The Future of Airport Pavement

P-601 Fuel-Resistant Hot Mix Asphalt (HMA) Pavement

• An Interesting Development...
Introduction

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  - 24 years with AVCON
  - Professional Civil Engineer; Univ. of Florida
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  - Authority on Airport Pavements
  - Former Asphalt Institute Engineer
  - Extension of AVCON Staff

Presentation Outline

- Presentation Outline:
  - Review of Asphalt Considerations
  - Performance Grade Binders
  - Research: High Polymer Asphalt Mixes
  - P-601: How it Works
  - Recent Successes
  - P-601 Features & Predictions
  - Summary
History of Asphalt Technology

• **Early 1800s**: Europe - “tarmacadam”
• **1870**: United States - Edmund DeSmedt
• **1920s**: Hubbard Field Design - Volumetrics
• **1920s**: Hveem Mix Design - % Oil, Stability
• **1939**: Marshall Mix Design - Inexpensive Tests
• **1960**: Asphalt Rejuvenators - Maintenance
• **1993**: Superpave - Binder/Aggregate Selection
• **2004**: Warm Mix Asphalt - Reduced Emissions
• **Today**: Fuel-Resistant Asphalt - High Polymer

Asphalt Pavement Considerations

• **Deterioration Causes:**
  – Environmental: oxidation, water, freeze/thaw
  – Traffic loading
  – Poor construction
  – Chemical & petroleum exposure

• **Pavement management programs**

• **Coal-tar products:**
  – Can be useful; variety of products
  – May contain Polycyclic Aromatic Hydrocarbons
  – Differing coefficient of thermal expansion
Asphalt Binders: 101

**Performance Grades**

<table>
<thead>
<tr>
<th>Max. Design Temp.</th>
<th>PG 46</th>
<th>PG 52</th>
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<tr>
<td>Min. Design Temp.</td>
<td>44.4</td>
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**Common Polymer-Modified Binders:**

- **PG82-22, Highly Modified:** Difficult to Compact
- **PG76-22 (MAC-20):** 767 Traffic; Interstates
- **PG70-22 (AC-40):** Not commonly used

**Common Neat “Straight-Run” Binders:**

- **PG67-22 (AC-20 Special):** Mid-grade
- **PG64-22 (AC-20):** Florida standard
- **PG64-28:** Colorado standard
- **PG58-28:** Northern regions
- **PG52-28:** Northern regions

Source: Asphalt Institute
# Asphalt Binders: 101

## Performance Grades

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Temperatures in Celsius

Source: Asphalt Institute

### Common Polymer-Modified Binders:
- **PG82-22**, Highly Modified: Difficult to Compact
- **PG76-22** (MAC-20): 767 Traffic; Interstates
- **PG70-22** (AC-40): Not commonly used

### Common Neat “Straight-Run” Binders:
- **PG67-22**: One grade “bump”
- **PG64-22**: Standard
- **PG64-28**: Colorado standard
- **PG58-28**: Northern regions
- **PG52-28**: Northern regions

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![Diagram showing Binder Quality](image-url)

*Temperatures in Celsius*
Asphalt Binders: 101

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Temperatures in Celsius

Source: Asphalt Institute

**Common Polymer-Modified Binders:**
- PG82-22: Difficult to Compact
- PG76-22: Two grade “bumps”
- PG70-22 (AC-40): Not commonly used

**Common Neat “Straight-Run” Binders:**
- PG67-22: One grade “bump”
- PG64-22: Standard
- PG64-28: Florida standard
- PG58-28: Colorado standard
- PG52-28: Northern regions

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**History of High Polymer Mixes**

- Experimented in Europe, 1990’s
- Seeking durable, rut-resistant pavement
- International success:
  - 1995: Kuala Lumpur
  - 1997: Cairo
  - 2000: Yemen
  - 2001: St. Maarten
- Domestic success:
  - 2002: LaGuardia
  - 2004: Boston Logan
  - 2006: Charlotte Douglas

P-601 Fuel-Resistant Hot Mix Asphalt (HMA) Pavement

March 17, 2015
P-601: How It Works

• Mixture:
  – Highly modified binder (PG82-22)
  – Fine aggregate gradation:
    • Improved interlock
    • 3/8” max aggregate size
  – Reduced air voids: 2.5% mix design

• Method:
  – Target field air voids: 4.0% in place
  – Lift thickness: 1.0”- 2.0”; 1.5” max. recommended
  – Close monitoring of entire process
Fuel-Resistant Properties

- Fuel Immersion Tests (24-hour soak):

  - With standard PG64-22 Binder: 10% + losses
  - With highly-modified binder: < 1.0% losses

Note: P-601 requires not more than 2.5% loss

Recent Success of P-601

- 2011: Bob Sikes Airport
  - Formalized the P-601 specification
  - Considerations:
    - Temperatures & workability
    - Contractor unfamiliarity
    - Cost
  - Contingencies
- 2012: Herlong Recreational Airport
- 2014: Northwest Florida Beaches International Airport
  - Terminal Apron expansion
  - First AIP-funded application of P-601
P-601 Features:
- More durable, rut-resistant, fuel-resistant pavement
- Reduced maintenance
- P-601 approved by FAA 7/21/14; issued in AC 150/5370-10G
- AIP-Eligible: for pavements “subjected to fuel spills”
- Cost comparison:
  *Approx. 20-25% premium on per-ton price
  *Less than 10% premium on a project cost

P-601 Predictions:
- Improved life-cycle costs
- 25-30% extended pavement life
- Application for runways & taxiways
- Decreasing costs with increasing popularity
- Similar specification approved as military standard:
  UFGS 32 12 15.19 is under consideration
- A PG88-22 specification is coming
P-601 Summary

• P-601 Summary:
  – Non-proprietary; no “secret ingredients”
  – Favorable, proven results
  – Reduced maintenance & life-cycle costs
  – Three-step process...more than just a spec!
    • Mix design
    • Plant production
    • Field compaction
  – Read the specification, follow the specification
    “...The future of airport pavement”

Questions

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