

State-of-the-Knowledge and Practice of Asphalt Binder Specifications in US and Canada

**Asphalt Technical Symposium Webinar
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Discussion Outline



- MSCR Implementation in the US and Canada
- State-of-the-Knowledge Document on Delta Tc

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- MSCR Implementation in the US and Canada
- State-of-the-Knowledge Document on Delta Tc

Always Changing...

MSCR Implementation in US and Canada



- The use of polymer modified binders has grown tremendously over the past several years in US and Canada
- Most widely used specification: AASHTO M320
 - Based on a study of neat (unmodified) binders
 - May not properly characterize polymer modified binders

Does PG Grading Predict Performance?

Study of the two mixes with the same aggregate structure, but different binders.

PG 64-22 modified, no rutting



PG 67-22 unmodified, 15mm rut



What happened as a result of M 320's inability to fully characterize polymer-modified binders?

- Most states began requiring additional tests to the ones required in AASHTO M 320
- These mostly empirical tests are commonly referred to as “PG Plus” tests
- These tests and requirements are not standard across the various agencies – difficult for suppliers
- Even some of the tests that are the most common, e.g. Elastic Recovery, are not run the same way from state to state

MSCR PG Grading System (AASHTO M 332)



- Environmental grade plus traffic level designation;
i.e. **PG 64E-22**
 - Four traffic levels
 - S = Standard: < 10 million ESALs and standard traffic loading
 - H = Heavy: 10 – 30 million ESALs or slow-moving traffic loading
 - V = Very Heavy: > 30 million ESALs or standing traffic loading
 - E = Extra Heavy: > 30 million ESALs and standing traffic loading

Note: MSCR system replaces grade bumping.

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i.e. **PG 64E-22**

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- | | | |
|--------------------|--|---------------------|
| • S = Standard: | < 10 million ESALs <u>and</u> standard traffic loading | Jnr = 2.0 – 4.5 kPa |
| • H = Heavy: | 10 – 30 million ESALs <u>or</u> slow-moving traffic loading | Jnr = 1.0 – 2.0 kPa |
| • V = Very Heavy: | > 30 million ESALs <u>or</u> standing traffic loading | Jnr = 0.5 – 1.0 kPa |
| • E = Extra Heavy: | > 30 million ESALs <u>and</u> standing traffic loading | Jnr < 0.5 kPa |

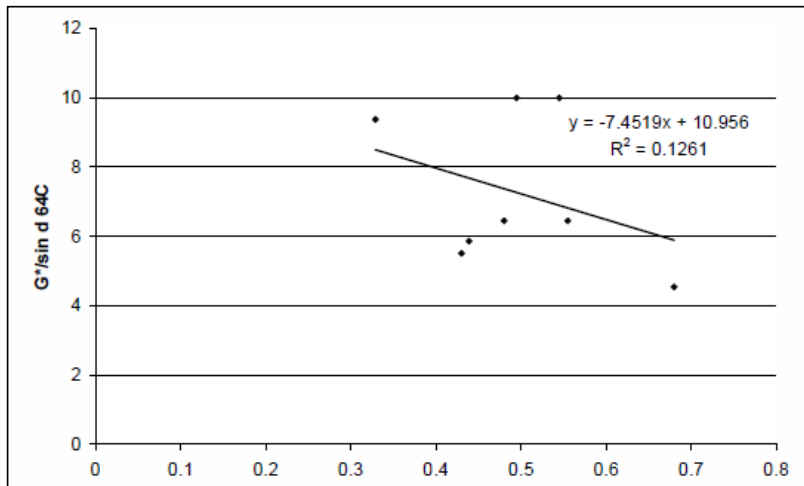
Note: MSCR system replaces grade bumping.

Accelerated Loading Facility (ALF)

- The pavement was heated to a constant 64°C
- The FHWA ALF uses an 18,000 lbs. single wheel load with no wheel wander
- The speed is 12 MPH
- This is an extreme loading condition far more severe than any actual highway

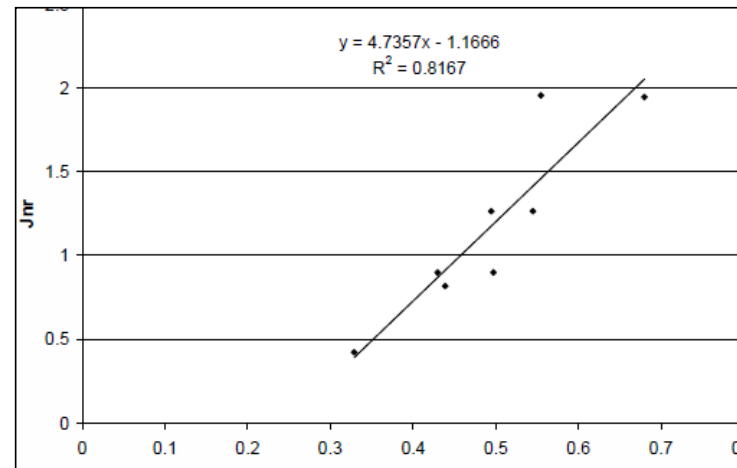


ALF Loading – M 320 vs. M 332

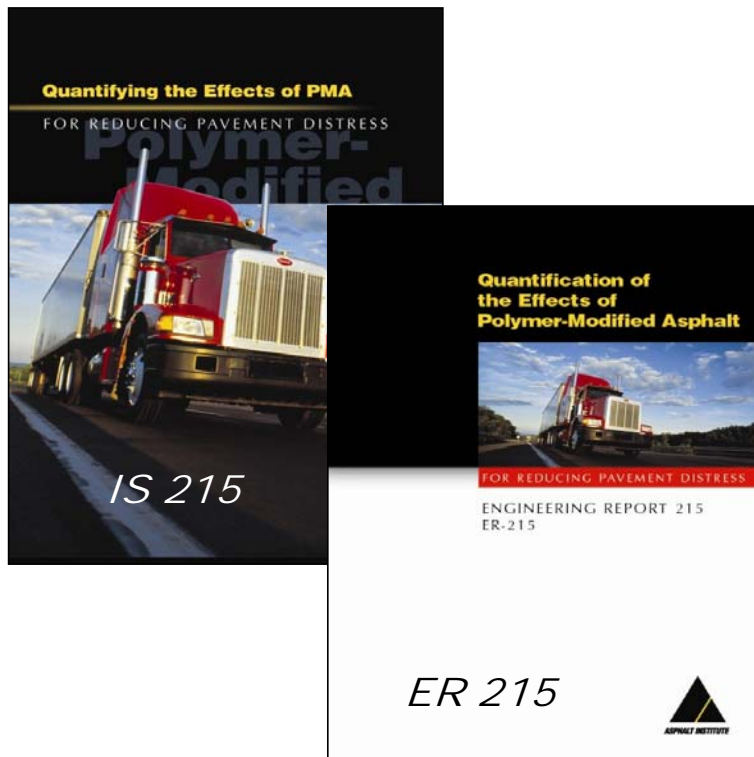


Traditional M 320
PG Spec
 $R^2 = 0.13$

New M 332
PG Spec
 $R^2 = 0.82$



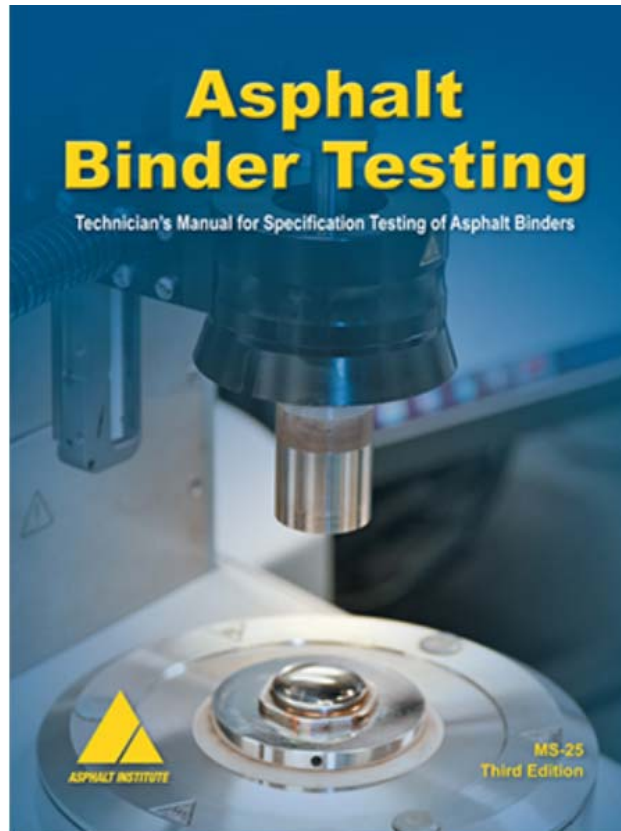
Quantifying the Effects of PMA for Reducing Pavement Distress



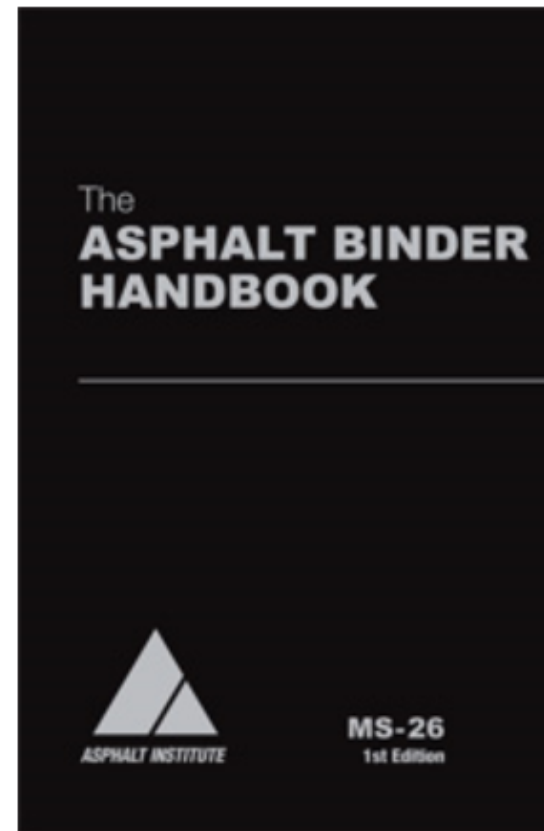
This study (published in Feb 2005) used national field data to determine enhanced service life of pavements containing polymer modified binders versus conventional binders.

The data is from a variety of climates and traffic volumes within North America.

For More Binder Information



MS-25



MS-26

Intent of this “National Snapshot” is to:



- Provide overall national perspective
 - Around MSCR Implementation
- Not to get into specific state agency details
 - Those found within:
 - AI's binder spec database
 - The state agency spec book
 - Disclaimer: Many grey areas where a state fits
 - i.e. spec doesn't explicitly exclude a modifier, but implicitly does
 - i.e. DOT's interpretation different than exact wording in spec

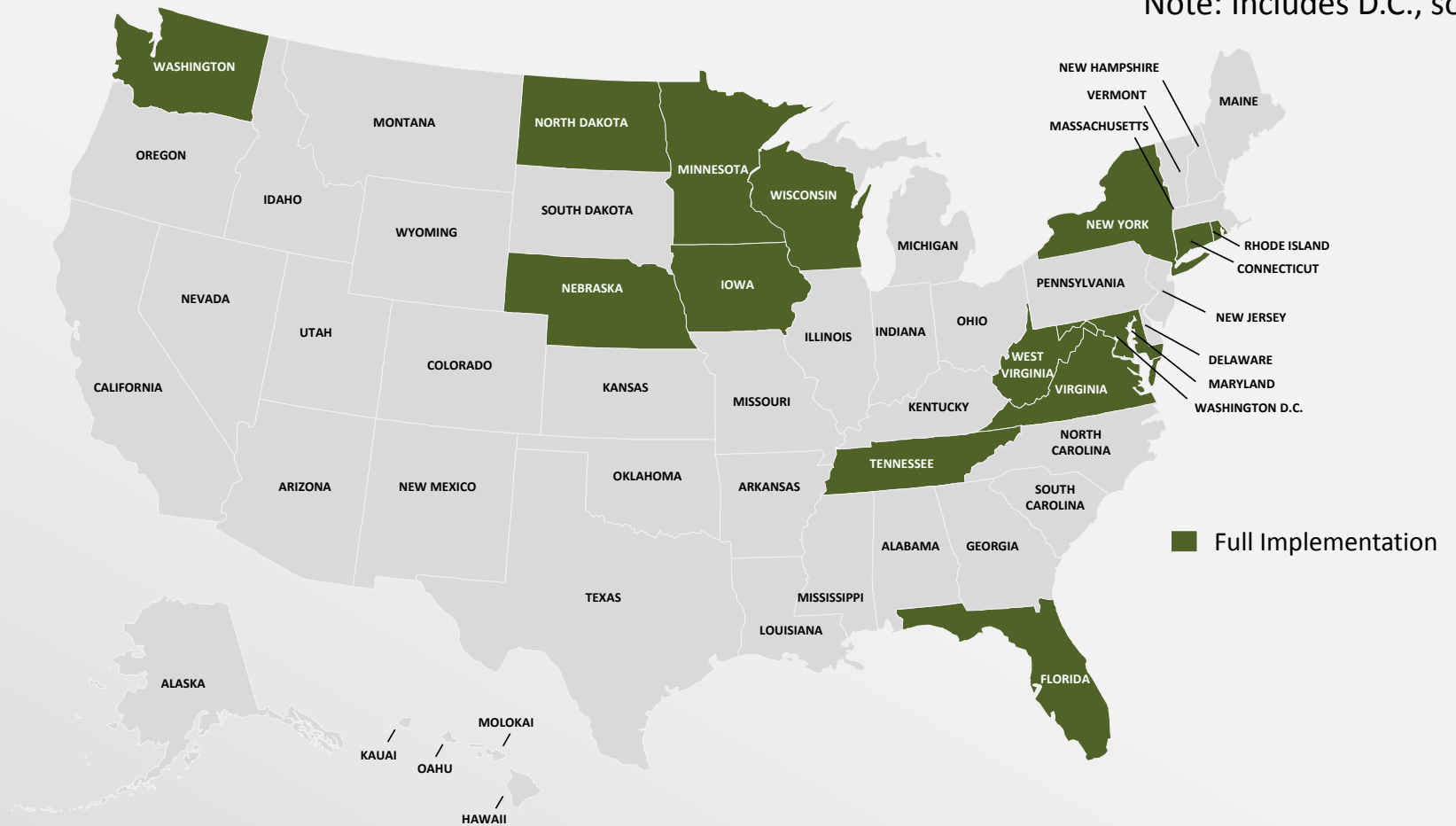
Accessing Binder Spec Database



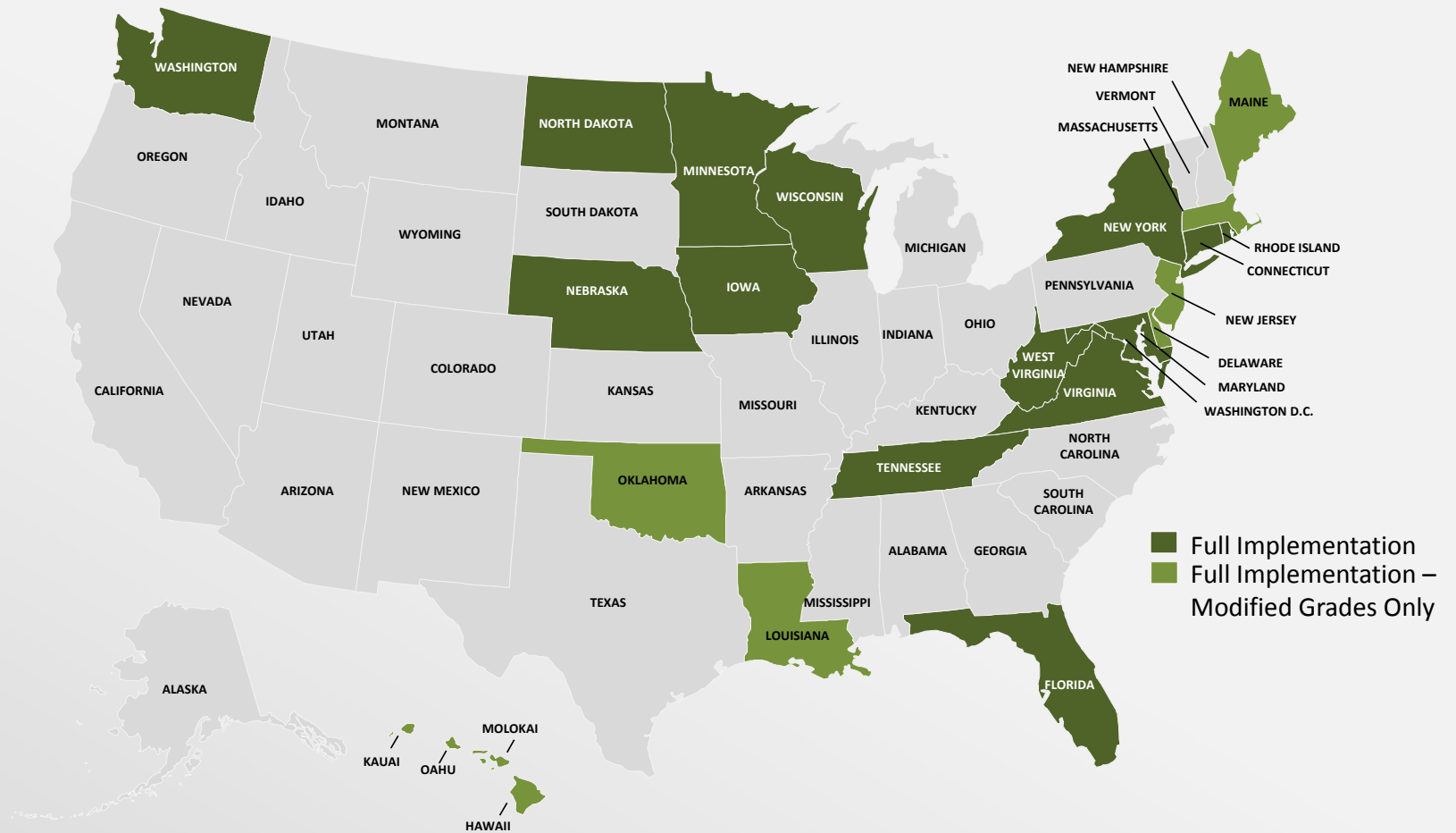
The screenshot shows the homepage of the Asphalt Institute website. At the top, there is a navigation bar with a home icon, the URL "www.asphaltinstitute.org", a "110%" zoom indicator, and icons for search, home, and star. Below this is a secondary navigation bar with "Sign In" and "Donate" buttons, and social media icons for YouTube, Twitter, Facebook, LinkedIn, and RSS. The main content area features a large "100" graphic with the Asphalt Institute logo and the text "1919-2019 ASPHALT INSTITUTE Building for the next 100 years". To the right of this graphic, a blue arrow points to a list of links: "AI SPECIFICATION DATABASES", "ASPHALT INSTITUTE FOUNDATION", "ASPHALT MAGAZINE", and "R18LABQMS®". Below the main content is a dark navigation bar with links for "ENGINEERING", "LABORATORY", "HSE", "TRAINING", "STORE", and "MEMBERSHIP", along with a search box. The bottom section of the page is a large banner image of a building at sunset, with the text "Welcome to the Asphalt Institute" overlaid.

Full MSCR (M332) Implementation: All Grades – 15 States

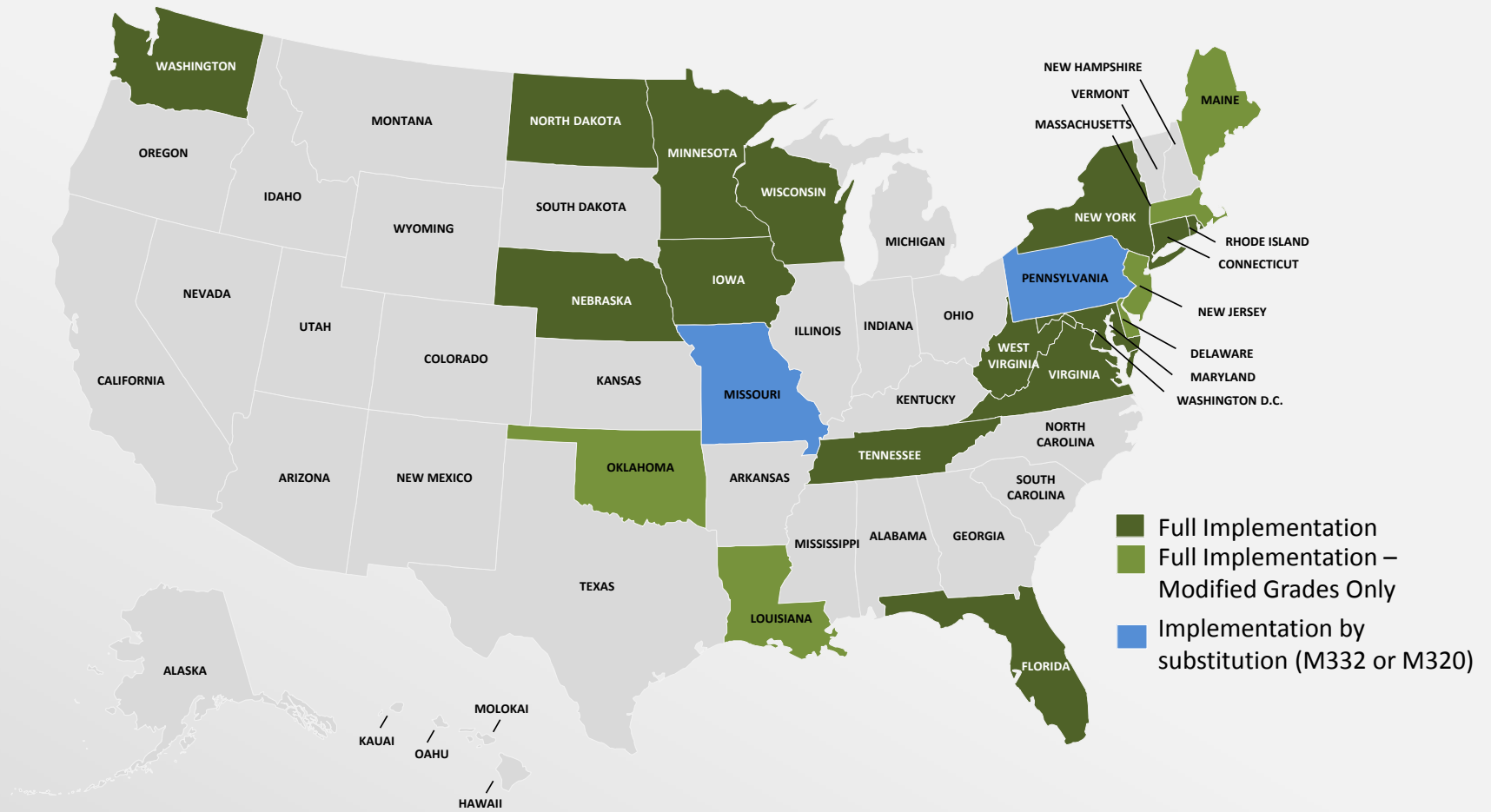
Note: Includes D.C., so 15/51



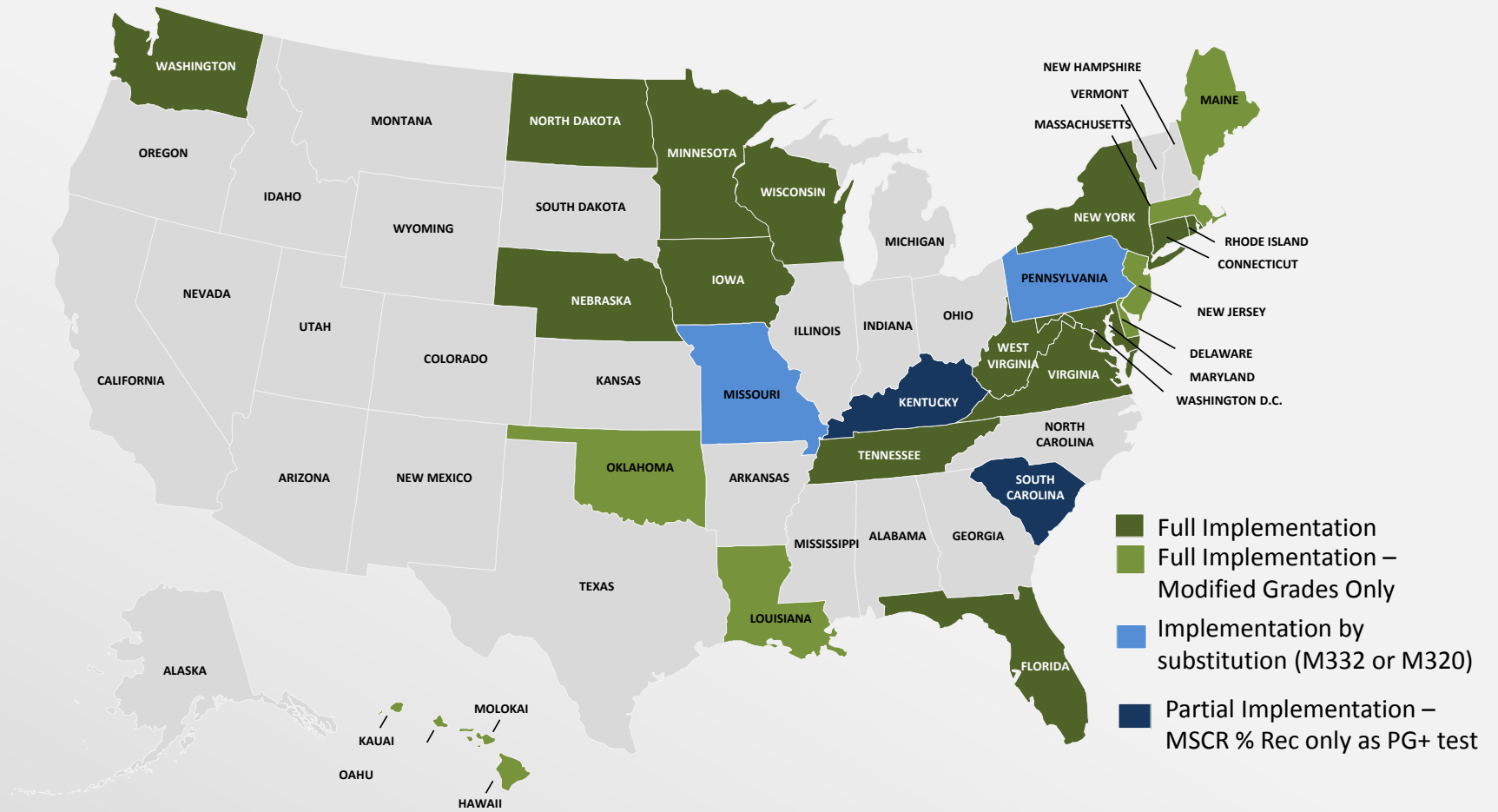
Full MSCR Implementation: All Grades or Modified Grades Only - 24 States



Full MSCR: All Grades, Modified Grades Only, or Substitution - 26 States



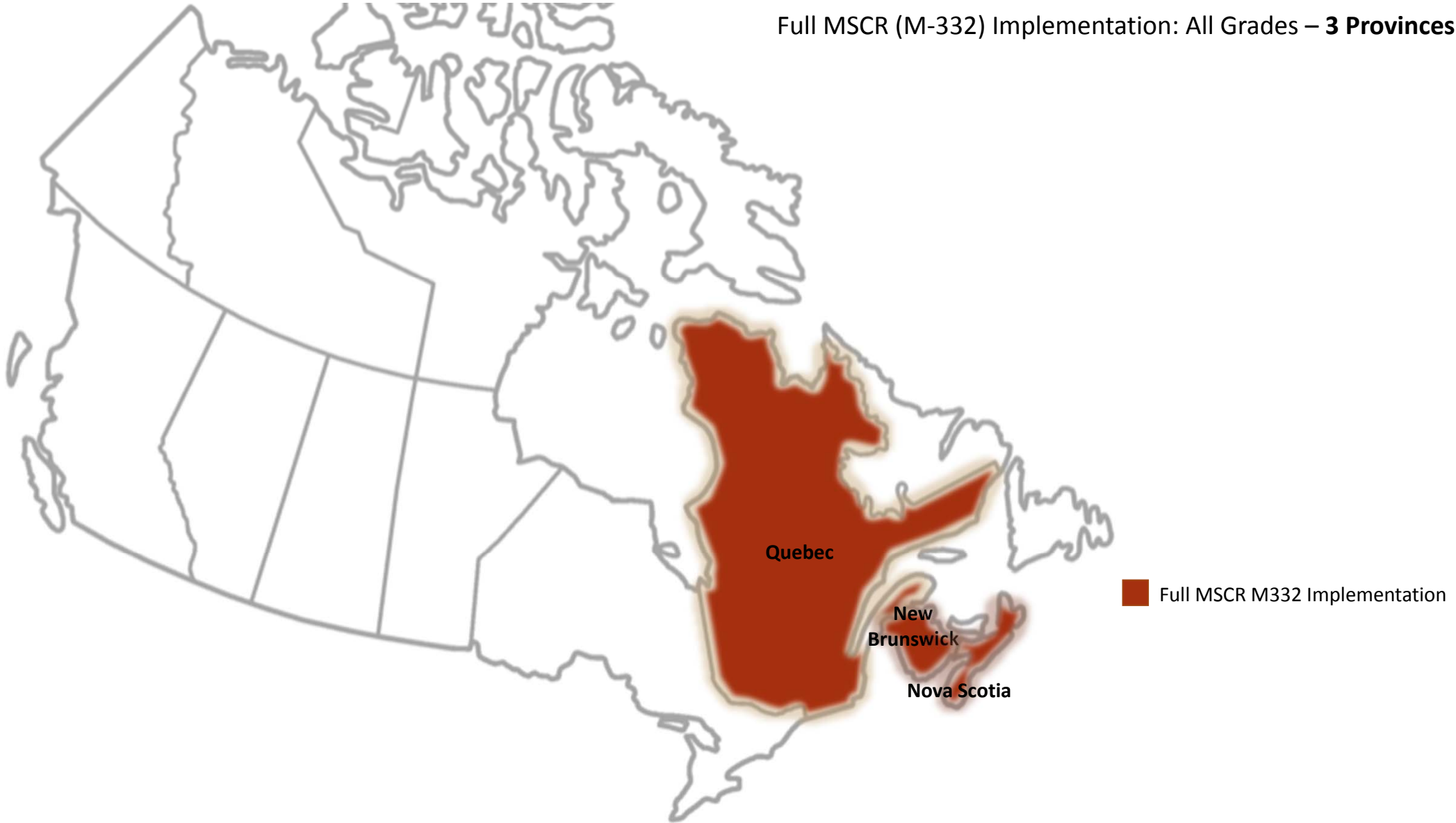
Full or Partial MSCR: All Grades, Modified Grades Only, or Substitution - 28 States



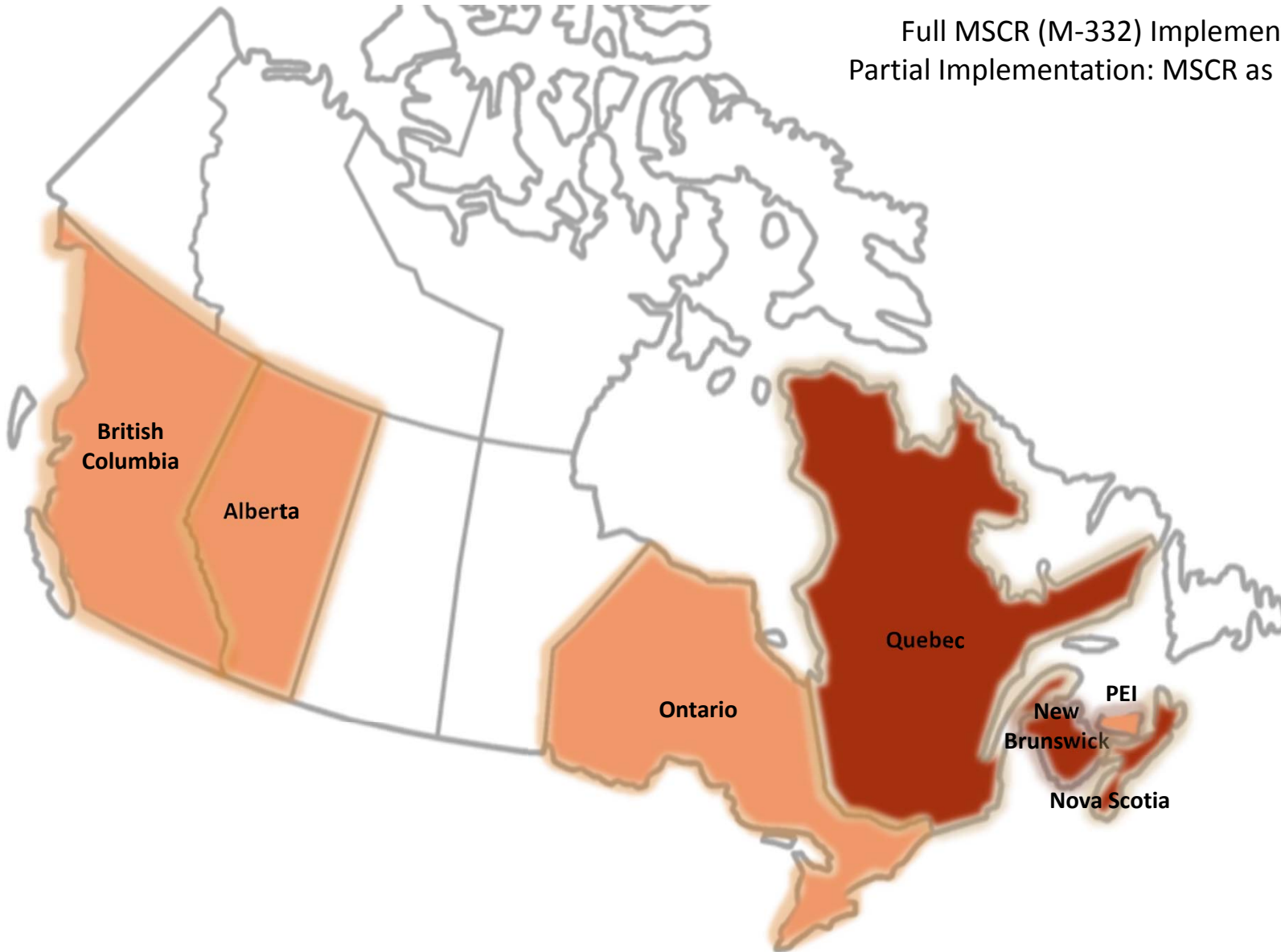
Canada





Full MSCR (M-332) Implementation: All Grades – **3 Provinces**



Full MSCR (M-332) Implementation: All Grades – **3 Provinces**
Partial Implementation: MSCR as PG+ Test for PMA – **4 Provinces**



-  Full MSCR M332 Implementation
-  Partial: MSCR as PG+ Test for PMA

Discussion Outline



- ✓ MSCR Implementation in the US and Canada
- State-of-the-Knowledge Document on Delta Tc

- Published Oct 2019
- IS-240
- 11 chapters, 64 pages
- Free download as e-Book on AI's website (under Engineering)

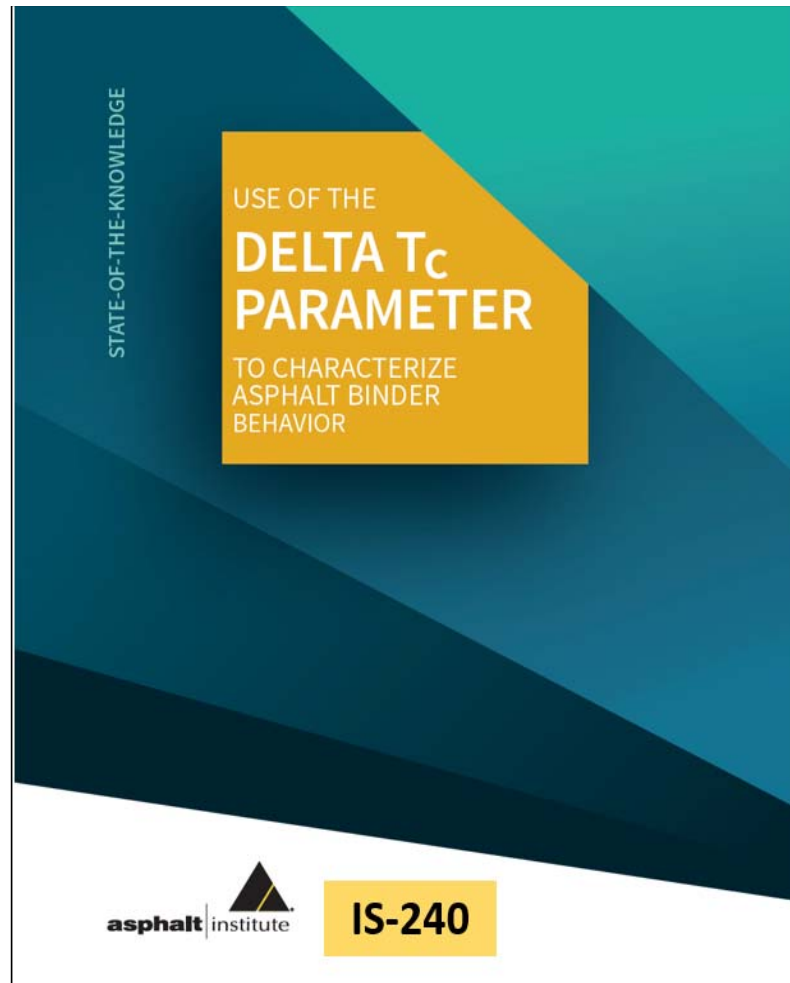


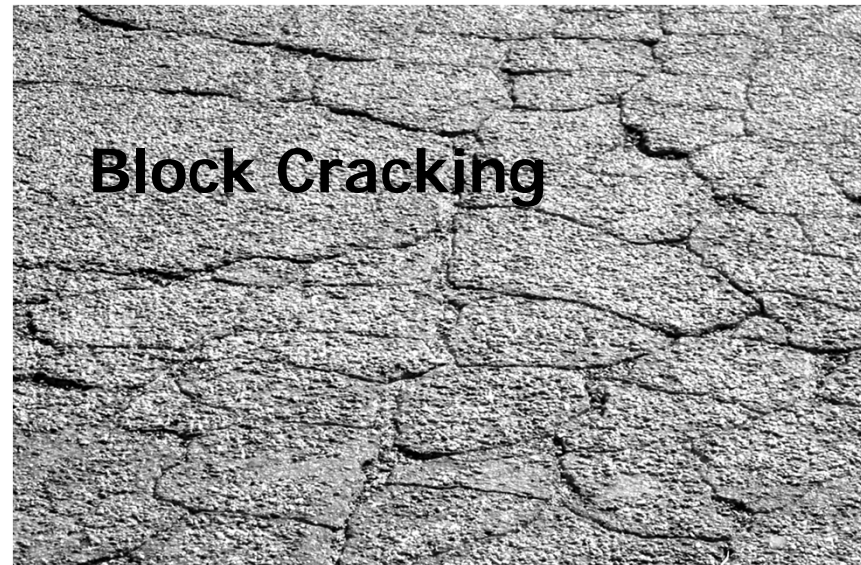
TABLE OF CONTENTS

| | |
|---|----|
| 1.0 Introduction and Purpose | 4 |
| 2.0 Origin of ΔT_c | 5 |
| Comments on Originating Study: AAPTP Project 06-01..... | 10 |
| 3.0 The Mechanics of ΔT_c | 11 |
| Calculation of ΔT_c | 11 |
| What the ΔT_c Number Means..... | 12 |
| What ΔT_c Looks Like..... | 15 |
| 4.0 What Affects ΔT_c? | 19 |
| Laboratory Aging..... | 19 |
| Reclaimed Asphalt Pavement (RAP)..... | 27 |
| Recycled Asphalt Shingles (RAS)..... | 29 |
| Re-refined Engine Oil Bottoms (REOB)..... | 32 |
| Combined Effects..... | 35 |
| Elastomeric Polymer Modification..... | 38 |
| Other Asphalt Characteristics..... | 42 |
| 5.0 Considerations When Using ΔT_c | 45 |
| Distress Types that ΔT_c Addresses..... | 45 |
| Recovered Binder in Relation to ΔT_c | 46 |
| Precision..... | 46 |
| Practical Considerations..... | 46 |
| 6.0 Full-Scale Test Projects and ΔT_c | 48 |
| 7.0 Perceived Utility of ΔT_c | 51 |
| Asphalt Institute Survey..... | 51 |
| Agency Specifications..... | 52 |
| Considerations for Implementation of ΔT_c as a Specification Parameter..... | 55 |
| Alternatives to ΔT_c for Addressing Block Cracking..... | 56 |
| 8.0 Recent National Research Projects and ΔT_c | 57 |
| 9.0 Summary | 58 |
| 10.0 References | 60 |
| 11.0 Frequently Asked Questions | 63 |

<http://www.asphaltinstitute.org/engineering/delta-tc-technical-document/>

What is ΔT_c ?

- Asphalt durability parameter derived from low temp BBR test and results (S and m)
- Provides insight into binder relaxation properties that contribute to non-load related cracking and other age-related embrittlement distresses



What is ΔT_c ?



- Conceptualized by Anderson, et al. in Journal AAPT, Vol. 80, 2011
 - FAA sponsored study, AAPT 06-01 Techniques for Prevention and Remediation of Non-Load-Related Distresses on HMA Airport Pavements
 - Intended as a forensic analysis of existing airfield pavements
 - Aimed at timing of preventive maintenance
- Since 2011 gained interest as specification parameter by DOT's

Document Background and Purpose

- AI TAC decided in April 2019 to develop this document
- Why
 - More and more agencies looking to implement ΔT_c in binder purchase spec
 - Relevant info on ΔT_c was scattered
 - Difficult to sort through relevant sources
- Need
 - Single, comprehensive, up-to-date reference
 - Focal point for dialog to those wanting a better understanding of ΔT_c and its relevance in characterizing binder behavior

Task Force Members



- Bob McGennis (Chair)
- Mike Anderson (Co-lead)
- Mark Buncher
- Mark Blow
- Bob Horan
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- Hassan Tabatabaee
- Andy Cascione
- Neal Lewis
- Jean-Pascal Planche (WRI)
- Tim Aschenbrener (FHWA)
- Blair Heptig (KSDOT)


Goal of Document

- Capture current state of the knowledge
 - Summarizing lots of research and data
- Not intended to persuade or discourage an agency from using ΔT_c
 - A.I. does not take a position on adoption of ΔT_c in a binder purchase spec
 - Document describes number of key steps that should be considered beforehand
 - Document includes discussion of those agencies that have incorporated ΔT_c in their specs

| Chapter | Topics |
|---------|--|
| 1 | Introduction and Purpose |
| 2 | Origin of ΔT_c |
| 3 | How calculated, testing involved, physical meaning, typical values |
| 4 | Factors affecting ΔT_c : lab aging, various recycled binders, elastomers |
| 5 | Considerations: distresses, recovered binder, precision, lab workflow |
| 6 | Data from full-scale projects |
| 7 | Perceived utility of ΔT_c : forensics and specifications. Steps agencies should consider before adoption. Alternatives to ΔT_c |
| 8 | Recent national research that includes ΔT_c |
| 9 | Summary |
| 10 | References |
| 11 | 20 FAQs (and answers) |

Implementation Status, Oct 2019

| State | Spec, C | PAV Aging, hrs | When | Other |
|--------|---------|-------------------|---------------|----------------------|
| KS | -5 | 40 | Now | |
| OK | -5 | 20 | Now | |
| FL | -5 | 20 | Now | |
| UT | -2 | 20 | Now | UTI \geq 92 C only |
| VT | -5 | 40 | 2020 | |
| MD | -5 | 40 | 2020 | |
| DE | -5 | 40 | 2020 | |
| PANYNJ | -5 | 40 | Now | |
| IL | ? | Eval | possible 2020 | |
| TX | <6.0 | 20 | Now | BMD projects only |
| MTQ | -5 | 40 | 2021 | PG 52n-40 |

| STATE-OF-THE-KNOWLEDGE | |
|--|----|
| <p>USE OF THE DELTA T_c PARAMETER TO CHARACTERIZE ASPHALT BINDER BEHAVIOR</p> | |
|  | |
| <p>IS-240</p> | |
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<http://www.asphaltinstitute.org/engineering/delta-tc-technical-document/>

Testing / Evaluation Delta Tc – **3 Provinces**



■ Testing / Evaluating ΔT_c

ASPHALT ACADEMY

NEW WEBINARS NOW AVAILABLE!

Scheduled Live Sessions:

Every live session will be recorded and available as a recording after the live webinar is completed.

| Webinar Title | Date | Time | PDHs | Instructors |
|---------------------------------|---------------|-------------|------|-----------------------------|
| Delta Tc – IS 240 | June 17, 2020 | 12:00PM EDT | 1.5 | Mike Anderson & Greg Harder |
| Causes and Cures of Segregation | June 18, 2020 | 12:00PM EDT | 1.5 | Wayne Jones & Dave Johnson |

Thank You AI Members.

Questions?



Global, International, Regular, Associate and Canadian members



Affiliate and Commercial members

