FAA’s Mixture Specifications
- Revised P-401 (and P-403)
- New P-601 (Fuel Resistant Mix)

For SEAUPG, Nov 2014
By Mark Buncher
Univ. of KY.  2012 National Champs!

F-18 Shockwave at Mach-1

Back to Airfield Pavement
Airfields provide unique pavement challenges that are different from highways. Some examples:

- Heavier Loadings
- FOD Unacceptable!!!
- Higher Tire Pressures

Aircraft loads can exceed 1M pounds
Cracking on Airfield Pavement Surfaces Leads to Foreign Object Debris (FOD)

Airfield pavements built to higher standard relative to highways due to FOD. Huge $ and safety issue.
Tire pressures can exceed 300 psi
Commercial aircraft typically 250psi or higher
Often slow moving, channelized traffic pattern
AI / FAA Airport Pavement Technical Workshops

- **Twice per year**
  - Rotate among FAA Regions
- **Provide state of the art technical information on airport asphalt pavements**
- **Incorporates FAA’s New AC 150/5370-10G**
  - Standards for Specifying Construction of Airports
  - Includes all specs (P-401, P-601, etc)

*All lessons customized for airport pavements and FAA standards*

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**Agenda for APTW**

- **Day One**
  - FAA Overview, Issues and Guidance
  - Design and Evaluation
  - Material Selection
- **Day Two**
  - Mix Design Considerations
  - Construction
- **Day Three**
  - Management and Preservation
  - Rehabilitation
  - Innovative Technologies
“Item P-401 Hot Mix Asphalt (HMA) Pavements”

• Section 1: Description
  – Note: used for surface courses on airfields with aircraft >12,500 lbs. For underlying layers, and for <12,500 lb aircraft, Item P-403 may be used. (P-403 similar to P-401 except no PWL.) State highway specs may be used for shoulders and other pavements not subjected to aircraft.

• Section 2: Materials
  – Aggregates, Asphalt Cement Binder, others
  – Submission of certified material test reports

P-401

• Section 3: Composition
  – 401-3.2 Job Mix Formula (JMF)
    • Marshall or Gyratory Method (engineer chooses)
  – 401-3.3 RAP
    • Note: None in surface mixes. Max 30% allowed on intermediate lifts and shoulders. Follow AI’s MS-2.
      – No coal tar in RAP
      – No RAS
      – If 20-30% RAP, one binder grade softer. No grade dump!
  – 401-3.5 Test Section
    • Testing requirements
    • Min 300’ x 20-30’, include a longitudinal joint
P-401

• Section 4: Construction Methods
  – 401-4.1 Weather Limitations
  – 401-4.2 HMA Plant Requirements
  – 401-4.3 to 401-4.5 Haul Trucks, MTVs, Pavers, Rollers
  – 401-4.10 Preparing underlying surface (tack or prime coat)
  – 401-4.11 Laydown Plan Required
  – 401-4.12 Compaction
  – 401-4.13 Joints
    • Cutback longitudinal joints 3-6”
  – 401-4.14 Grooving (P-621)

P-401

• Section 5: Material Acceptance (by engineer-owner)
  – 401-5.1 Acceptance Sampling and Testing
    • Plant produced material
    • Field placed material
  – 401-5.2 Acceptance Criteria
    • PWL

• Section 6: Contractor Quality Control (in addition to, and separate from acceptance testing)
  – 401-6.2 Contractor Testing Laboratory
  – 401-6.3 Quality Control Testing
  – 401-6.4 Sampling
  – 401-6.5 Control charts
    • Action and suspension limits
    • Reports
P-401

- **Section 7: Methods of Measurement**
  - 401-7.1 HMA is measured in number of Tons used in acceptable work

- **Section 8: Basis of Payment**
  - Percent Within Limits (PWL)
  - Adjusted payment schedule based on:
    - Smoothness
    - Mat and joint density (relative to lab density – not Rice)
    - Lab air voids

- **Testing Requirement Methods**
  - Mostly ASTM

**Assumptions**

- Runway- 150’
- Each paver pass- 18’- 10”
- 8 passes to cover runway
- 7 longitudinal joints
**Assumptions**

Runway - 150'
Each paver pass - 25' - 1”
6 passes to cover runway
5 longitudinal joints

Runway - 150'
Each paver pass - 37' - 6”
4 passes to pave runway
3 longitudinal joints
Cutting Back the Joint
- Eliminates low density area
- When HMA still warm
- Straight is critical
  - long-wheel base vehicle is best

B. Prowell photos

Longitudinal Joint Construction

Preferred ??
Cut LJ face with a cutting wheel on a motor grader at Jackson, MS Airport.

401-2.3 Revised Binder Paragraph

- Performance Grade (PG) per ASTM D6373
  - (removed option for Vis or Pen Grades)
- Guidance for Selecting the PG (In Note)
  - “Initial” (Base) grade consistent with local State DOT practices for climate only
  - Then grade bump according to aircraft wt.:
    - Less than 12,500#: no grade bump
    - Between 12,500# and 100,000#: 1 bump
    - Over 100,000#: 2 grade bumps
    - Also consider tire pressures, stacking, any history of rutting
401-2.3 Revised Binder Paragraph

- Additional Guidance (in Note)
  - Grade bump only for P-401, not P-403
  - Grade bump top 5 inches of HMA
  - Refer to:
    o Al’s MS-26 The Asphalt Binder Handbook
    o Al’s State Binder Spec Database on their website
    o The LTPPBind program
  - Modified grades (UTI >92) require a minimum elastic recovery (ASTM 6084) of 70, or some other PG-Plus test required by the State
    o Refer to Al’s Binder Spec Database
P-401 Mixture Classifications

• Three mixes in P-401
  – Gradation 1: 100% passing 1”. Essentially a 19mm
    • Typically non-surface lifts.
  – Gradation 2: 100% passing ¾”. Essentially a 12.5mm
    • Typical surface lift. Also used for underlying lifts.
  – Gradation 3: 100% passing ½”. Essentially a 9.5mm
    • Used for leveling course, airfield shoulders, roads

• Lift Thickness: New P-401 says “4 x MAS”.
  – FAA backing off. Now saying 2.5” for gradation 2.

• CA Crushed Faces
  – Aircraft ≥60,000 Lbs. – 75% 2FF & 85% 1FF
  – Aircraft <60,000 Lbs. – 50% 2FF & 65% 1FF

Either “Marshall Method”
Mix Criteria, P-401

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Gross Wt ≥ 60 kips or Tire Pressures ≥ 100 psi</th>
<th>Gross Wt &lt; 60 kips or Tire Pressures &lt; 100 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Blows</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>Stability, lbs (min)</td>
<td>2150</td>
<td>1350</td>
</tr>
<tr>
<td>Flow, 0.01 in</td>
<td>10 - 16</td>
<td>10 - 18</td>
</tr>
<tr>
<td>Target Air Voids, %</td>
<td>3.5</td>
<td>3.5</td>
</tr>
</tbody>
</table>
### Or “Gyratory Method” Mix Criteria, P-401

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Gross Wt ≥ 60 kips or Tire Pressures ≥ 100 psi</th>
<th>Gross Wt &lt; 60 kips or Tire Pressures &lt; 100 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Gyrations</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>Target Air Voids, %</td>
<td>3.5</td>
<td>3.5</td>
</tr>
</tbody>
</table>

### Minimum VMA, P-401

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Minimum VMA</th>
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<tbody>
<tr>
<td>Gradation 3</td>
<td>16 %</td>
</tr>
<tr>
<td>Gradation 2</td>
<td>15 %</td>
</tr>
<tr>
<td>Gradation 1</td>
<td>14 %</td>
</tr>
</tbody>
</table>

VMA requirements are 1% higher than AASHTO M323 and AI’s MS-2.
- Required at mix design and also checked during test strip.
- Not checked during production.
Moisture Sensitivity, P-401

- ASTM D 4867
- TSR ≥ 75%
  - If less, try adding LAS, hydrated lime or changing aggregate/binder combination

P-601 (Fuel-Resistant) Asphalt Pavement Specification:
- Background: Airports have fuel and oil spills on aprons/ TWs.
- Also concerns with use of coal tar sealers
- P-601 Highly modified binder (PG 82-22)
- Gradation 3 (9.5mm NMAS). 50 blow or 50 gyrations.
- Low design air voids (2.5%)
- Improved stability and durability. Longer lasting pavement
- Minimal weight loss during fuel immersion tests

*Standard mix with PG64-22*  
*P-601*

In fuel immersion test, the standard mix loss was approximately 10% by weight compared to a new limit of <2.5% with the FR mixture.
SEC-AAAEE General Aviation Airport Project of the Year: Airfield Project

Fuel Resistant Apron Rehabilitation Project
Bob Sikes Airport (CEW)—Crestview, FL

- Feature article in Asphalt Institute magazine Feb 2012
- Now FAA’s P-601. Also UFGS 32 12 12 FR.
- Also placed in Malaysia, Egypt, Yemen, Caribbean, La Guardia, Boston Logan, Charlotte Douglas, FDOT, Bob Sikes Airport FL, Herlong Airport FL.

Logan Airport - 2014

10 year old FR Pavement
Al’s New Mix Design Manual

_MS-2, Asphalt Mix Design Methods, 7th Edition_

- 55th year as industry’s standard
- Defines Al’s position
- Merges current SP-2 and MS-2
- 200 pages, 13 chapters
- Release: Dec 2014

Questions?
Time for Drawing?