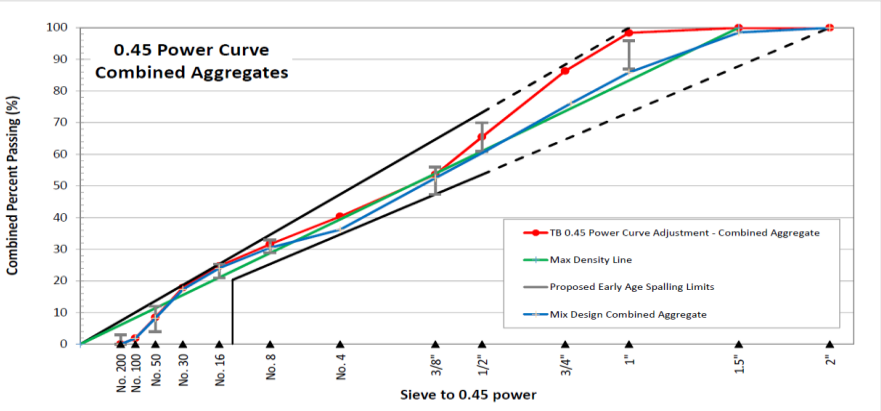
# Coarseness (CF) and Workability Factors (WF)

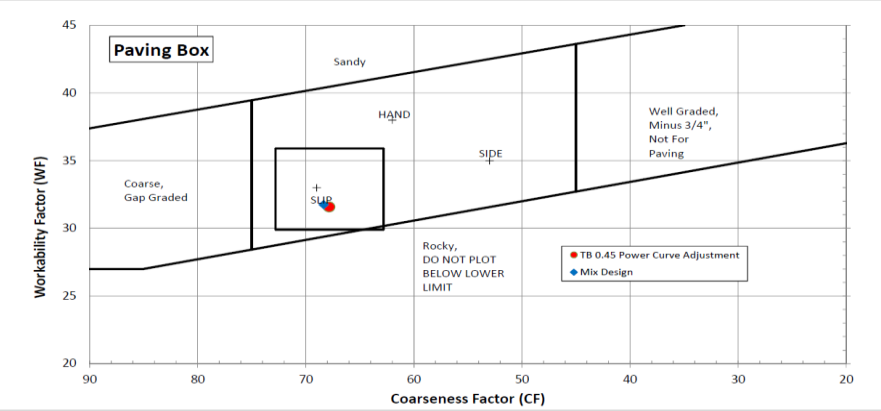
- Required method for mixture design
- CF & WF plot required in mixture design and QC plan
- References Air Force ETL 97-5 (TSPWG M 3-250-04.97-05 *Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements*)
- Other Tools
  - Percent Retained
  - 0.45 Power Curve

# Mixture Optimization

- CF/WF – need more
- Use all the tools.
- 0.45 Power Curve and percent retain curve will help refine.
- TSPWG M 3-250-04.97-05 *Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements*
  - Minimize spalling potential
  - Less shrinkage
  - Less risk of early age cracking



# Tarantula Curve

- Can be an issue for airfield pavements
- Will allow too much mortar
- Increase shrinkage potential
- May lead to cracking and sliver spalls
- Possible edge slump issues

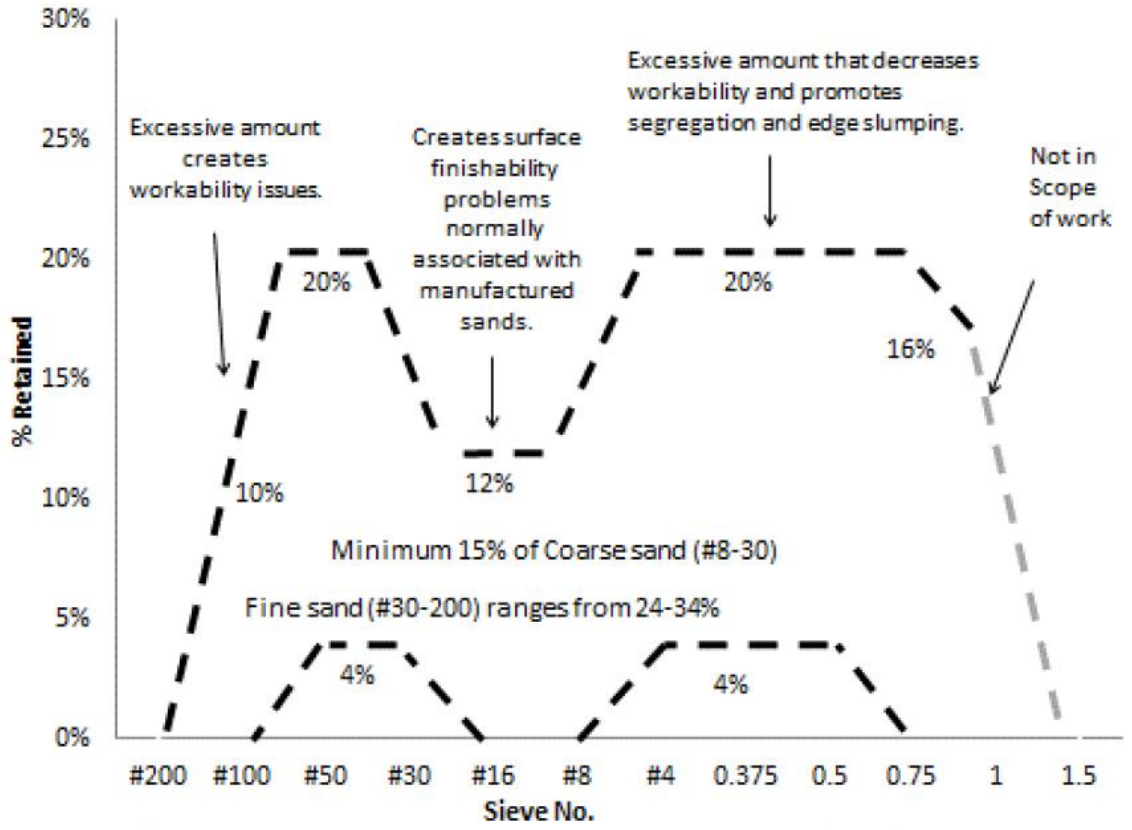



**Figure 4-24 shows the recommended specification limits for Oklahoma.**

# Item P-501 Cement Concrete Pavement

- Paragraph 501-4.1 Control Strip
  - 250-foot for both pilot and fill-in lanes
  - Contractor to demonstrate to owner materials, mixture, equipment, process, quality control are adequate
  - Visual representation of what is expected and agreed to
  - Minor adjustment to the submitted mixture
  - Accepted production mixture is based on control strip
  - Will be paid for if it meet all acceptance criteria

# Item P-501 Cement Concrete Pavement

- Paragraph 501-3.5 Equipment
- Several wording changes and rearranging of provision (e.g. side forms changed to fixed forms; description of paver reduced & moved to be included under finishing equipment)
- Engineer's authority to approve the paver has been removed (no standard was given for approval)
- For plants—added ASTM C685 to address volumetric plants
- Engineer's "approval" of finishing equipment changed to "acceptance"
- **Operating frequency of vibrators changed to as "sufficient to consolidate the pavement without segregation or voids"**

# Item P-501 Cement Concrete Pavement

- Paragraph 501-4.3 Form setting
  - Means and methods removed (e.g. "underlying surface shall be thoroughly tamped mechanical or hand", "thoroughly tamped" is undefined"
- Paragraph 501-4.4 Base surface preparation prior to placement
  - Redundancy removed from previous paragraph
  - Language cleaned up (removed template requirement)
- Track line edge design is Engineer's responsibility (eliminates some contractor from skimping on the track line so it is in the bid and paid for)
- Engineer determines if bond breaker is required and inserts appropriate P-specification

# Item P-501 Cement Concrete Pavement

- Paragraph 501-4.6 Mixing concrete
  - Note to the engineer 30-minute time limit from water addition can be adjusted
  - Batch Plant location must be provided to ensure time limit is reasonable for delivery and placement
- Paragraph 501-4.7 Weather Limitation on mixing and placing
  - Means and methods removed
  - Language simplified to protect pavement from exceeding the 0.02 psf evaporation rate
  - HIPERPAVE 3 is mentioned in note to the Engineer as example of temperature management—provides contractor a tool for weather management plan

# Item P-501 Cement Concrete Pavement

- Paragraph 501-4.8 Concrete Placement—various confusing statement and ambiguities have been changed
- Paragraph 501-4.10 Joints
  - Dowel holes excessive spalling defined (limit to spalling outside the grout ring)

# Item P-501 Cement Concrete Pavement

- Paragraph 501.4-11 Finishing—means and methods descriptions changed, added, or removed
  - Mortar rich surface re-defined as ¼ inch versus 1/8 inch.
  - Finishing aids included as remedy for prevention of plastic shrinkage cracks
  - Direction is given on removal of slurry running over sides
- Paragraph 501-4.13 Curing
  - Note to not add curing compound to surface to after bleed water is gone was added to text
  - Prevent blistering

# Item P-501 Cement Concrete Pavement

- Paragraph 501-4.14 Removing forms
  - Definition of honeycomb given
  - Extend less than 1" into slab-–repair with grout
  - Extend greater than 1" into slab—remove and replace
- Opening to Construction Traffic
  - Construction loads are shown not to be detrimental
  - Change strength to opening for construction to 450 psi flex (from 550 psi)
  - To expedite construction

# Item P-501 Cement Concrete Pavement

- Paragraph 501-4.19 Repair, removal, or replacement of slabs
  - Changed depth of shrinkage cracks that can be repaired (from 4" to 1/3 slab depth)
- Added High Molecular Weight Methacrylate (HMWM) as repair option
- Removed diamond grinding requirement "should not exceed 10%"
  - Penalty added if diamond grinding exceed 25% of lot

# Item P-501 Cement Concrete Pavement

- Contractor Quality Control
  - Moved to follow construction method – better fit
  - References Item C-100 Quality Control
  - Quality control plan required for project over $500K where paving is major work
  - Note added to engineer to explain intent of grinding for smoothness

"Note change in deviation of final surface course that require grinding., limited to deviations > ¼ inch that trap water, intent here is to focus on areas that may cause issues with the safe operation of aircraft and to minimize grinding if it will not improve safety."

# Item P-501 Cement Concrete Pavement

- The California Profilograph requirement has been removed
- Contractor may use 12-foot straightedge
- Contractor may use a rolling inclinometer meeting the requirement of ASTM E2133
- Rolling inclinometer data may be evaluated using ProFAA using 12-foot straightedge simulation function
- Longitudinal measurement must be taken for each day's production
- Deviations that trap water ¼ inch deep must be ground (L &T)
- Protect aircraft ops—not ride quality
- If grade and straightedge are met—ride is considered acceptable.

# Item P-501 Cement Concrete Pavement

- Paragraph 501-6.5 Acceptance Sampling and Testing
  - Smoothness acceptance criteria has been changed
  - Note to Engineer stating MOS is REQUIRED to change smoothness criteria
  - Adjustment to payment
    - Areas with spalls, crack, partial panel etc. payment limited to 95%
    - Area with sublots exceeding 25% payment limited to 95%
  - Edge slump is no longer an acceptance criteria (QC requirement)

# Item P-501 Cement Concrete Pavement

- Paragraph 501-6.5 Acceptance Criteria
  1. Strength
  2. Thickness
  3. Grade
  4. Profile smoothness (may not be used for some project and California Profilograph is no longer required)
  5. Adjustments for repairs
  6. Adjustments for grinding

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**Add bracketed text when profilograph smoothness not used.**

**Profilograph smoothness and acceptance adjustment paragraphs only apply when the overall project is a new and/or reconstructed runway(s) and/or taxiway(s) greater than 500 feet (152 m) in length. Any changes to the profilograph smoothness acceptance limits requires a modification to standards in accordance with FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards.**

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# Clarification Still Needed

**501-4.17 Protection of pavement.** The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the RPR. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense.

Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the RPR.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days, the joints are protected, the concrete has attained a minimum field cured flexural strength of 450 psi (3100 kPa), and the slab edge is protected.

All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

Damaged pavements shall be removed and replaced at the Contractor's expense. Slabs shall be removed to the full depth, width, and length of the slab.

**501-4.18 Opening to construction traffic.** The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 450 pounds per square inch (3100 kPa) when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

**501-4.17 Protection of pavement.** In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days, the joints are protected, the concrete has attained a minimum field cured flexural strength of 450 psi (3100 kPa), and the slab edge is protected.

**501-4.18 Opening to construction traffic.** The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 450 pounds per square inch (3100 kPa) when tested in accordance with ASTM C78.

# Intent

- **Paragraph 4.17– '...**will be permitted on the new pavement if the joints and slab edge are protected and the concrete has attained a minimum field cured strength of 450 psi (3100 kPa) **or** has been cured for 7 days."
- Paragraph 4.18– should be at least to support traffic that slab will be exposed to .
- May be a bracketed item [650 psi, (  )]
- FAA is looking for design strength here

# THANK YOU!

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