National Center for Asphalt Technology
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at AUBURN UNIVERSITY

NCAT Update

Wisconsin Asphalt Pavement Association

62nd Annual Conference & Business Meeting

Randy C. West

NCAT History

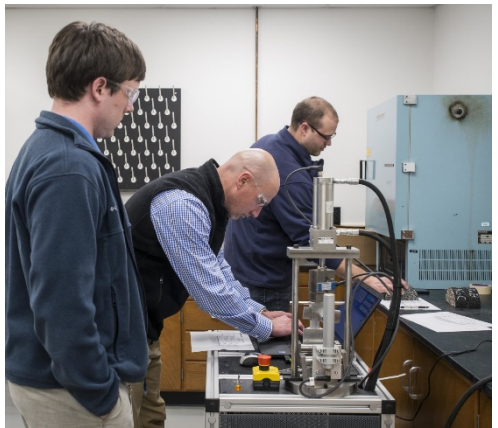
NCAT main office and lab
277 Technology Parkway
Auburn, AL

- Established in 1986
- A partnership between Auburn University and the National Asphalt Pavement Association Research & Education Foundation
- Best known for the “NCAT Textbook”, the ignition method, the Professor Training Course, the *Asphalt Technology News* newsletter, the NCAT Test Track, and applied research.
- The majority of funding for research comes from state Departments of Transportation.

Training & Education

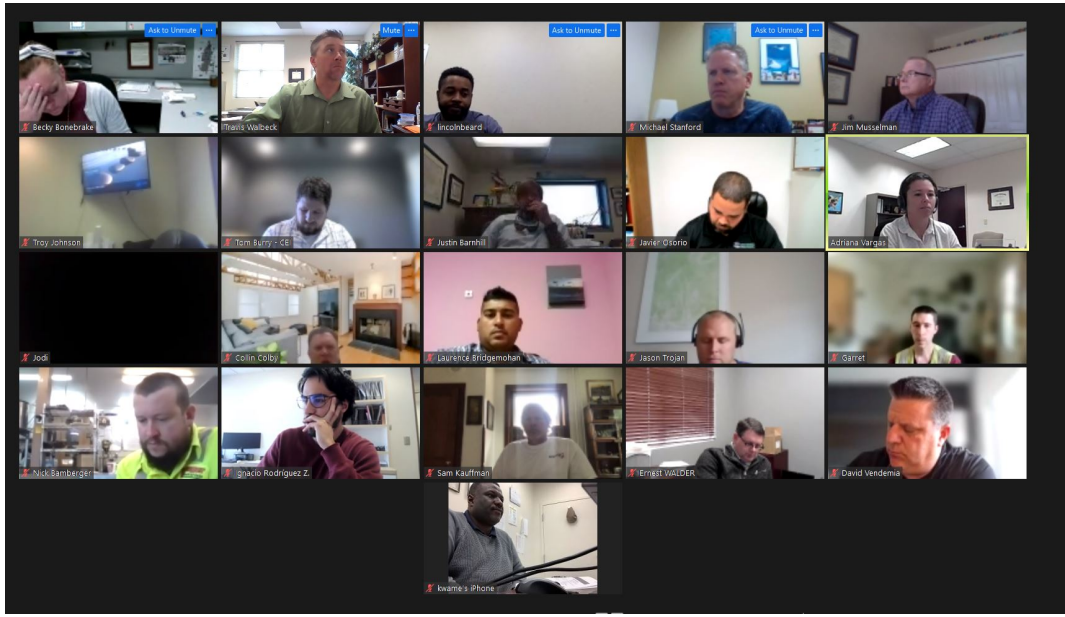
- Training Courses
  - Technician certification courses
  - General asphalt technology
  - Mix design: Superpave and BMD
  - Asphalt Engineers Workshops
- 7 graduate courses in Pavement Engineering: traditional and on-line
- Professor Training Course

Each year, NCAT typically trains over 1000 industry personnel




Virtual Training Courses

- Asphalt Engineers Workshop
  - North Dakota 2020
  - Colorado 2021
  - North Carolina 2022
- Asphalt Technology Workshop
  - April 2021
  - 29 Attendees
  - 5 Countries
  - 16 States



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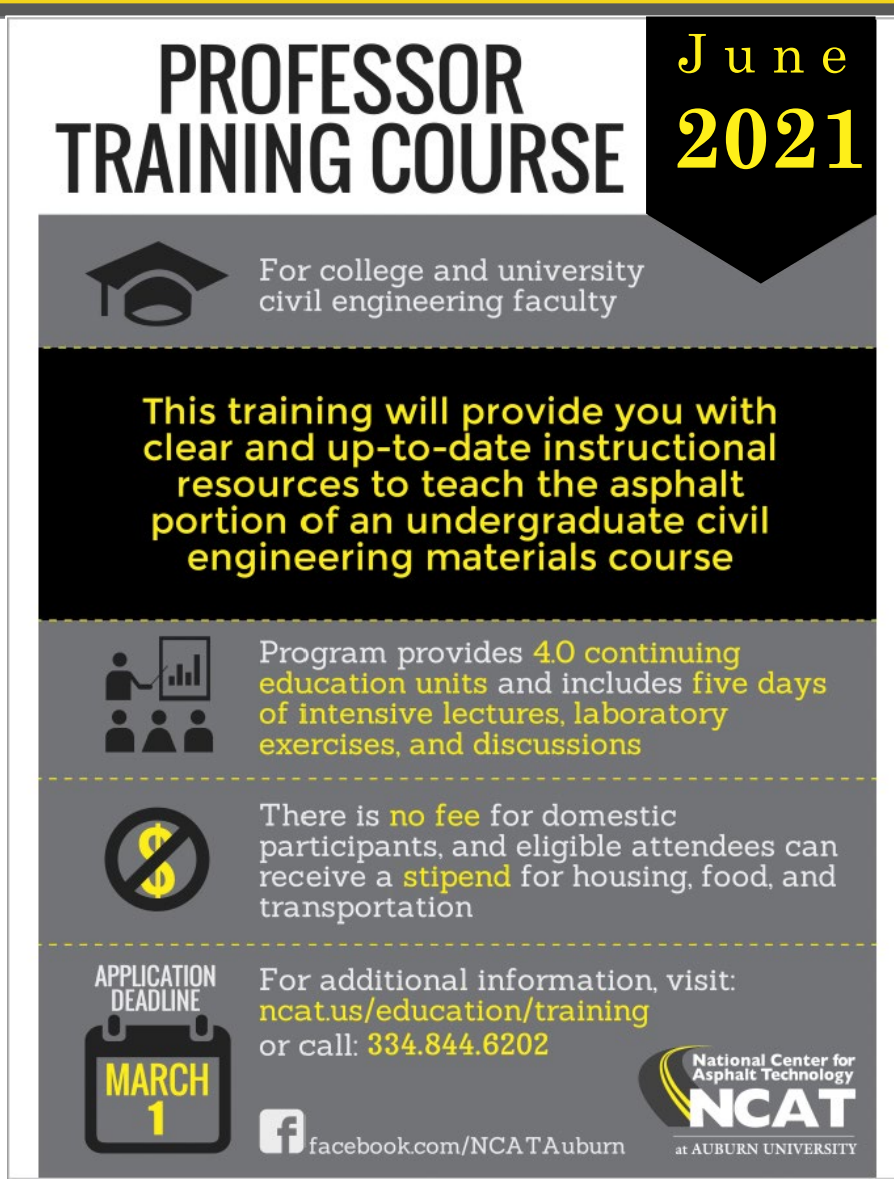
Professor Training Course

- Began in 1988
- Offered every two years
- Free to US Professors
- Designed to equip professors to offer undergraduate asphalt education
- Attendance

  500 – US Professors

  +80 – Other Attendees

  580 – Trained



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Professor Training Course
June 14-18, 2021

- 17 Attendees
- 12 States
- 15 Universities

Thank you NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

Airfield Asphalt Certification Program

- Goal: Increase the quality of construction for work performed under the UFGS asphalt airfield specifications.

AACP

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Airfield Asphalt Certification Program

- Quality Control Manager and Asphalt Laboratory Technician taught by NCAT
- Course scheduled quarterly in Auburn
- Remote hosted courses as needed
  - Hawaii – October 2021
  - California – November 2021
- 67 Technicians Certified to date

AACP

http://airfieldasphaltcert.com/

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TRAINING IN YOUR POCKET

- YouTube based short asphalt videos
- Subscribers – 436
- Current videos – 15
- Views - >5300

SCAN ME

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Training In Your Pocket

436 subscribers

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Ideal Cracking Test (ICT)

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Volumetric Gmb Gmm Va

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Volumetric Terms

275 views • 5 months ago

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PG Binder Grading Explained

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Types of Rollers Used for Asphalt Paving

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Four Approaches to Balanced Mix Design

217 views • 3 months ago

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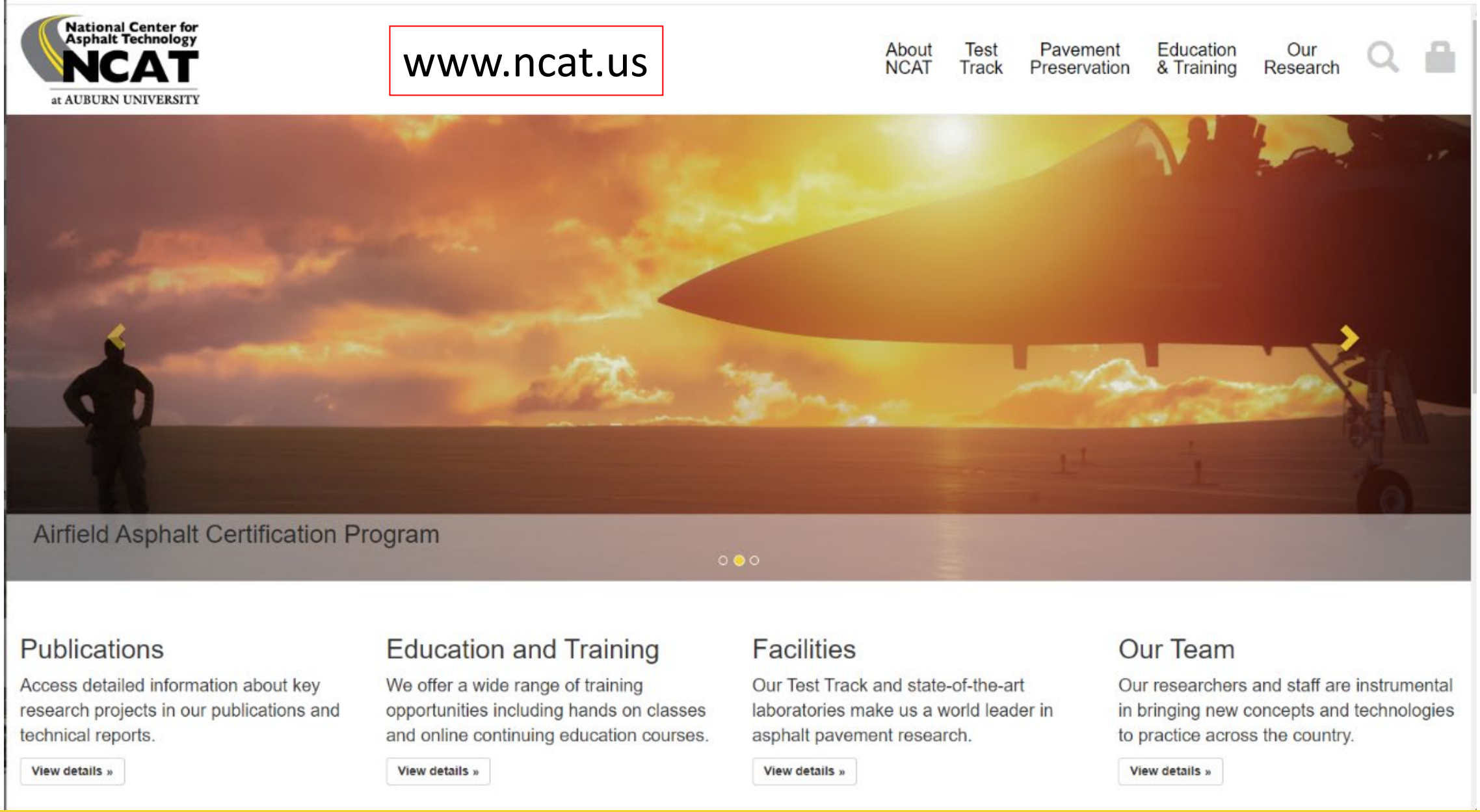

NCAT's mission is to provide innovative, relevant and implementable research, technology development and education that advances safe, durable and sustainable asphalt pavements.

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Findings from 20 years of Test Track Research

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Turnkey Research







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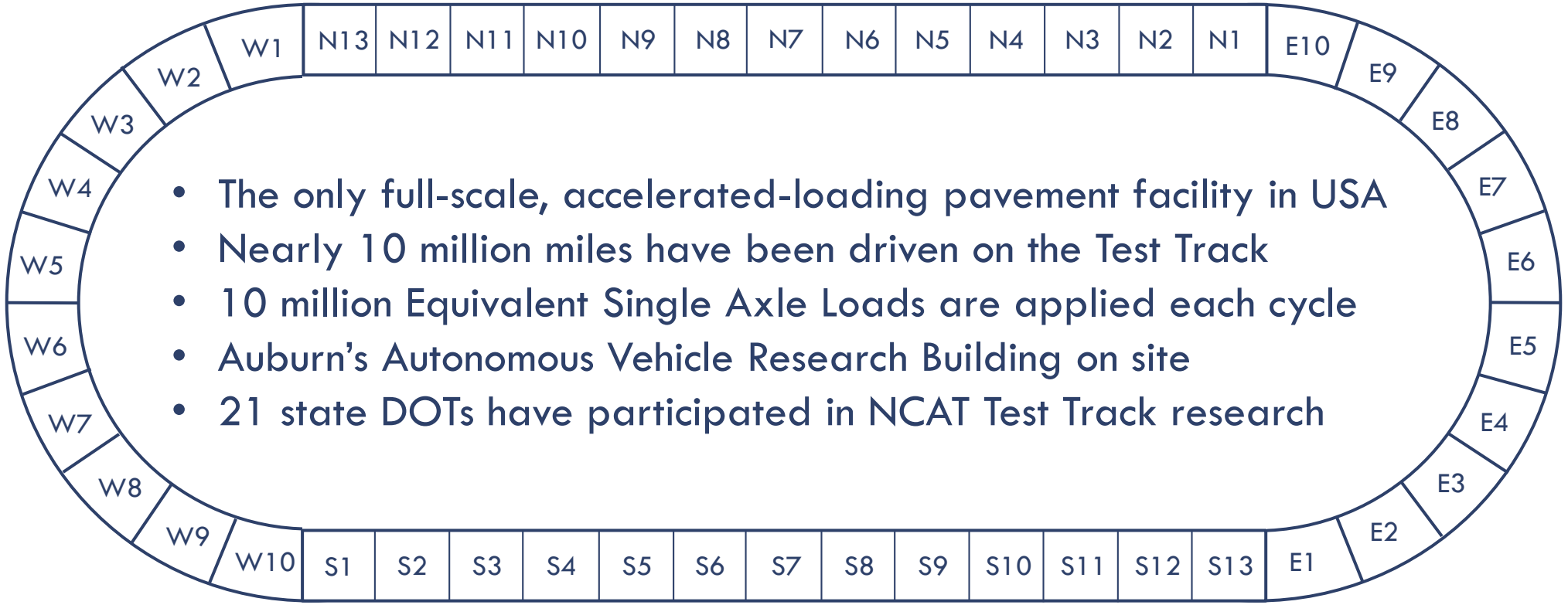
NCAT Test Track

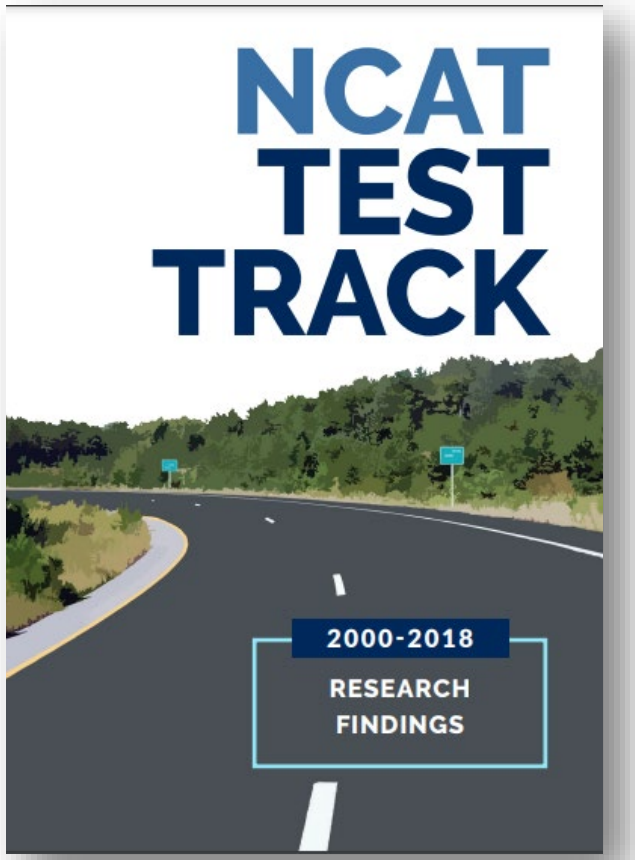
- Test sections are evaluated continuously over 3 year cycles
- 2021 began our 8th cycle
- 46 Test Sections, 200 ft. each
- 5 trucks each pulling 3 heavily loaded trailers make 400 laps/day

NCAT Test Track Facts



- The only full-scale, accelerated-loading pavement facility in USA
- Nearly 10 million miles have been driven on the Test Track
- 10 million Equivalent Single Axle Loads are applied each cycle
- Auburn's Autonomous Vehicle Research Building on site
- 21 state DOTs have participated in NCAT Test Track research

For more information…visit: www.ncat.us



Since the results of experiments are typically evident in the performance of the sections, the findings are generally easy to interpret. This gives highway agency sponsors confidence to make decisions regarding their specifications, construction practices and pavement design methods that can improve the performance of their roadways. Industry sponsors use the track to publicly and convincingly demonstrate their technology to the pavement engineering community.

Types of Test Track Experiments

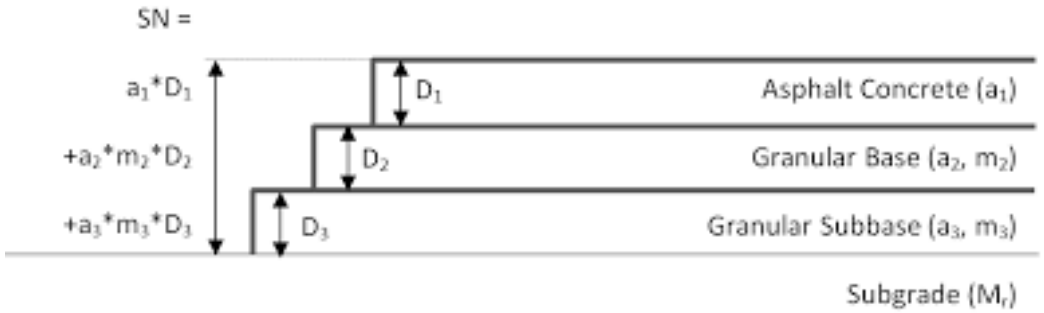
1. Structural Experiments
   - Full-depth reconstruction of cross-section
   - Instrumented with stress & strain sensors and temperature probes.
   - FWD testing throughout experiment

2. Surface-layer Experiments
   - Only upper layer(s) replaced
   - No instrumentation

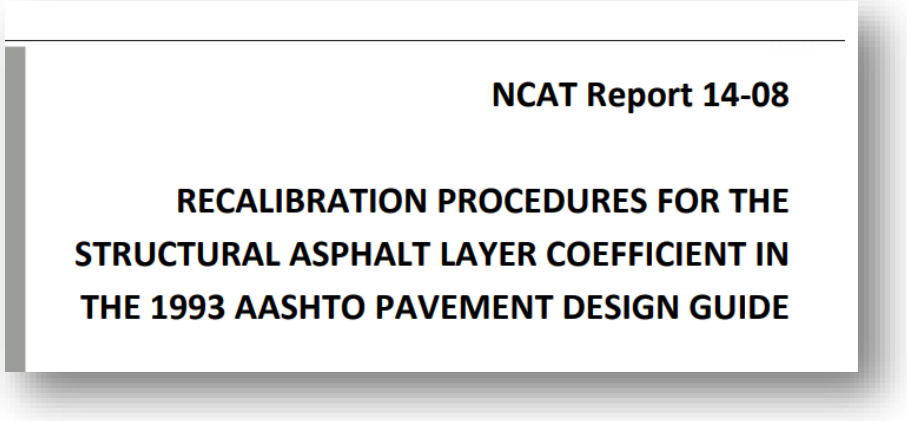
Structural Experiments

Revised Asphalt Layer Coefficient, a_1

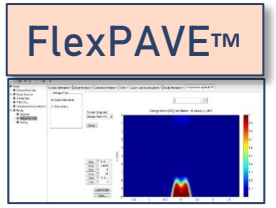
- 1993 AASHTO Pavement Design Guide
- Analysis based on…
  - ✓ Lab Modulus
  - ✓ Field deflections and backcalculation
  - ✓ Field Performance



Implemented in Alabama in 2010
Annual Savings between $25 and $50 million



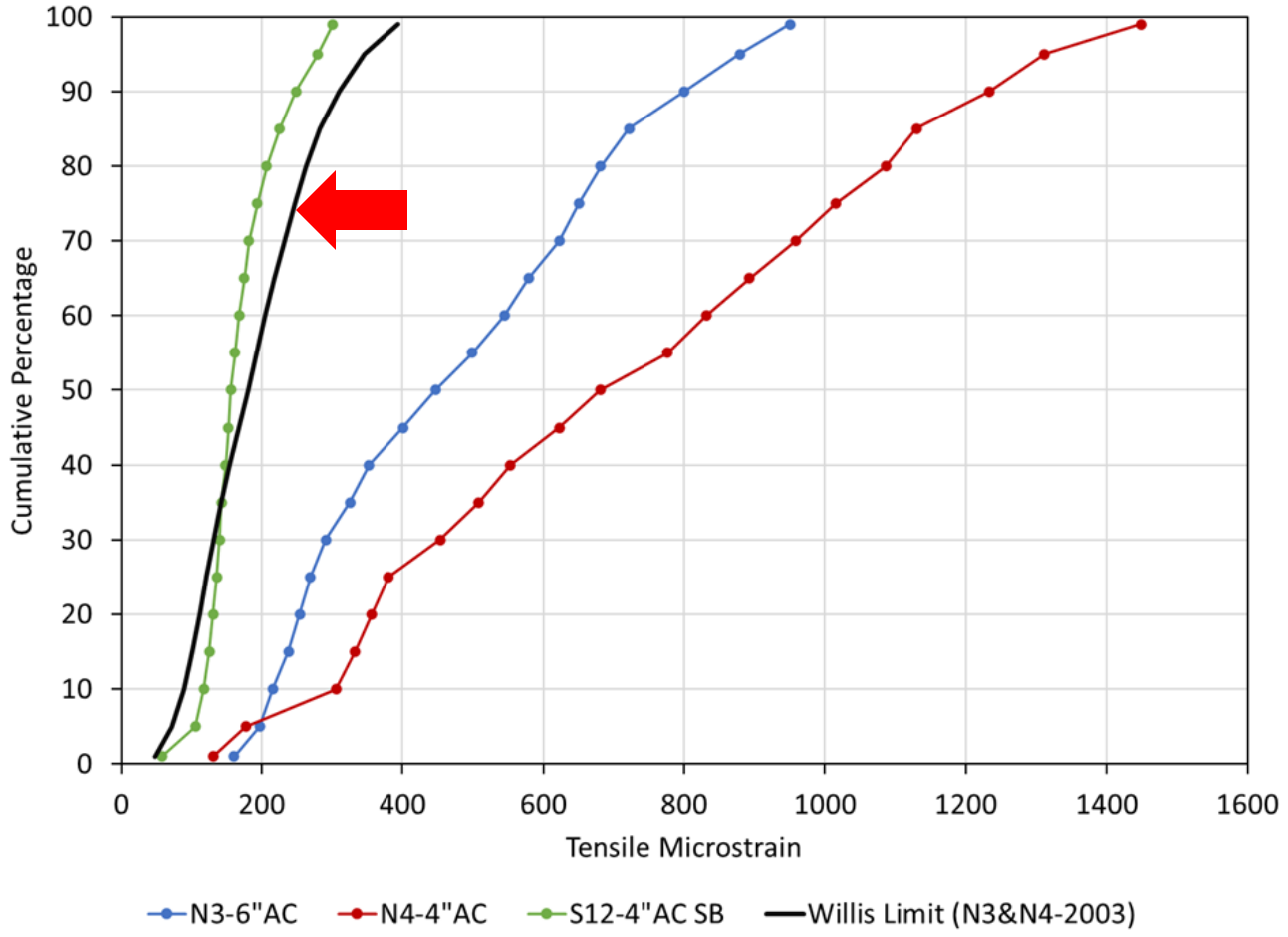
Mechanistic-Empirical Design Procedures

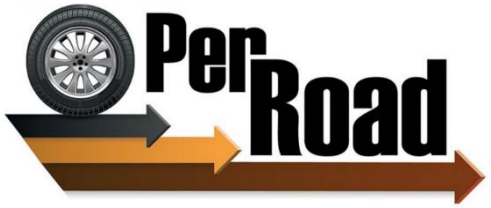


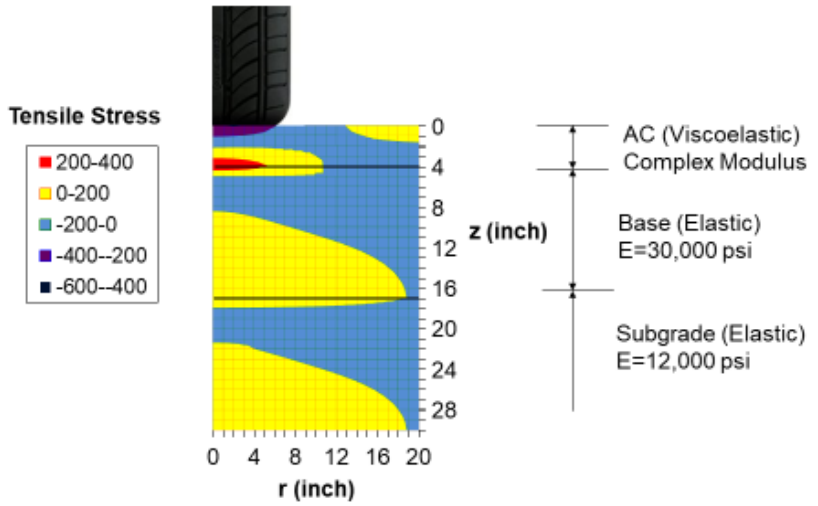
- All of these programs have used NCAT test sections for model calibration.
- MEPDG over-predicted rutting by 50-100% using default national calibration coefficients.
- MEPDG fatigue prediction was poor even after adjusting coefficients.
- Several non-traditional asphalt mixtures and other materials have been validated.

NCAT Test Track

Perpetual Pavement Strain Distributions

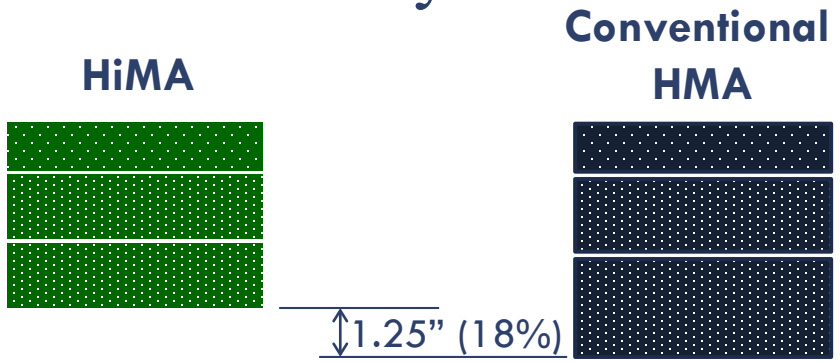






Highly Modified HMA Structural Assessment

- 5.75 inches vs 7 inches
- Same mix designs in surface, intermediate, and base layers



- Control section: 10% of lane area fatigue cracking
- HiMA section: 6% of lane area top-down cracking

Cold Central Plant Recycling

Other Structural Experiments

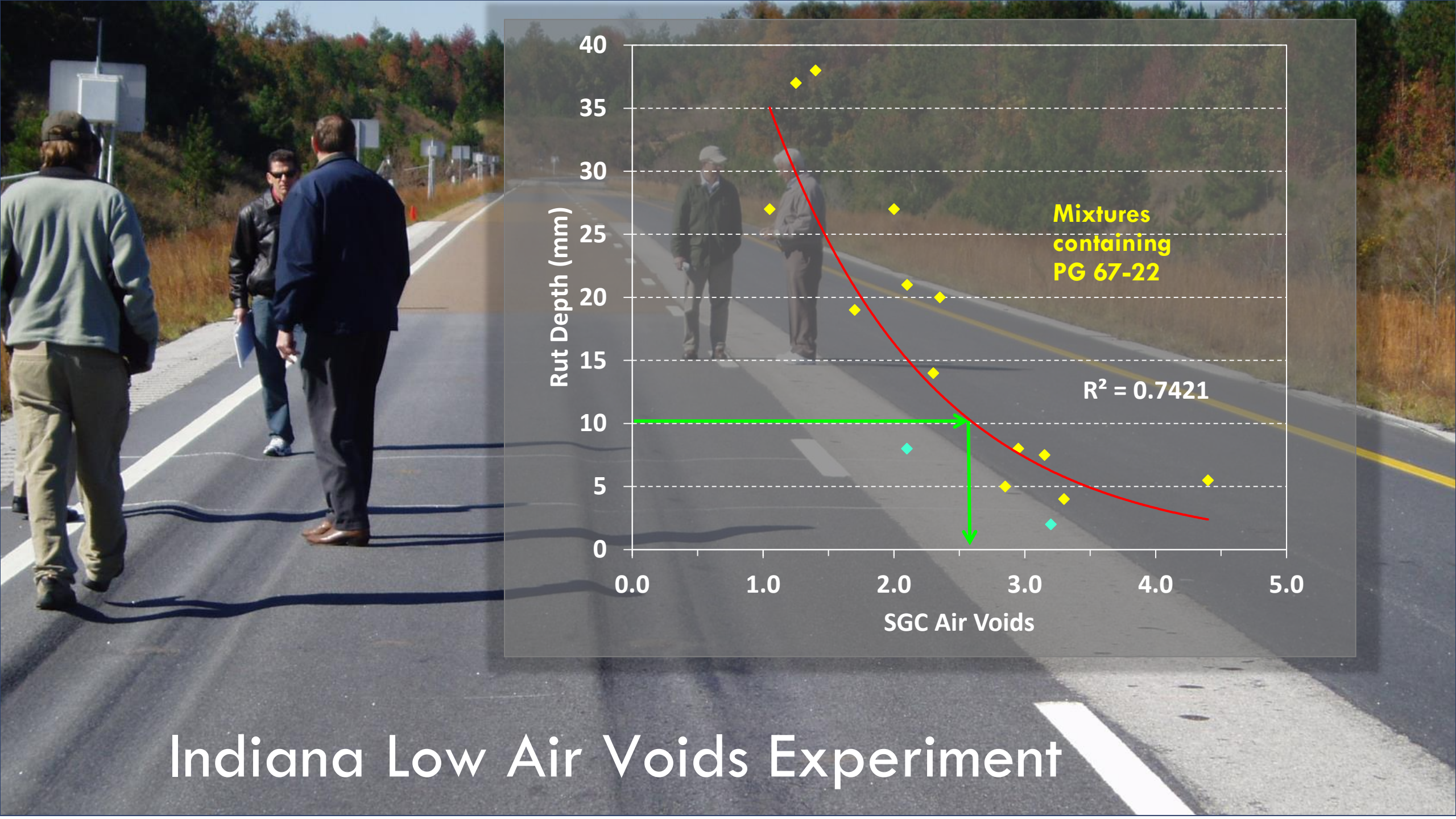
Cement and lime stabilized layers

Thick, Single-Lift Reconstruction

Surface Mix Experiments

Refinements to Mix Design Specifications

- Fine and coarse Superpave mixes perform similarly regardless of aggregate type
- PG 76 vs PG 67 - reduces rutting approximately 50%
- Dense-graded as rut resistant as SMA, but SMA is more durable
- Lowering N_{design} is OK
- 50% RAP mixes perform equal to virgin mixtures in all layers



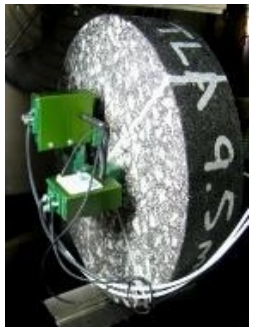
Indiana Low Air Voids Experiment

Aggregate Specifications

- Elimination of the Restricted Zone
- Evaluation of marginal aggregate
- Gravel suitability in SMA & OGFC
- Higher F&E content for SMA & OGFC
- Maximum limestone content for friction

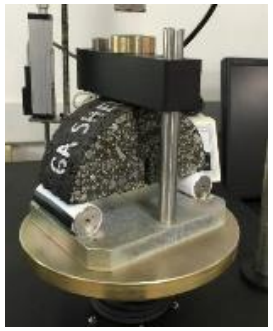
NCAT Test Track

Cracking Group Experiment: Which Tests Correlate to Field the Best?



Energy Ratio

SCB-LA



I-FIT

OT-TX

OT-NCAT

IDEAL-CT

AMPT Cyclic Fatigue

Tests* were conducted on:

1. lab prepared mix after short-term aging
2. lab prepared mix after short-term and critical aging
3. plant mix samples that were reheated
4. plant mix samples that were reheated and critically aged

*AMPT Cyclic Fatigue Tests were tested only on plant mix samples

Summary of Correlations

Test and Parameter	Average COV	Games Howell Groups	Range of R^2
Energy Ratio, ER	Not available	Not applicable	0.03 to 0.28
Texas Overlay Test, β	17%	5	0.76 to 0.91
NCAT Overlay Test, β	10%	4	0.79 to 0.97
Louisiana SCB, J_c	20%	Not applicable	0.13 to 0.78
Illinois Flexibility Index Test, *FI*	34%	3	0.76 to 0.89
IDEAL Cracking Test, CT_{Index}	18%	4	0.87 to 0.94
AMPT Cyclic Fatigue, S_{app}	16%	5	0.89 to 0.90

Cracking Group Field Performance Findings

1. Higher in-place density (96.1% vs. 93.6%) reduced cracking by 70%.
2. Lower asphalt content and lower in-place density substantially reduced the life of the surface layer.
3. Using a softer virgin binder with a high RAP mix can provide outstanding mix durability.
4. Using HiMA instead of the PG 67-22 binder in the control mix dramatically improved its cracking resistance (45% lane area cracking vs. 1% after 5.5 years and 20 million ESALs).
5. Gap-Graded, asphalt-rubber mixes (with higher asphalt contents) can provide superior performance for surface layers.

Balanced Mix Design

- Comparison of BMD vs. Superpave
- Preliminary validation of BMD criteria
- Evaluation of innovative additives for improving mix performance and increasing sustainability
- Combining BMD and friction assessment for surface layers

WHRP F22-04 BMD Pilot and Field Sections

Objectives:

1. Assist WisDOT with the construction and evaluation of test sections to validate IDEAL-CT and Hamburg criteria
2. Gather mixtures from 10 projects across Wisconsin to assess production variability of these tests for establishing appropriate specifications.

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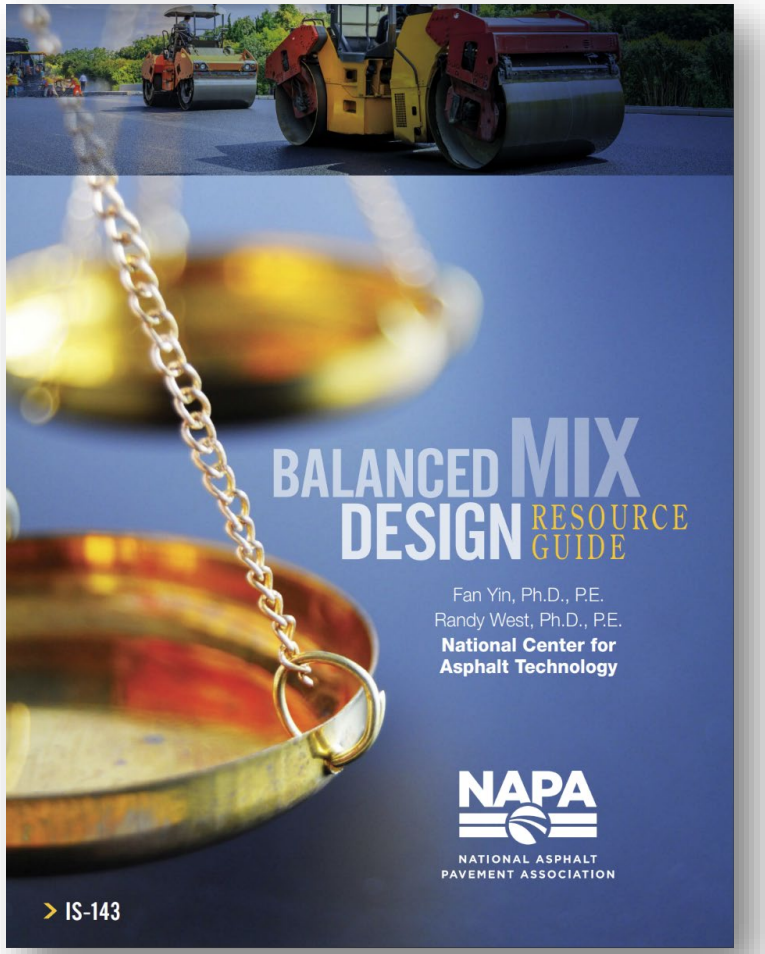
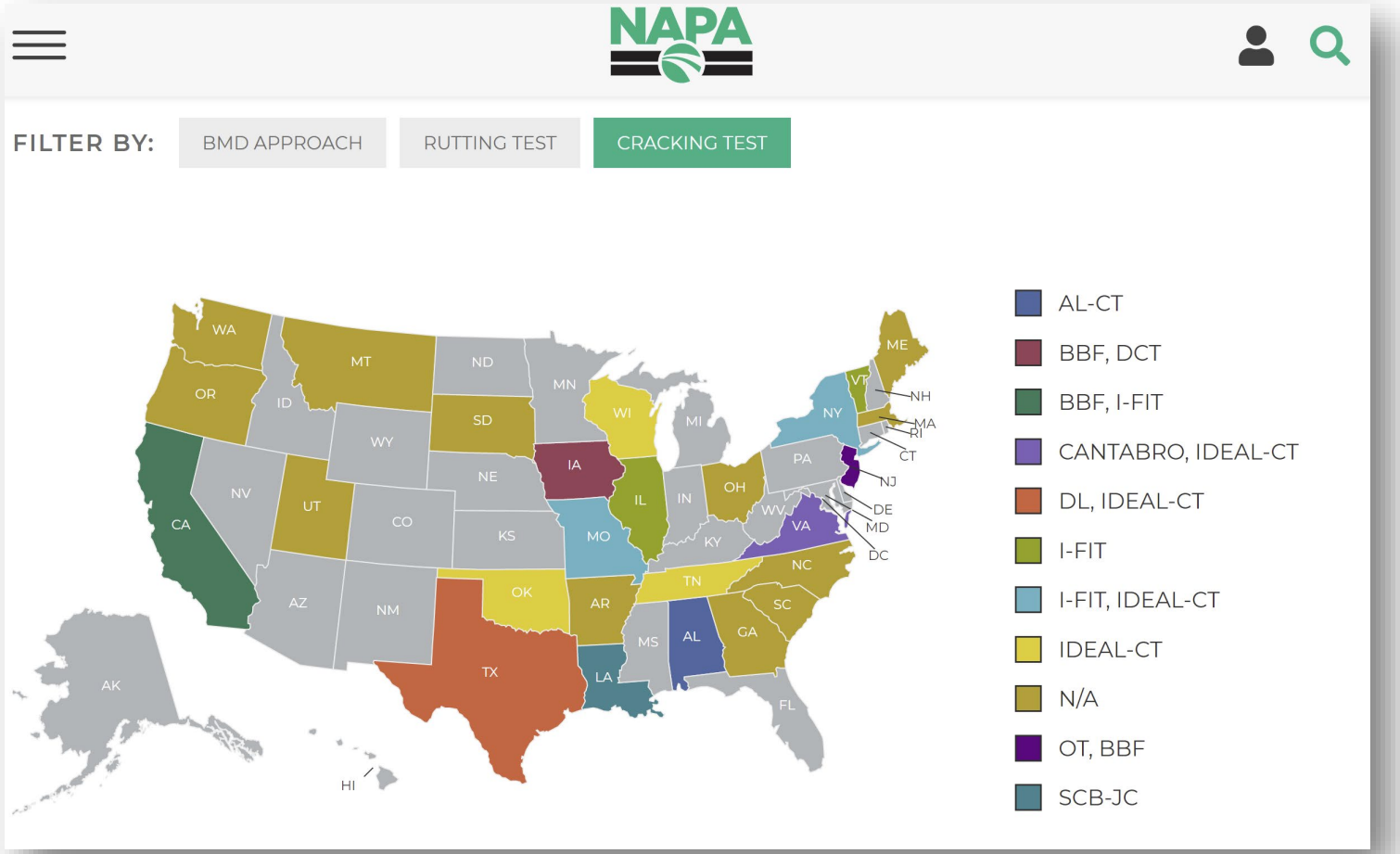
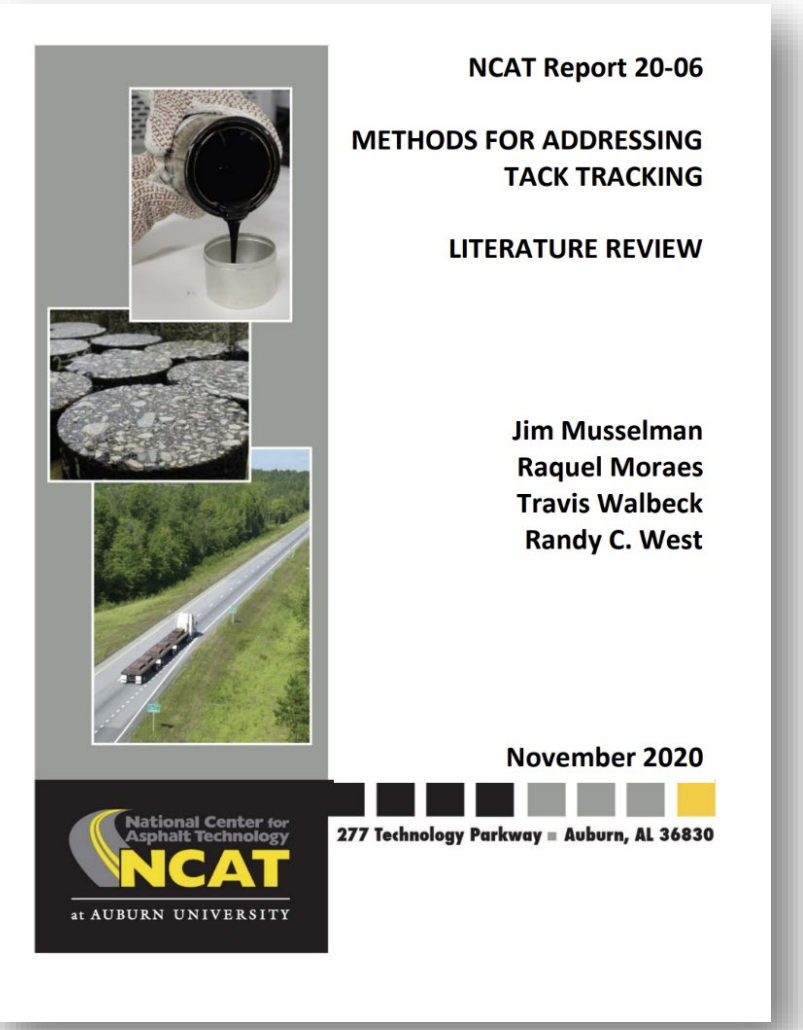


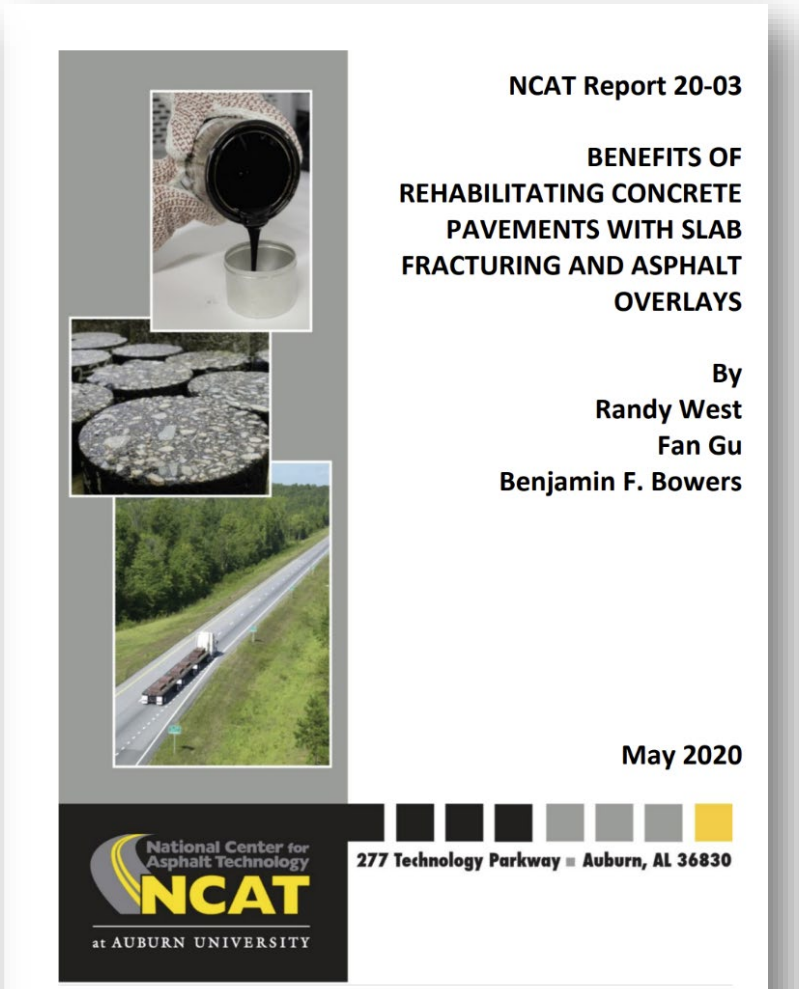


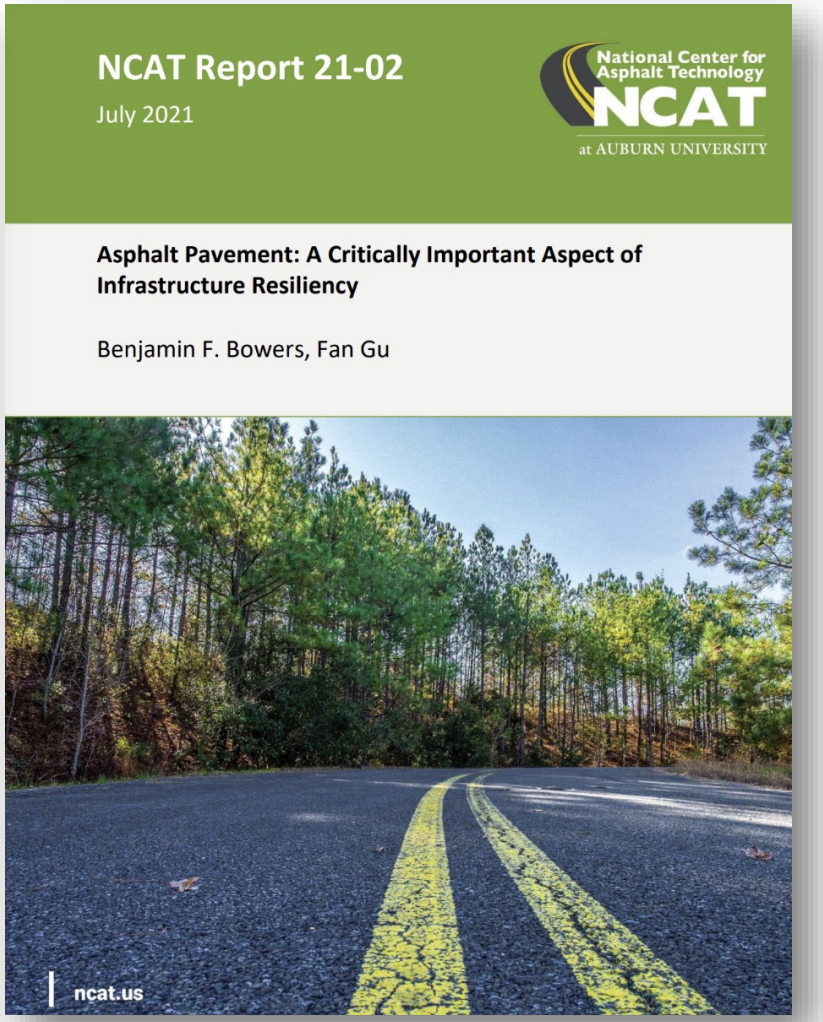
BMD Resources

Scan this code or visit aub.ie/bmd for useful resources related to balanced mix design

Other recent NCAT Research Reports you don't want to miss

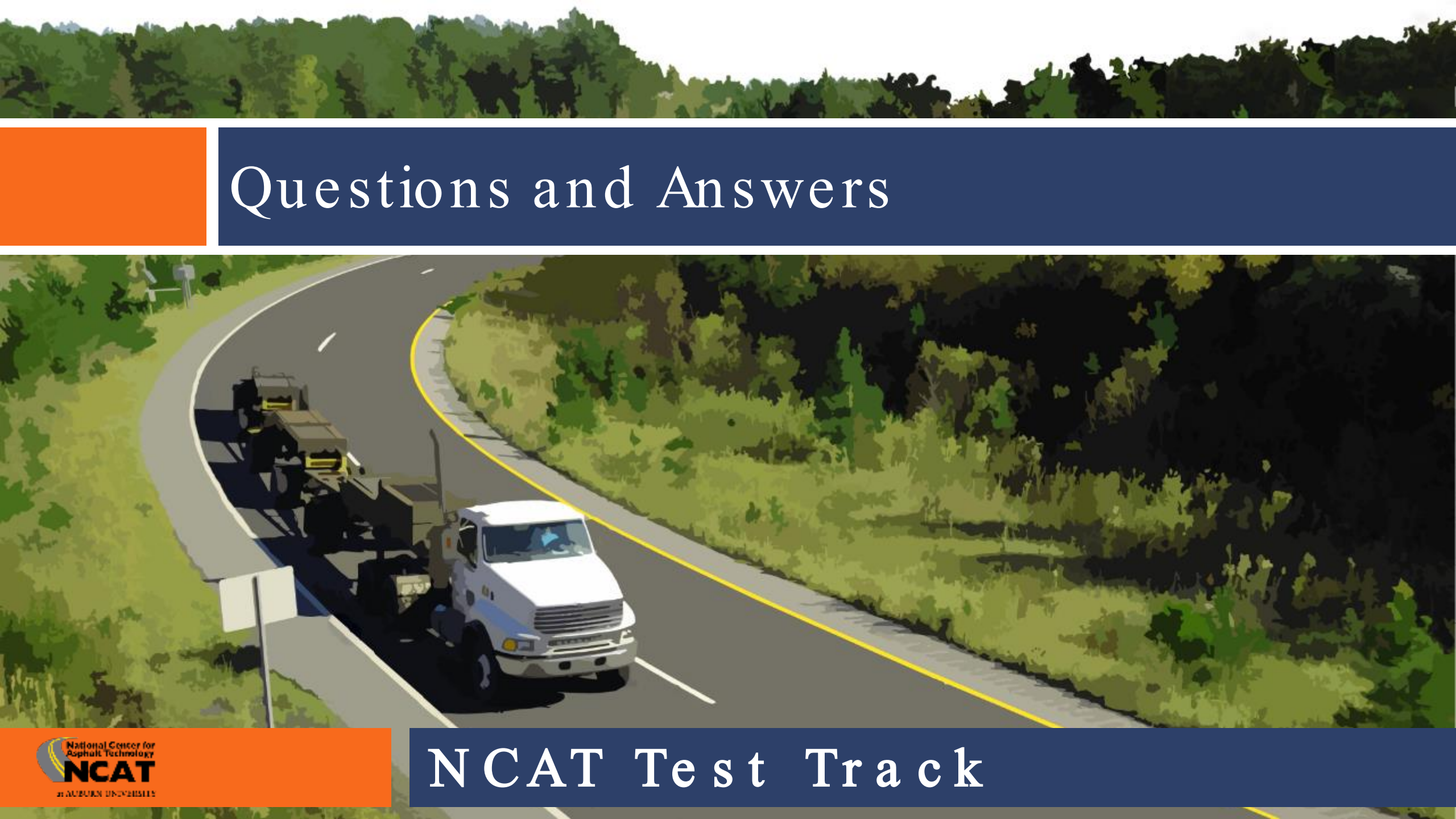






The Bucket Brigade

Questions and Answers



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