Innovative Asphalt Products

SEAUPG – Wilmington, NC
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Innovative Asphalt Products

- Fuel Resistant HMA
- Colorless Asphalt Pavement

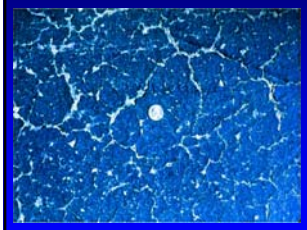
Background

- Airports experience jet fuel spills on aprons and taxiways
  - Fueling operations
  - Aircraft sitting in queues
  - Softens (weakens) asphalt
  - Causes permanent deformations and failures

Fuel Resistant Pavement Sealers

- Coal tar sealers are most commonly used to protect Hot Mix Asphalt pavements from fuel damage
- Different coefficient of expansion for coal tar causes substantial alligator cracking within 2-3 years
- Cracking allows fuel penetration - short service life

Fuel Resistant Pavement Sealers



- Coal tar sealers are carcinogenic
  - MSDS – "Unusual Chronic Toxicity: May cause cancer of the skin, lungs, kidney and bladder."
  - Adding carcinogenic material to pavement that may be recycled – future exposure
- Austin, TX and United States Geological Survey Report
  - 90% of PAHs in waterways may come from runoff from coal tar sealed pavements
  - Austin has outlawed use
- Coal Tar sealers are outlawed in California

Development of Fuel-Resistant PMA

- Kuala Lumpur Airport specified jet fuel resistant asphalt pavements for new construction in 1995
- Ooms Avenhorn Holding developed a Fuel-Resistant PMA for airport usage
- Objective – add fuel resistance to SBS PMA technology without sacrificing performance
- Contains no Coal Tar

Development of Fuel-Resistant PMA

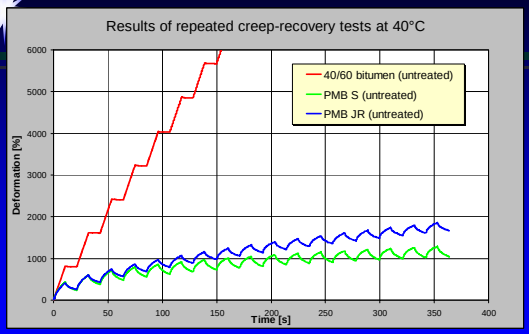
- Specifications required compacted mix samples to be immersed in jet fuel for 24 hours.
- Average weight loss of the specimens must be less than 1.5%

Development of Fuel-Resistant PMA

- Standard Hot Mix Asphalt mixture may lose up to 10% weight from 24 hour soak in jet fuel
- Standard Polymer Modified Asphalt (PG 76-22) may lose up to 5.0% weight after 24 soak in jet fuel
- Fuel Resistant PMA – typically lose less than 1.0% weight loss

Asphalt Binder Testing

- Repeated Creep-Recovery Test
  - Evaluate binder's resistance to rutting
  - Apply 10 kPa load for 11 seconds, followed by 11 second recovery period
  - 17 Creep-Recovery cycles were applied at 40˚C
  - Deformation was continuously recorded



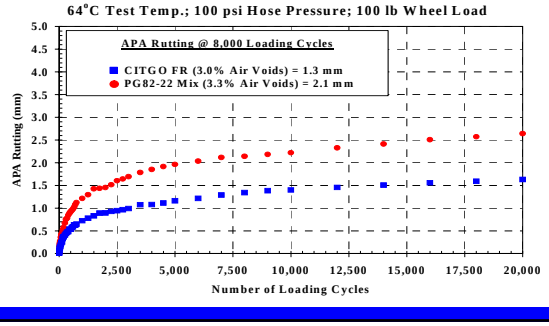
Laboratory Testing - Mixture

- Compared original hot mix asphalt (HMA) with mix submersed in jet fuel
- Compared unmodified PG 70-22 with PMA PG 76-22 and fuel resistant PMA
- Tested resistance to rutting and cracking

Asphalt Pavement Analyzer (APA) - Rutting Evaluation of HMA

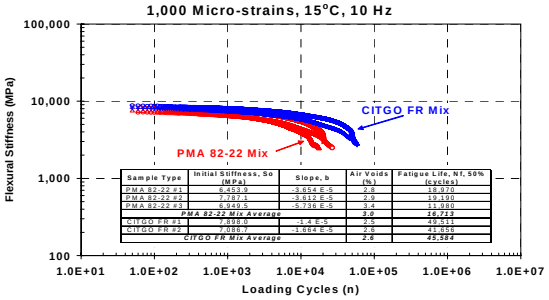
- Moving wheel load (100 lbs) applied to a pressurized hose (100 psi) which lies on top of asphalt samples
- Tested at 64ºC for 8,000 loading cycles
- Computer data acquisition system

Asphalt Pavement Analyzer (APA) Testing



Flexural Beam Fatigue Device

Flexural Beam Testing



Sample Type	Initial Stiffness, So (MPa)	Slope, b	Air Voids (%)	Fatigue Life, Nf, 50% (cycles)
PMA 82-22 #1	6,453.9	-3.654 E-5	2.8	18,970
PMA 82-22 #2	7,797.1	-3.512 E-5	2.5	19,190
PMA 82-22 #3	6,949.5	-5.736 E-5	3.4	11,980
PMA 82-22 Mix Average			*3.0*	*16,713*
CITGO FR #1	7,898.0	-1.4 E-5	2.5	49,511
CITGO FR #2	7,086.7	-1.664 E-5	2.6	41,658
CITGO FR Mix Average			*2.6*	*45,584*

Fuel-Resistant PMA Usage

- Fuel Resistant PMA Airport Projects Around the World
  - Cairo, Egypt Airport – Reconstruction of main runway – 1997 (220,000 tons)
  - Aden, Yemen Airport – Reconstruction of main runway – 1999-2000 (40,000 tons)
  - St Maarten Airport – Reconstruction of apron – 2001 (12,000 tons)
- All projects report excellent performance to date

Fuel-Resistant PMA Usage

- First Fuel Resistant PMA Construction Project in US – La Guardia Airport - 2002
  - Test section on taxiway – 450 tons
  - Problem with fuel contamination – 6 ins.
  - Milled out bad material – replaced with PMA base and FR top

Fuel-Resistant PMA Usage – La Guardia

- Placed Fuel Resistant PMA at La Guardia Airport August 2002
- Graded as PG 94-22
- Pumped into plant at 330°F
- Produced mix at 340°F
- Placed in silo for 4 hours

Fuel-Resistant PMA Usage – La Guardia

- Paved at 330°F
- No problems with placement
- Handwork and longitudinal joints look good
- Density achieved
- Paving crew could not see a difference in Fuel Resistant PMA material from standard PMA

Fuel-Resistant PMA Usage – La Guardia

- Inspected fuel resistant pavement in October 2003
- Excellent condition
  - No rutting
  - No cracking
  - No surface deterioration

Fuel-Resistant PMA Usage

- Port Auth. airports, normally used coarse mixes to prevent rutting
  - Low AC %
  - Prone to segregate
  - Durability
- The 1 ½" wearing course with FR provided both fuel resistance and better surface characteristics
  - Use ½" Max. P-401 mix
  - Design at 2.5% air voids

Fuel-Resistant Usage – Logan Airport

- In June 2004 - 1300 tons of fuel resistant mix was placed on Taxiway N and Runway 4L-22R at Logan Airport - Boston

Fuel-Resistant Usage – Logan Airport

- FR Asphalt graded as PG 94-22
- 1/2" P-401 mix designed at 2.5% air voids
- 7% asphalt content design target
- Lab rut testing at WPI showed 0.70mm rutting on this mix

Fuel-Resistant Usage – Logan Airport

- Mix produced in drum plant at 340˚F
- Placed at 325˚F without difficulty
- Met density specification
- Excellent surface appearance

Fuel-Resistant Usage – Logan Airport

- Revisited Logan in October 2004 & October 2005
- Previous HMA materials on this taxiway exhibited plastic flow (rutting and shoving) after one summer

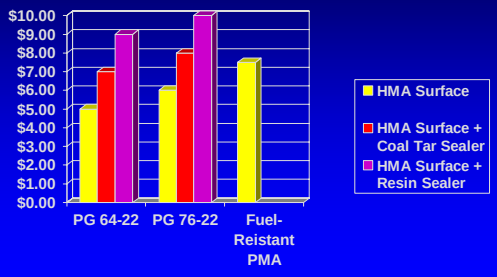
Fuel-Resistant Usage – Logan Airport

- October 2005 – after 2 summers
  - No rutting
  - No raveling
  - No cracking
  - "Grooving looks like the day we cut them"

Fuel-Resistant Usage – US - Projects

- Port Auth. NY&NJ - La Guardia Airport
- Boston, MA - Logan Airport
  - Alleyway Project – Summer 2006
- Charlotte, NC - Douglas International Airport
  - Taxiway Project – Summer 2006
- Florida DOT
  - I-95 Truck Inspection Station – Summer 2006

Cost Comparison



Cost Comparison

- Compared to surface treatment applications
  - FR mix is 1½" thick – much more durable
  - FR mix is part of the structural layer of the pavement
  - Surface Mix can be finer and more uniform and have a higher binder film thickness due to the properties of the FR binder

Other Applications – FR

- Truck stop fueling areas
- Highway weighing stations
- NYC restaurant district

Fuel-Resistant PMA Usage

- Developed generic spec. for fuel resistant HMA
  - Minimum PG 82-22 PMA
    - Min. 85% Elastic Recovery
    - Pass separation test
  - Standard test method for mix fuel resistance
  - ½" Max. mix
    - 50 blow / gyration mix design
    - Design at 2.5% air voids
    - Pass mix fuel resistance test

Fuel Resistant PMA Summary

- FR mix provides excellent resistance to permanent deformation and cracking
- Workability allows contractors to use standard construction practices
- Can be very cost effective for certain applications

Questions?