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Florida's Experience and Current Research with Crack Relief Interlayers

2022 SEAUPG ANNUAL MEETING & EXHIBITS

FDOT Highway System

- 45,221 lane miles
  - 8,723 interstate lane miles (19%)
  - 34,074 arterial lane miles (76%)
  - 2,424 Turnpike lane miles (5%)
- 97.2% of pavement is asphalt
- 2.8% of pavement is concrete

Asphalt Surfaces

- 50.4% of asphalt surfaces are dense-graded (by lane mile)
- 49.6% of asphalt surfaces are open-graded

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Pavement Distress in Florida

- The predominant pavement distress in Florida is cracking
- Most of the cracking is top-down, much of which is full depth

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Resurfacing

- Sufficient budget not available to remove all the cracking on many projects
- Resurfacing depths average around three inches
- Crack depths are deeper in many cases

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FDOT Historical Reflective Cracking Mitigation

- Bituminous crack relief layer
  - Essentially a chip seal with #67 stone and either hot or emulsified binder
- Asphalt Rubber Membrane Interlayer (ARMI)
  - Chip seal with #6 Stone and hot binder modified with 20% GTR
- ARMI replaced the bituminous crack relief layer and performed better

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More Recently

- ARMI not being used today
- Mixed performance and opinions on effectiveness
- Difficult to construct
  - Lower production rates
  - Couldn't open to traffic until it was covered with mix
- Costly
  - Performance was better with thicker mix coverage
- No structural coefficient
- Not recommended for urban or other low speed corridors
- Materials no longer readily available

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Replacement for the ARMI

- What's needed?
- A mix that can be produced with current materials
  - Must mitigate reflective cracking effectively
  - Can be opened to traffic
  - Has structural value
  - Easy to construct
  - Requires minimal cover
    - 1.5 – 2.0 inches
  - Has good rutting resistance

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Recent FDOT Research

- Evaluation of Reflective Cracking Mitigation Treatments Using the Composite Specimen Interface Cracking (CSIC) Test
  - FDOT contracted research with the University of Florida
  - Final report was issued in June 2018

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Project Objectives

- Develop guidelines for an effective alternative to the ARMI that was less expensive than a geotextile system
  - Identify key mixture characteristics that provide high fracture tolerance and shear resistance
  - Refine an existing test device to effectively evaluate reflective cracking performance
  - Develop preliminary mix design guidelines for mitigating reflective cracking on resurfacing projects

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Project Overview

- Research evaluated 14 mixtures covering a broad range of gradations.
  - The crack attenuating mixture (CAM) and binder rich intermediate course (BRIC) mixture were used as starting points
- Evaluated two granite aggregate sources and one limestone aggregate source commonly used in Florida
- Two binder types were considered: Polymer modified PG 76-22 and high polymer binder (HiMA)
- Two lift thicknesses were studied: 0.75" and 1.0"

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Gradations evaluated

- Six 9.5-mm dense-graded blends
  - 3 with limestone and 3 with granite
- Two 9.5-mm gap-graded
  - 1 with limestone and 1 with granite
- Six 4.75-mm dense-graded blends
  - 3 with limestone and 3 with granite

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Laboratory Analysis and Testing

- Mixtures designed using Superpave volumetrics and Dominant Aggregate Size Range – Interstitial Component (DASR-IC) analysis to optimize mixture gradations
  - Ndesign = 50 gyrations
  - Effective film thickness determined
- Composite Specimen Interface Cracking (CSIC) test developed by UF used to evaluate reflective cracking resistance
- Asphalt Pavement Analyzer (APA) used to evaluate mixture rutting

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Recent FDOT Research

- Composite Specimen Interface Cracking (CSIC) Test

(a) (b) (c)

Figure 4-2. Assembly of CSIC composite specimen: (a) Cutting to obtain two symmetrical parts (plan view), (b) Two symmetrical parts aligned and glued to the central metal spacer, and (c) Complete CSIC specimen installed with gauge points.

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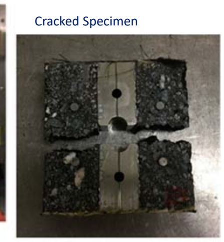
Recent FDOT Research

- Composite Specimen Interface Cracking (CSIC) Test

(a) (b) (c)

Figure 4-3. CSIC test setup: (a) Loading device, (b) Placement of CSIC specimen into the loading device, and (c) Connection of loading device to the MTS loading frame.

Cracked Specimen



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Findings

- Gap-graded granite mixture provided superior reflective cracking performance
  - However, it would be significantly more costly (higher AC content and fibers) and not suitable for limestone aggregates
- Dense-graded 9.5-mm mixtures (for all aggregate types) with a minimum EFT of 35 µm provided good laboratory reflective cracking and rutting performance
  - More suitable overall than the 4.75-mm mixtures
- The DASR-IC model developed in this study provides a systematic approach for designing these mixtures with improved reflective cracking and rutting performance and reduced cost

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Recommended Future Work

- A broader range of aggregate types, gradations, and interlayer thicknesses should be studied to refine the design guidelines
- Development of a simpler system to design the mixtures
- HVS testing or a controlled test section should be performed to finalize and validate the guidelines and performance

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Current Research

- Follow up research project with UF to finalize mix design process and specification requirements
  - "Practical Mix Design Guidelines for Reflective Cracking Resistant Mixtures"
  - Expected completion in the spring 2023
- Planned controlled test section on US 301 in Clay County
  - Anticipated construction in the summer or fall 2023
- Planning HVS test sections for the next cycle of testing

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Current UF Research Project

- Project variables
  - Two optimized 9.5-mm dense gradations
    - 2.0% air voids at Ndesign = 50 gyrations
  - Two aggregate types (granite and limestone)
  - Three density levels (94%, 96%, and 98%)
- Laboratory performance tests
  - Rutting: APA and Hamburg
  - Cracking: CSIC and Texas Overlay
  - Durability: Cantabro
- Two binders
  - Polymer modified PG 76-22 and high polymer binder (HiMA)
- Consideration for using RAP

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US 301 Test Section

- Existing corridor with minimal pavement deficiencies
  - 21,000 AADT, 30% trucks
  - Mill existing pavement 3.75"
  - Sawcut longitudinal and transverse cracks to granular base
- Control Section
  - Place 3.00" dense-graded structural course with PG 76-22 binder
  - Place 0.75" open-graded friction course with PG 76-22 binder
- Test Section
  - Place 1.25" crack relief mix (HP binder)
  - Place 1.75" dense-graded structural course with PG 76-22 binder
  - Place 0.75" open-graded friction course with PG 76-22 binder

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World Day of Remembrance

World Day of Remembrance for Road Traffic Victims (WDR)

Commemorated on the third Sunday of November each year, November 20th this year.

Every year, we add traffic accident victims to the list of those who have been killed or injured. This is a disaster that continues day in and day out in all countries of the world. During the new Decade of Action 2021-2030, World Day will have the important role of helping to achieve a 50% road casualty reduction target.

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Thank You
Questions?