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NCHRP

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Framework for Balanced Mix Design

NCHRP 20-07/Task 406

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Balanced Mix Design (BMD)

BMD is defined as an “asphalt mix design using performance tests on appropriately conditioned specimens that address *multiple* modes of distress taking into consideration mix aging, traffic, climate and location within the pavement structure.”

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Objective

- Develop a framework that addresses alternate approaches to devise and implement BMD procedures incorporating performance testing and criteria.
- The framework shall be in the format of an AASHTO recommended practice and will provide DOTs with options on which performance tests to use and how the tests can be used in the overall mix design framework.

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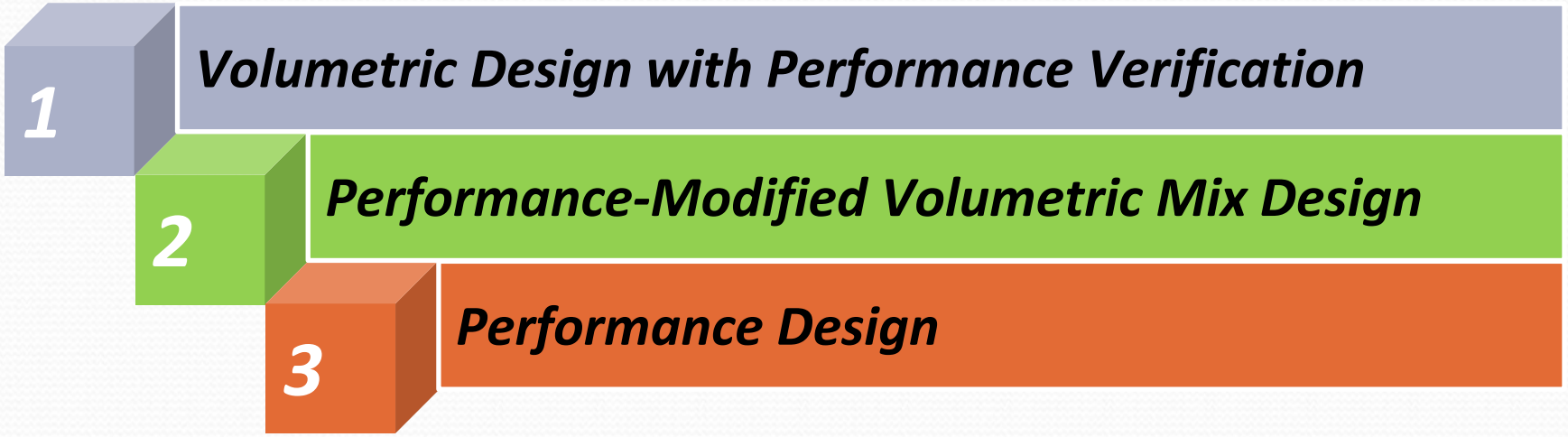
Balanced Mix Design Approaches



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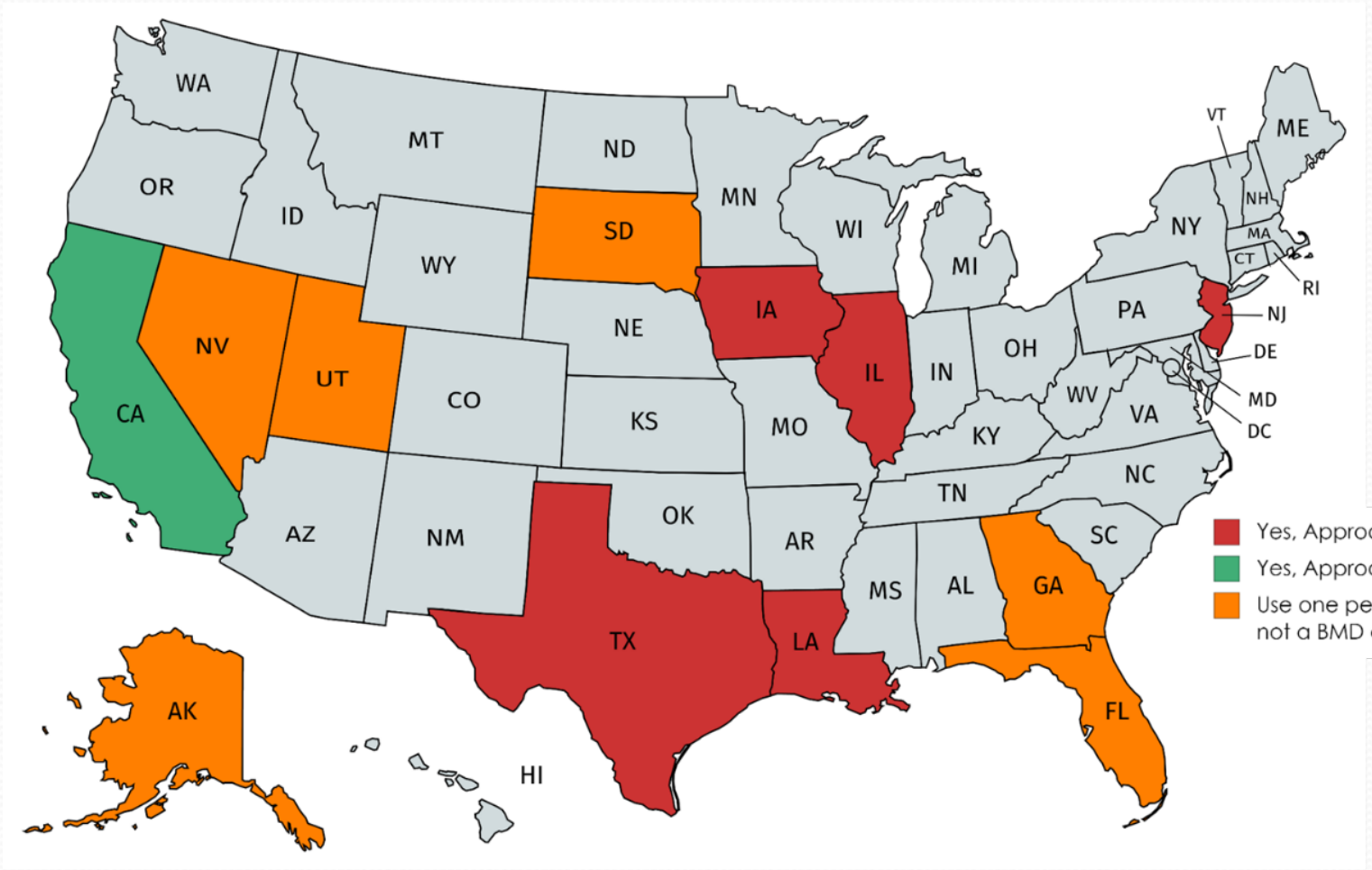
Does your agency CURRENTLY use a BMD approach?



Approach 1

Approach 2

Use a performance test, but not a "true" BMD approach

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On which types of asphalt mixtures does your agency use BMD?

Answers (DOT)	# Response
All mixes	2 (CA, IL)
Premium mixes (e.g., SMA, HiMA)	3 (IA, NJ, TX)
High traffic mixes	0
Bridge deck mixes	1 (NJ)
RAP/RAS mixes	0

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Will your agency consider modifying the current mix design procedure with a BMD approach?

Answers (DOT)	# Response
Yes, Approach 1 - Volumetric Design with Performance Verification	5
Yes, Approach 2 - Performance-Modified Volumetric Design	0
Yes, Approach 3 - Performance Design	1
Yes, Approach not determined	19
No	3

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What types of pavement distress does your agency want to address with mixture performance tests?

Answers (DOT)	# (%) Response
Fatigue cracking	36 (84%)
Rutting	32 (74%)
Thermal cracking	29 (67%)
Moisture damage	26 (60%)
Reflection cracking	24 (56%)
Raveling	22 (51%)
Others (block cracking, slippage, etc.)	22 (51%)

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Which of the following bottom-up fatigue cracking tests is used in your CURRENT mix design specs?

Answers (DOT)	# (%) Response
Test not required	34 (85%)
Flexural Bending Beam Fatigue Test (BBF)	3 (8%)
SCB at Intermediate Temperature (SCB-Jc)	1 (3%)
Illinois Flexibility Index Test (I-FIT)	1 (3%)
Texas Overlay Test (OT)	1 (3%)
Direct Tension Cyclic Fatigue Test (S-VECD)	0
IDT Fracture Energy Test	0

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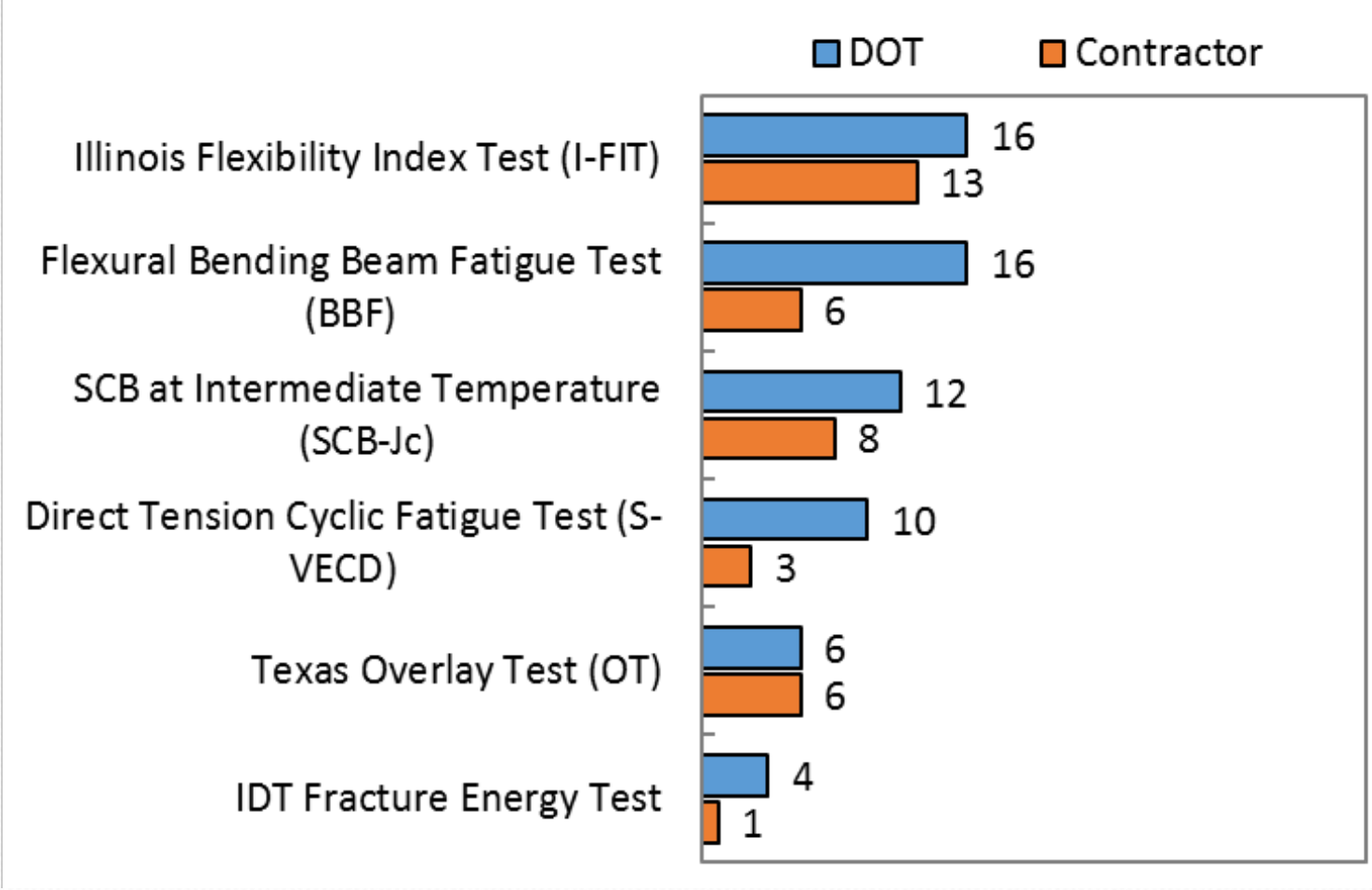
Which of the following performance tests do you *think* have the most potential to address bottom-up fatigue cracking?



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Which of the following top-down fatigue cracking tests is used in your CURRENT mix design specs?

Answers (DOT)	# (%) Response
Test not required	39 (98%)
Illinois Flexibility Index Test (I-FIT)	1 (3%)
Direct Tension Cyclic Fatigue Test (S-VECD)	0
IDT Energy Ratio Test (IDT ER)	0

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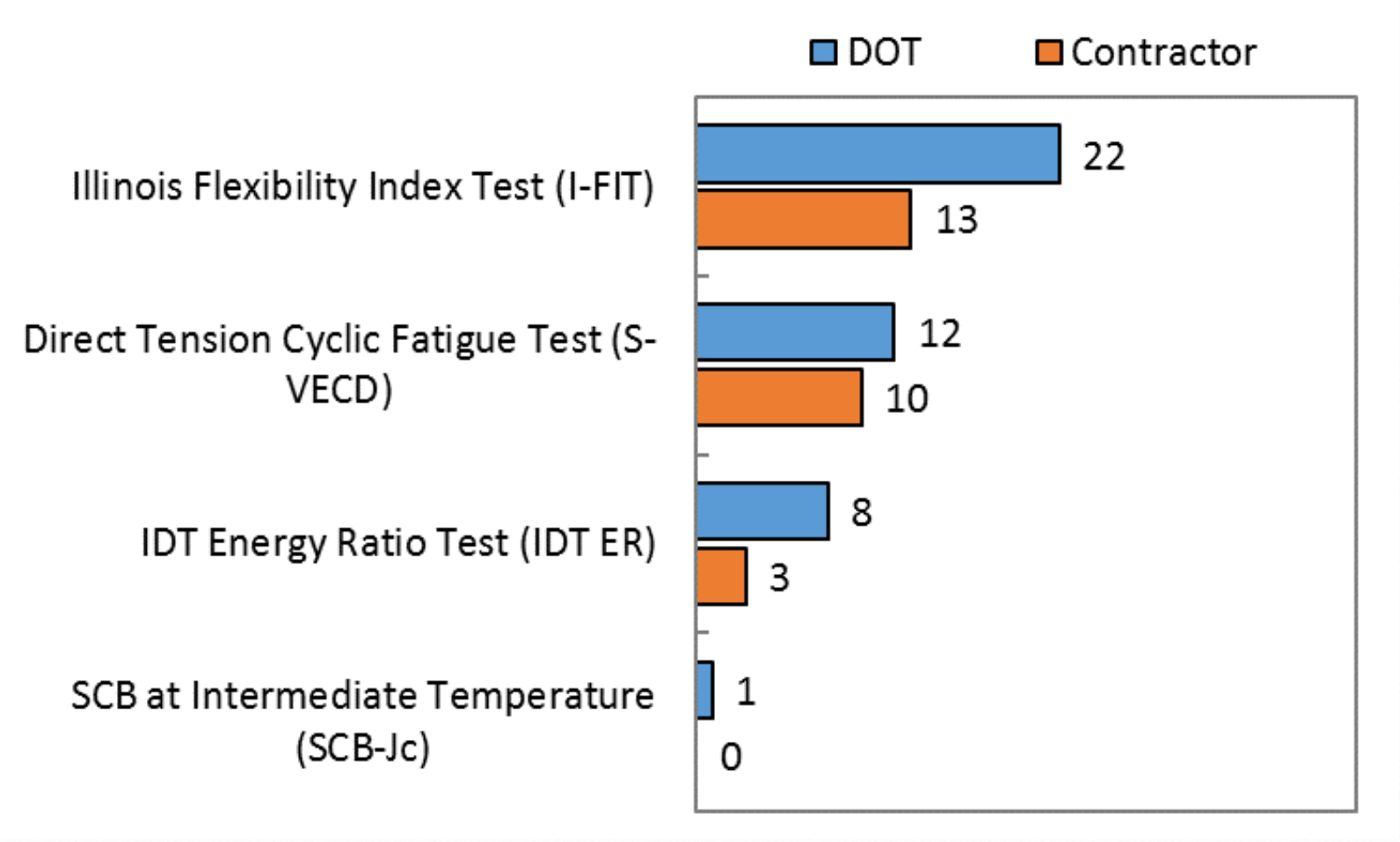
Which of the following performance tests do you *think* have the most potential to address top-down fatigue cracking?



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Which of the following rutting tests is used in your CURRENT mix design specifications?

Answers (DOT)	# (%) Response
Test not required	17 (43%)
Asphalt Pavement Analyzer (APA)	10 (25%)
Hamburg Wheel Tracking Test (HWTT)	10 (25%)
Hveem Stabilometer	2 (5%)
Flow Number (FN)	1 (3%)
Superpave Shear Tester (SST)	0

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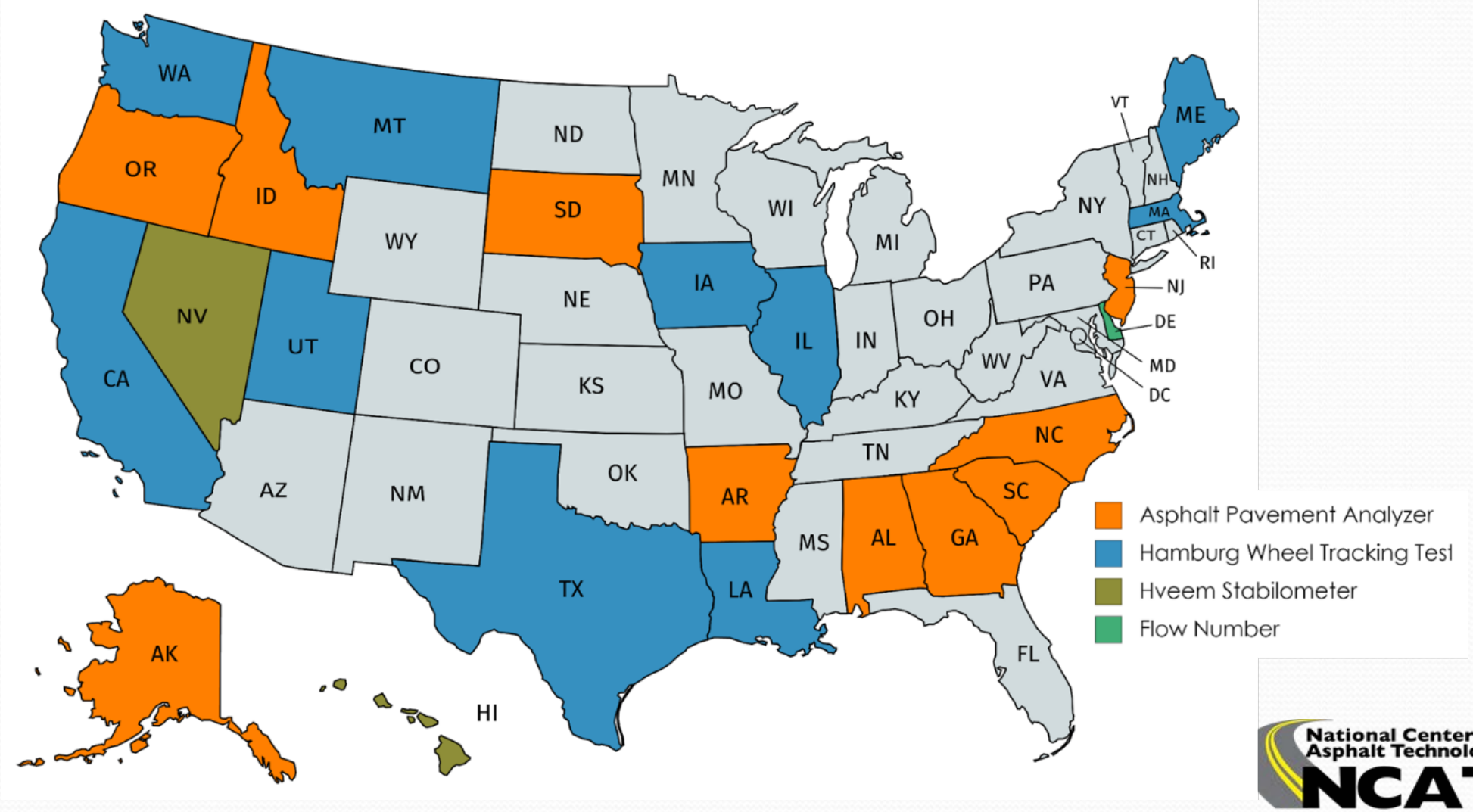
Current Use of Rutting Tests



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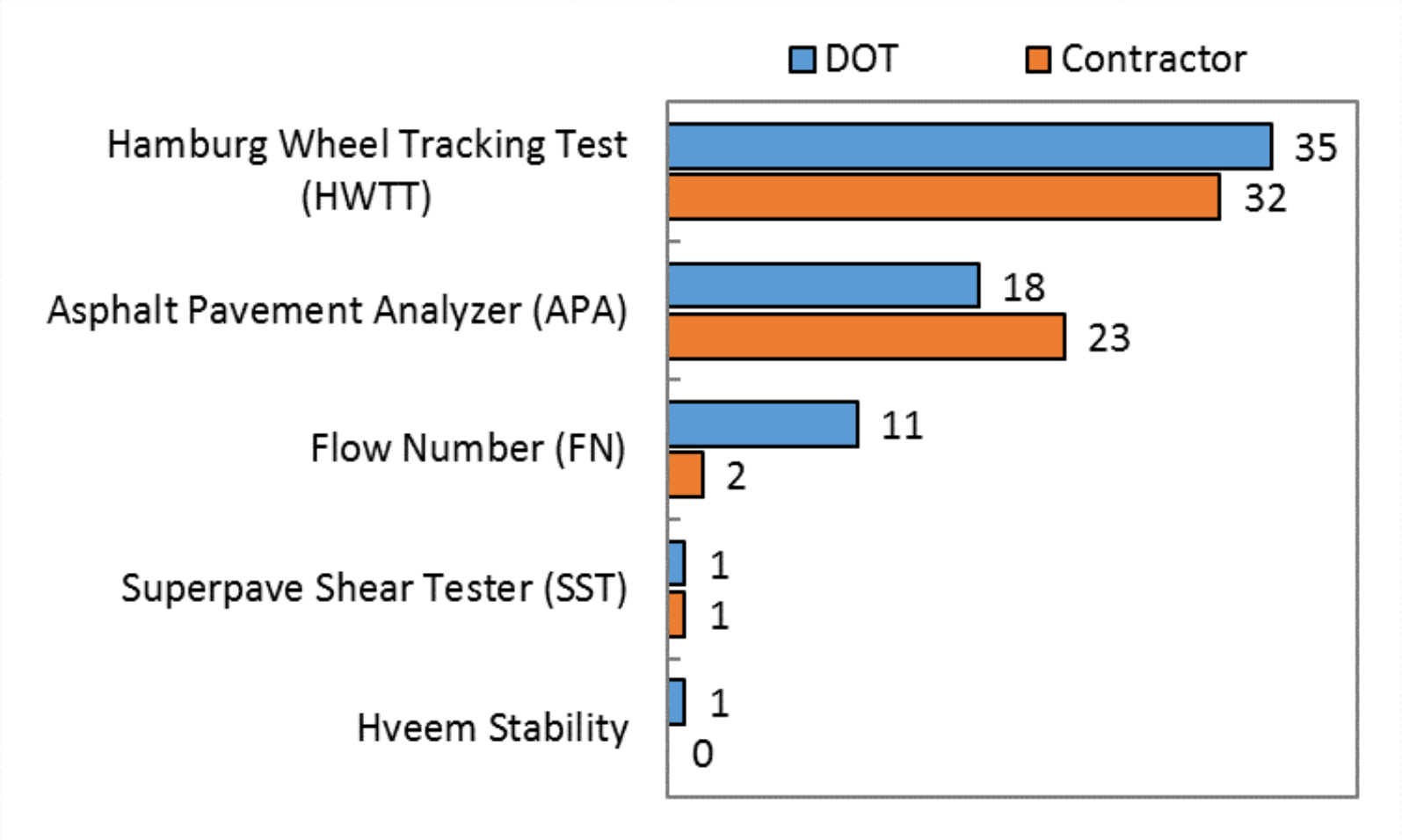
Which of the following performance tests do you *think* have the most potential to address rutting?



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Which of the following thermal cracking tests is used in your CURRENT mix design specifications?

Answers (DOT)	# (%) Response
Test not required	37 (93%)
Disk-Shaped Compact Tension Test (DCT)	3 (8%)
Semi-Circular Bend (SCB) Test at Low Temperature	0
Indirect Tensile (IDT) Creep Compliance and Strength Test	0
Thermal Stress Restrained Specimen Test (TSRST)	0

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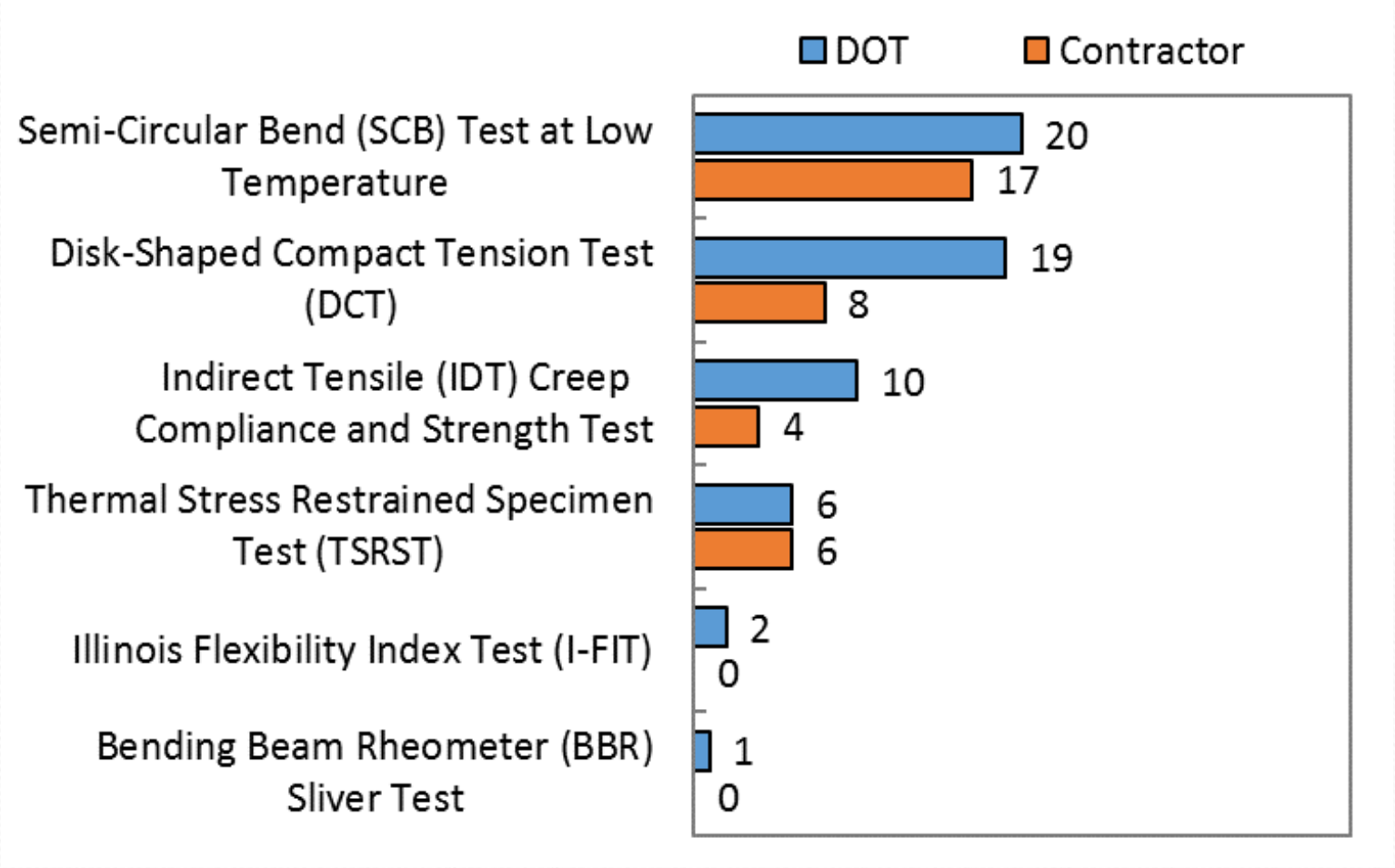
Which of the following performance tests do you *think* have the most potential to address <u>thermal cracking</u>?



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Which of the following reflection cracking tests is used in your CURRENT mix design specifications?

Answers (DOT)	# (%) Response
Test not required	37 (93%)
Texas Overlay Test (OT)	2 (5%)
Illinois Flexibility Index Test (I-FIT)	1 (3%)
Disk-Shaped Compact Tension Test (DCT)	0

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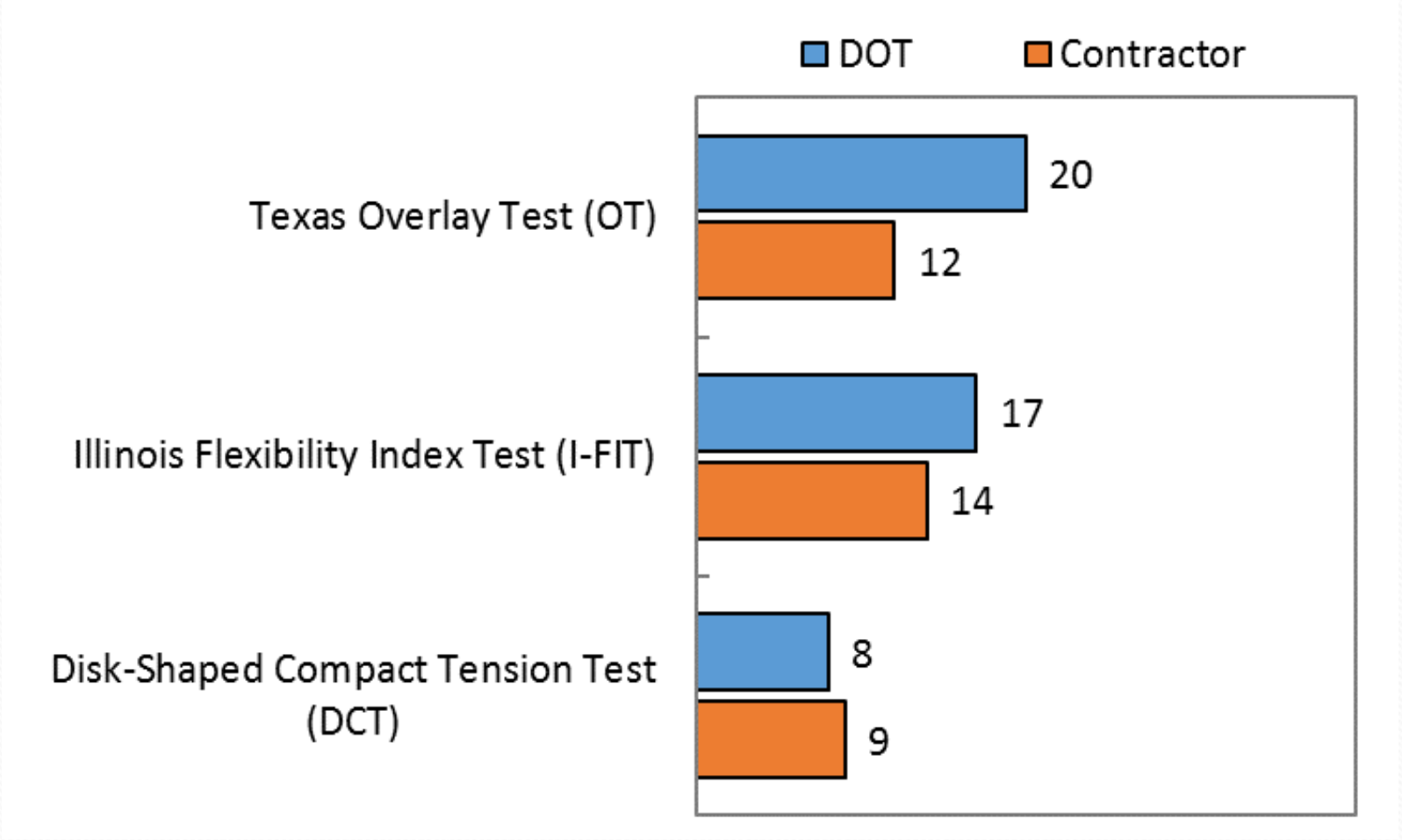
Which of the following performance tests do you think have the most potential to address reflection cracking?



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Which of the following moisture damage tests is used in your CURRENT mix design specifications?

Answers (DOT)	# (%) Response
Tensile Strength Ratio (TSR)	29 (73%)
Hamburg Wheel Tracking Test (HWTT)	5 (13%)
Test not required	3 (8%)
Immersion Compression Test	2 (5%)
Asphalt Film Retention Test	1 (3%)

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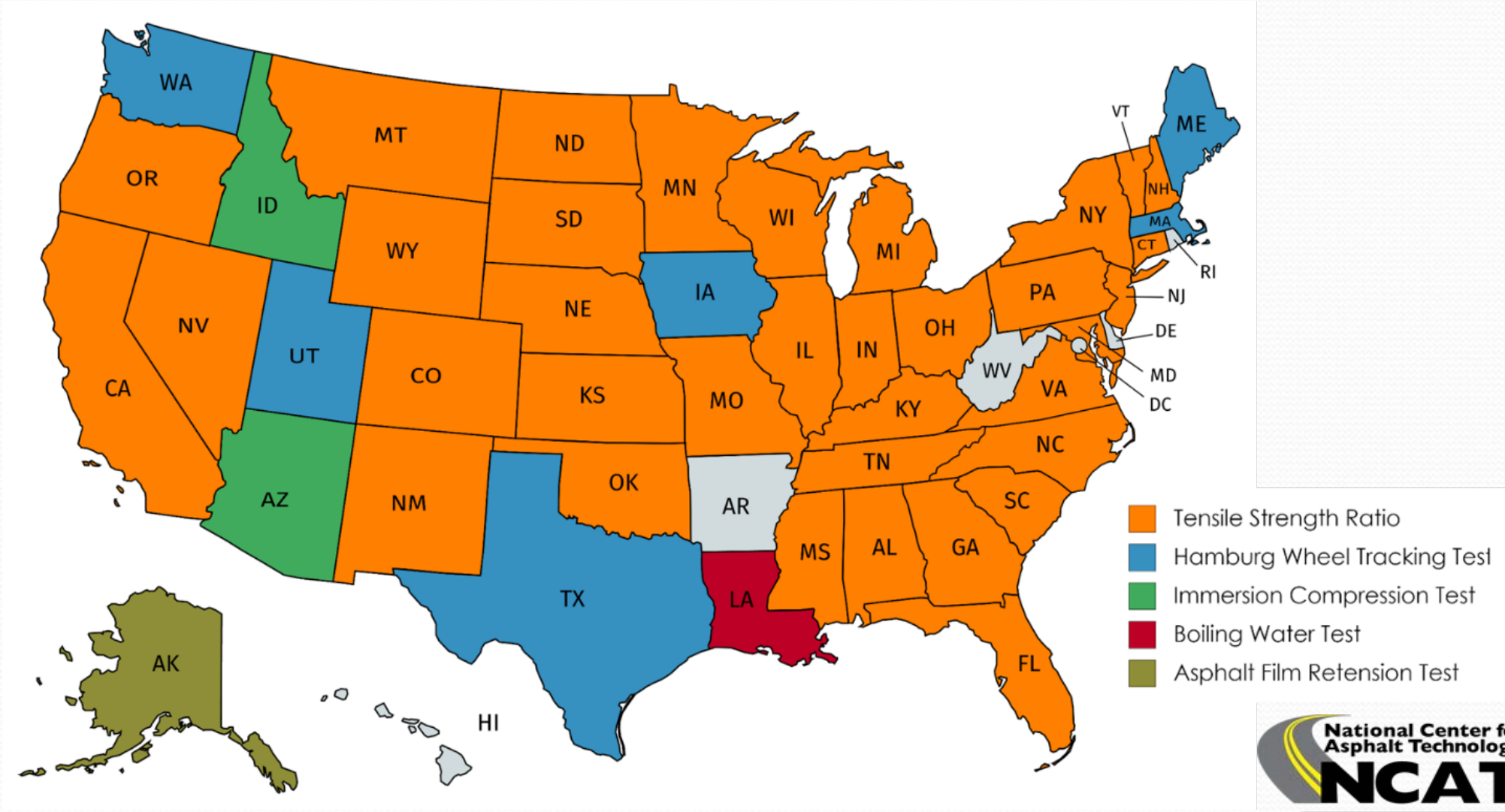
Current Use of Moisture Damage Tests



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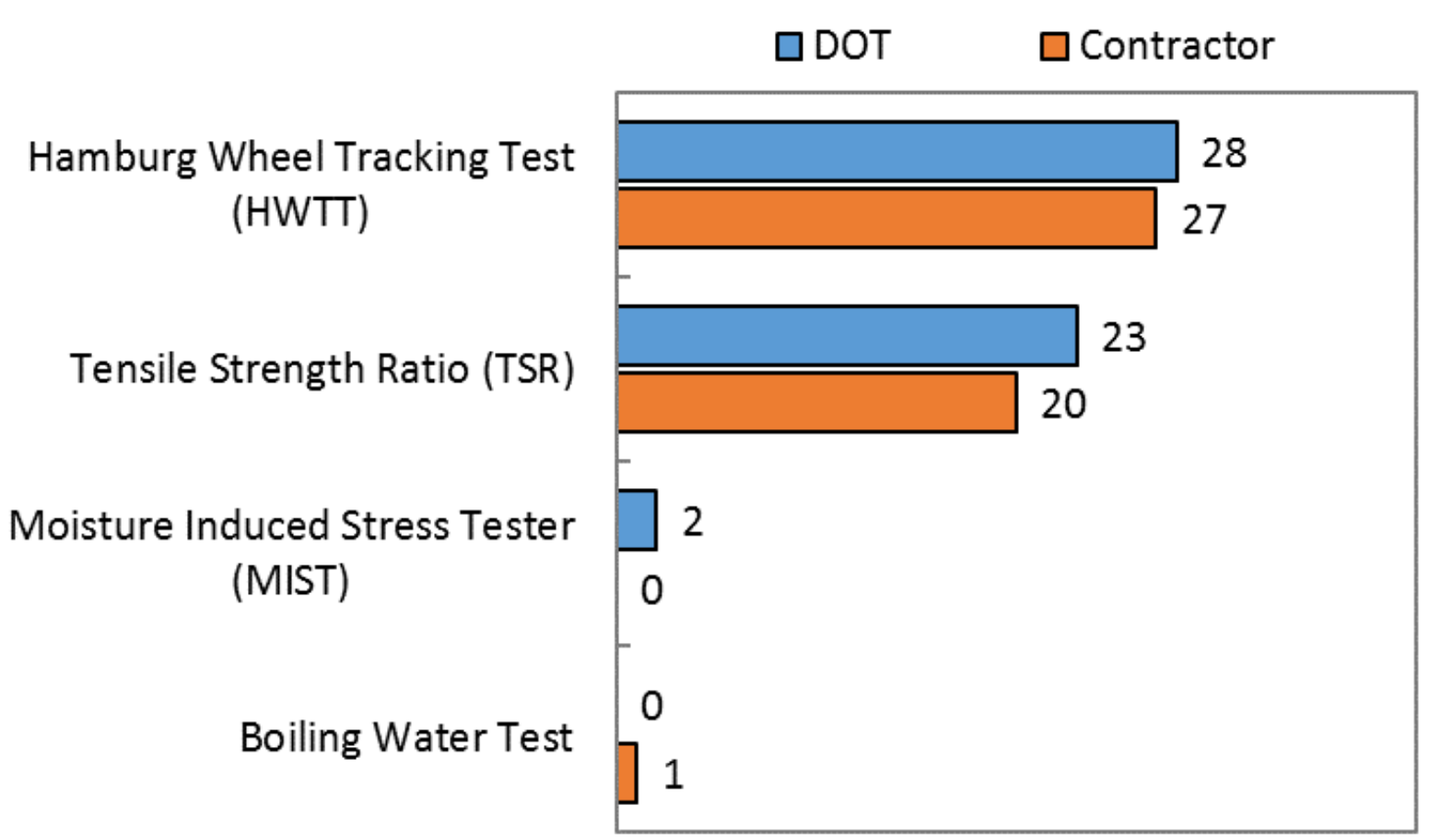
Which of the following performance tests do you *think* have the most potential to address moisture damage?



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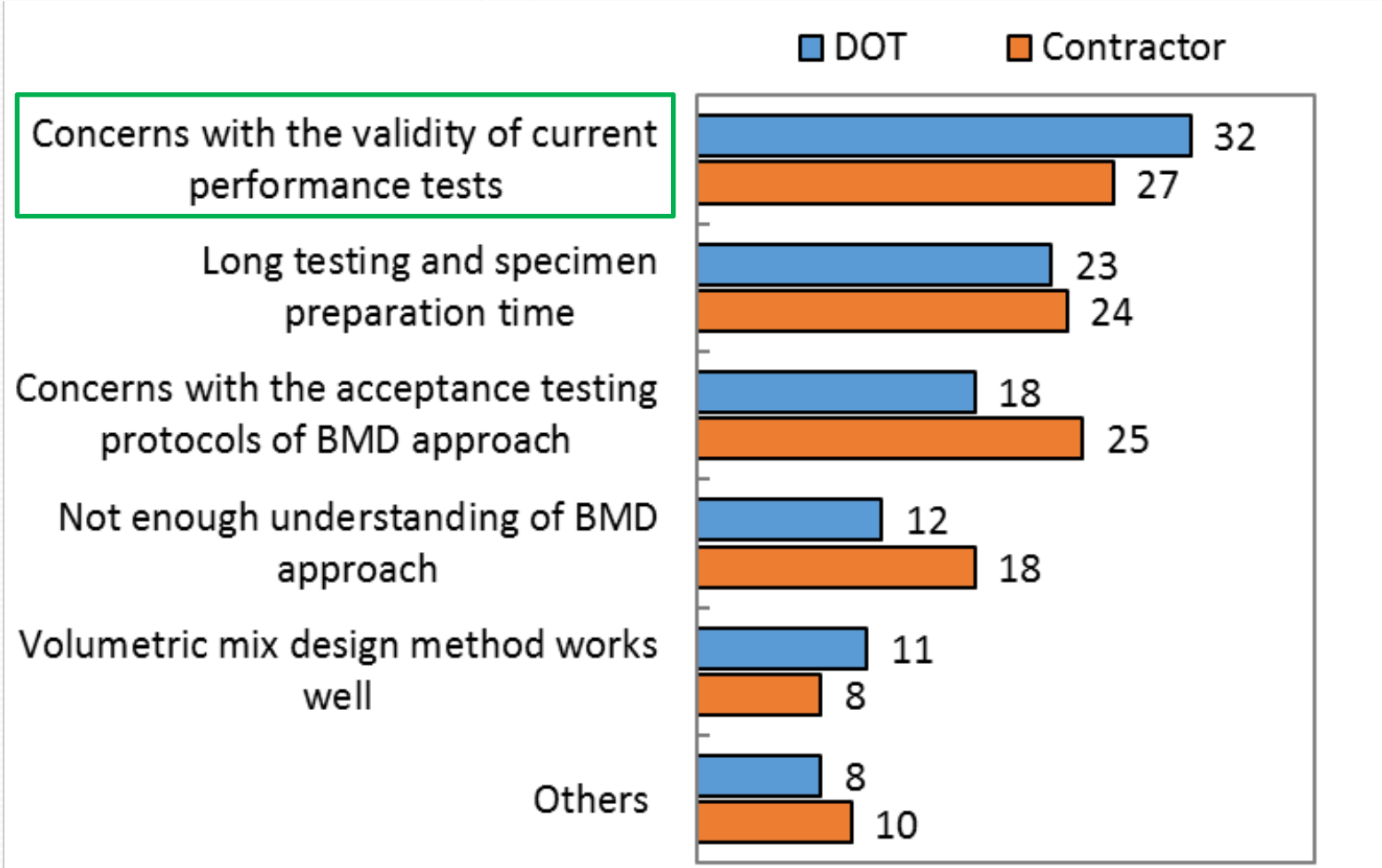
What are your concerns regarding the implementation of BMD?



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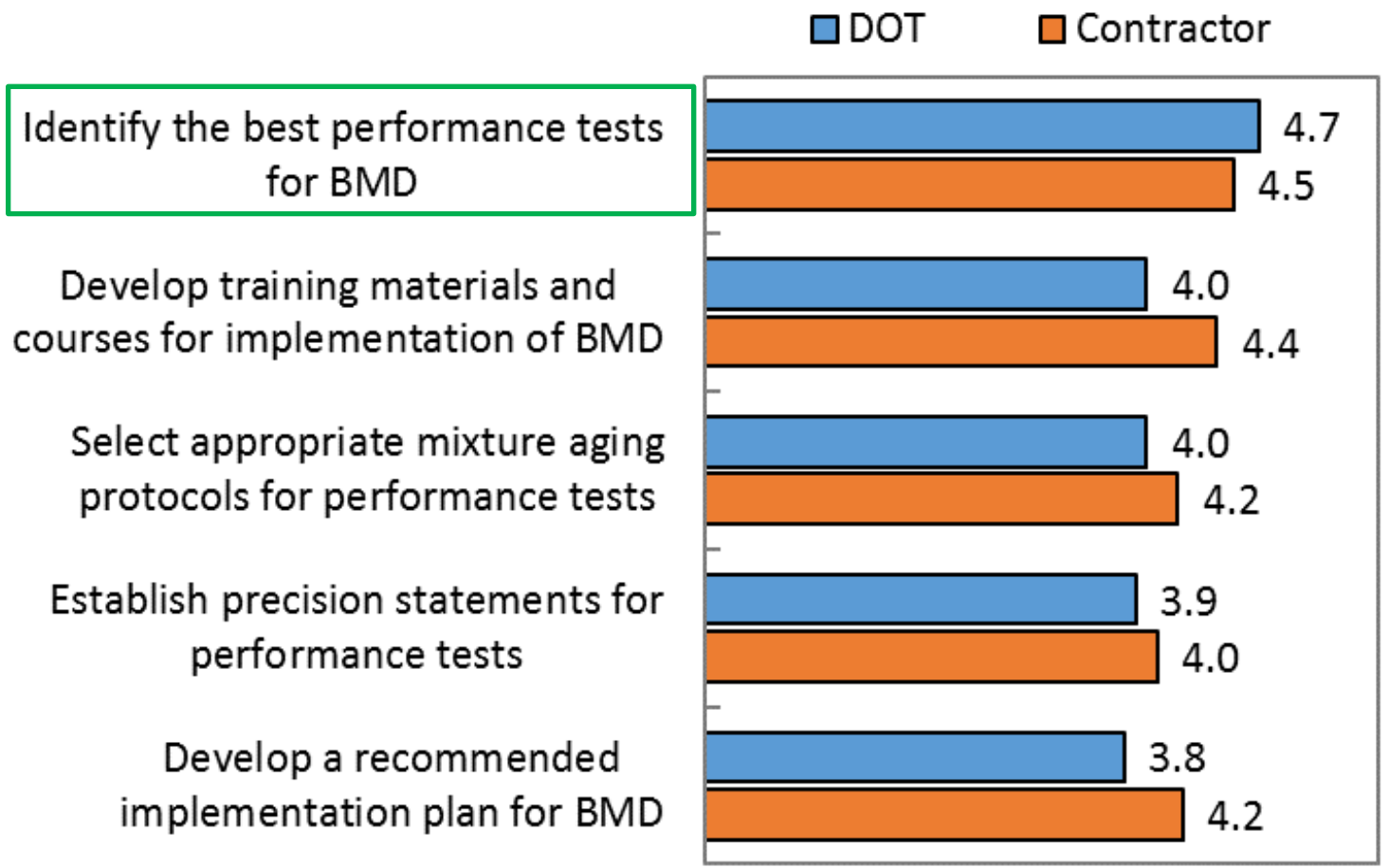
Please rate the following BMD related research topics based on their level of importance.

1= not important at all 5 = very important



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Free to AAPT members

AAPT
Association of Asphalt Paving Technologists

$75/part for non-members

2017 Webinar Series

Balanced Mix Design (BMD) for Asphalt Mixtures

Nov. 2, 9, and 16 (Three Consecutive Thursdays) at 2 PM EST

Part 1: Nov. 2

Background on the need for BMD, different approaches, and path to implementation

Dr. Shane Buchanan
Oldcastle Materials

Part 2: Nov. 9

Developing a BMD framework, current gaps and research needs, how to get started on BMD now

Dr. Randy West
NCAT

Part 3: Nov. 16

A case study of BMD implementation in Louisiana, Lessons learned

Dr. Louay Mohammad, LTRC
Dr. Sam Cooper III, LADOTD
Dr. Jay Winford, Prairie Contractors

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