

## Airport Paving Changes to FAA Guidance

SEAUPG 2019 Meeting  
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**Outline**

- Size of Airfield Market
- Airfield Challenges
- Specs for Airfield Paving
- Recent Changes to P-401
- Cutting Back Longitudinal Joint





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### FAA Airport Pavements in US National Plan of Integrated Airport Systems (NPIAS)

	AREA (million sy)	~14' wide Lane Mile	Overall %
RW	273	~33,000	59.4
TW	105	~13,000	22.8
Apron	81	~10,000	17.6
<b>Total</b>	<b>460</b>	<b>~56,000</b>	<b>100.0</b>

Credit Doug Johnson, FAA

**For Comparison: U.S. Interstate System has 226,304 Lane Miles**  
FHWA Table HM-60 - Highway Statistics 2017

**Approximately 80% of RWs are asphalt**  
- General Aviation (50%): 7:1 HMA/PCC  
- Primary (38%): 2:1 HMA/PCC

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### Airfields provide unique pavement challenges different from highways

**Heavier Loadings**  
aircraft loads can exceed 1M# vs. 160,000# max load on hways/bridges

**Higher Tire Pressures**  
can exceed 300 psi vs. semi truck = 100 psi

**Foreign Object Debris (FOD)**  
must keep airfields at higher serviceability level (single commercial aircraft engine = \$15M)



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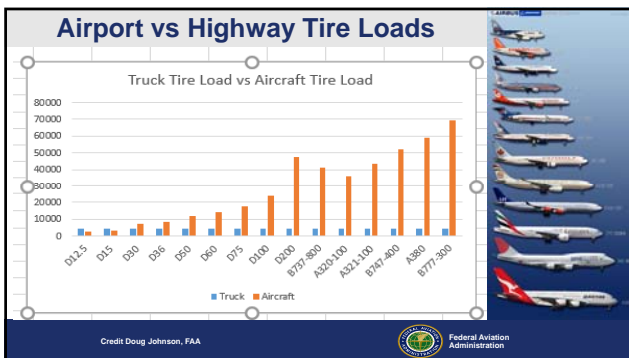
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### In Addition,

- Repairing RW or TW is Major Disruption to Ops
- Can't just close a lane and "keep traffic open"



Takes "Get In, Get Out, Stay Out" to Whole New Level

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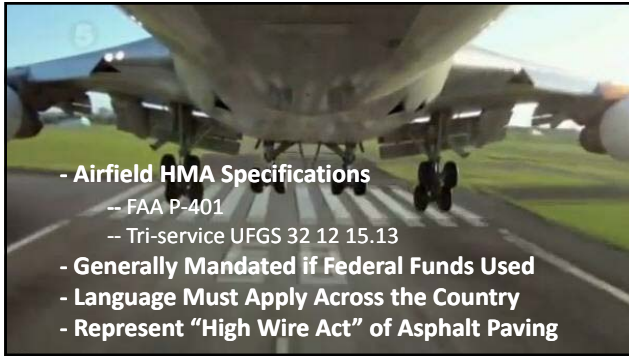
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- Airfield HMA Specifications
  - FAA P-401
  - Tri-service UFGS 32 12 15.13
- Generally Mandated if Federal Funds Used
- Language Must Apply Across the Country
- Represent "High Wire Act" of Asphalt Paving

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In Both P 401 and UFGS 32 12 15.13 

**Designer's option to choose between Marshall Hammer or Superpave Gyratory Compactor as Lab Compactor**

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**On December 21, 2018, FAA released a new version of their Airport Construction Standards**

~~AC 150/5370-10G (released 2014)~~  
**AC 150/5370-10H**

- P-401 just one of many specs in this AC (700+ pgs).

- Revision process includes extensive internal, industry and legal reviews (16 months, 2200+ comments). Thus, these ACs don't get updated very frequently.

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**Typical FAA Pavement Layers (for Flexible Pavements) and Their Specs in AC 150/5370-10H**



- Surface Course
  - P-401 (asphalt mix)
  - P-403 (similar to P-401 but no PWL)
    - For pavements supporting aircraft <30,000 lbs, or shoulders, roads, blast pads, or small maintenance projects
  - P-404 (fuel-resistant asphalt mix)
- Stabilized Base Course (typically required for aircraft > 100,000 lbs)
  - P-403 (when used as bond-breaker)
  - P-304, P-306, P307 (various cement treated aggregate bases)
- Base Course
  - P-209 (crushed aggregate)
  - P-208 (aggregate, less crushed)
  - P-207 (full depth reclamation - **New**)
- Subbase
  - P-154 (coarse sand)

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**Significant Changes to P-401 (Dec 2018)**



Covered in next Slides. Changes in red.

- Tack coat as a separate pay item
- Contractor quality control
  - greater emphasis, new requirements, separate pay item
- Compaction now % of TMD (vs lab bulk density)
  - matches highway industry
- Adjusted gradation bands
  - matching military airfield specs
- Improved minimum lift thickness guidance
- New loaded wheel test requirement for mix design
  - APA with 250 psi hose pressure at 64C
- New guidance on PG grade selection
  - additional grade bump
- Greater use of state highway standards

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**Changes to P-401 Mix Gradations (Table 2)**



Sieve	Gradation 1	Gradation 2	Gradation 3
1 inch	100	--	--
3/4 inch	90 - 100	100	--
1/2 inch	68 - 88	90 - 100	100
3/8 inch	60 - 82	72 - 88	90 - 100
No. 4	45 - 67	53 - 73	58 - 78
No. 8	32 - 54	38 - 60	40 - 60
No. 16	22 - 44	26 - 48	28 - 48
No. 30	15 - 35	18 - 38	18 - 38
No. 50	9 - 25	11 - 27	11 - 27
No. 100	6 - 18	6 - 18	6 - 18
No. 200	3 - 6	3 - 6	3 - 6

**P-401-3.3**

**Gradation bands adjusted to match UFGS 32 12 15.13, and be consistent with NMAS definition.**

**Gradation 2 is typical surface mix. Gradation 3 intended for leveling courses. Gradation 1 generally for non-surface mixes.**

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**Changes to P-401 Mix Gradations** 

Table 2. Aggregate - Asphalt Pavements P-401-3.3

	Gradation 1	Gradation 2	Gradation 3
Min. VMA	14.0	15.0	16.0
Asphalt percent by total weight of mixture:			
Stone or gravel	4.5 - 7.0	5.0 - 7.5	5.5 - 8.0
Slag	5.0 - 7.5	6.5 - 9.5	7.0 - 10.5
<i>Recommended Minimum Construction Lift Thickness</i>	3 inch	2 inch	1-1/2 inch

VMA now listed in Table 2. Criteria unchanged (1% higher than SP)

Min. Lift Thickness recommendation also added.

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**New Loaded Wheel Test Requirement as Part of Mix Design - Designer Options** 

- **Primary Method—APA @ 250 psi**
  - AASHTO T340, 64°C, 250 psi hose pressure
  - Rutting must be < 10 mm @ 4,000 passes
- **Alternative Method—APA @ 100 psi**
  - AASHTO T340, 64°C, 100 psi hose pressure
  - Rutting must be < 5 mm @ 8,000 passes
- **Alternative Method—Hamburg Device**
  - AASHTO T324
  - Rutting must be < 10 mm @ 20,000 passes

➤ **Only Required on Projects for > 60,000# aircraft**

- Per Errata published on 11/12/19

Reference: AC 150/5370-10H

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**P-401 Calls for PG Grade (ASTM D 6373) and possible PG-plus test** 

**Guidance in engineering note**

- Determine “base grade” (based on climate only, no bumping for traffic), then bump per table:

Aircraft Gross Weight	High Temperature Adjustment to Asphalt binder Grade	
	All Pavement Types	Pavement area with slow or stationary aircraft
≤ 12,500 lbs	--	1 Grade
< 100,000 lbs	1 Grade	2 Grade
≥ 100,000 lbs	2 Grade	3 Grade

- Add PG Plus test if UTI is 92 or greater
  - Default is ER (ASTM D6084) 75% min\*.
  - Errata note (Sep 2019): \*Follow procedure B on RTFO aged binder
  - Engineer may replace ER with the local state DOT’s PG-Plus test (and criteria).
  - Reference AI’s binder spec database to see what each state uses

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**What about RAP or RAS?** 

- No RAP for surface mixes, except shoulders
- Max RAP is 30% for non-surface layers & shoulders.
- When using RAP:
  - 0-20% RAP, no change in binder grade
  - 20-30% RAP, adjust to one grade softer (HT and LT)
    - PG 64-22 adjusted to 58-28.
- No Recycled Asphalt Shingles (RAS)

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**Expanded Opportunities to Use State Paving Specs** 

- **On Airfield pavements ≤ 30,000 lbs - NO FAA-approved MOS reqd. required**
  - Used to be ≤ 12,500 lbs (under ...-10G)
  - About 30% of RWs in NPIAS rated below 30,000 lbs
- **Non-primary airports > 30,000 and < 60,000 lbs**
  - with FAA-approved MOS
  - Due to FAA Reauthorization Act 2018
- **Other pavements not for aircraft loading: shoulders, perimeter roads, blast pads, vehicle roads and parking**
- **Stabilized base course under PCC**

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**P-404 Fuel-Resistant Mixture** 

- **Per FAA, use only as surface course (1.5" - 3" thick) where fuel resistance needed**
  - On aprons to replace PCC or coal tar sealers
  - Some airports have used P-404 on RWs and TWs prone to rutting
- **Properties**
  - 50-blow Marshall
  - Design air Voids: 2.5%
  - 9.5mm gradation
  - Weight loss from fuel immersion test < 1.5%
- **Binder**
  - PG 88-22 or 92-28
  - ER > 85%
  - Separation test: max. temp diff. of 4 deg C (w/ ring and ball)

*Tri-services will soon release a FR spec similar to P-404*

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**Airfield specs require cutting back the longitudinal joint.** asphalt institute

**>401-4.14 Joints**

- LJs shall be cutback if exposed >4 hrs, or if surface <175 deg F, or if irregular, damaged, uncompacted, etc.
- With cutting wheel (typical) or pavement saw (not typical)
- Cut back max of 3" for clean, sound, uniform vertical face full depth
- Remove cutback material
- Tack LJ face per P-603



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**Cutting Back Joint**

- Eliminates low density material
- Avoid tearing
  - must cut when mix still warm (temperature sweet spot)
  - watering cutting wheel may help
- Critical to cut straight (use stringline)
  - easier with long wheel base vehicle



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Cutting Wheel



NO!!!

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**Equipment for cutting back joint**



- Roller with cutting wheel attached to drum
  - operates on newly paved surface while mix is warm
- Grader
  - Operates on adjacent paving lane
    - Potential to cause rutting if on new mat that has not cooled
  - Some have cited easier to cut straight when cutting wheel attached to rear ripper versus blade between wheels
- Not recommended: short wheel base vehicles (i.e. skid steer)

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**Thule AFB, Greenland**



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**Thule AFB, Greenland (video)**



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**P-401 Joint Density**

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- 401-6.1 Acceptance sampling and testing
  - d. (5) In-place Joint density
    - One core centered over LJ for each sublot
    - Joint density = bulk density divided by avg. TMD for lot
      - "For joints between two lots, use lower avg. TMD"
- 401-6.2 c. Acceptance criteria for joint density
  - PWL of lot >90: acceptable
  - PWL <90%: evaluate reason
  - PWL <80%: cease operations until figure out why
  - PWL <71%: lot pay factor reduced by 5%
- 401-6.3 PWL Acceptance limit for joint density
  - Lower limit: 90.5% (Table 5)
  - 90 PWL achieved when consistently producing average joint density of at least 92.5% with 1.55% or less variability

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**Two AI Courses Specific to FAA Standards** 

 **NPTW**  
The Airport Pavement Technical Workshop

3 days on wide variety of topics, including pavement design/evaluation, materials, mix design, construction, preservation and rehab for airports.

- FAA's Southeast Region: Oct/Nov 2020

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 **APC**  
The Airport Pavement Clinic focusing on P-401

1.5 days focusing on P-401

- Denver: Apr 7-8, 2020
- Nashville: May 12-13, 2020

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**Thanks to our Members. Questions?** 

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