



**Future of Asphalt Binder Testing
New Test Methods and Parameters in Consideration
- National Research -**

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How Asphalt Pavements Behave – High Temperature

- Permanent Deformation
 - Mixture is Plastic
 - Wheel path rutting
 - Shoving at intersections
- Depends on...
 - Asphalt binder (some)
 - Mineral aggregate (some)
 - Volumetric proportioning (some)



Addressing Asphalt Binder Contribution to Rutting

- Most widely used specification: AASHTO M320 Standard Specification for Performance-Graded (PG) Asphalt Binder
 - Based on a study of neat (unmodified) binders
 - May not properly characterize polymer modified binders
- The use of polymer modified binders has grown tremendously over the past several years in US and Canada
- AASHTO M332 allows for better characterization of the high temperature, performance-related properties of asphalt binders

PG 67-22 unmodified, 15mm rut



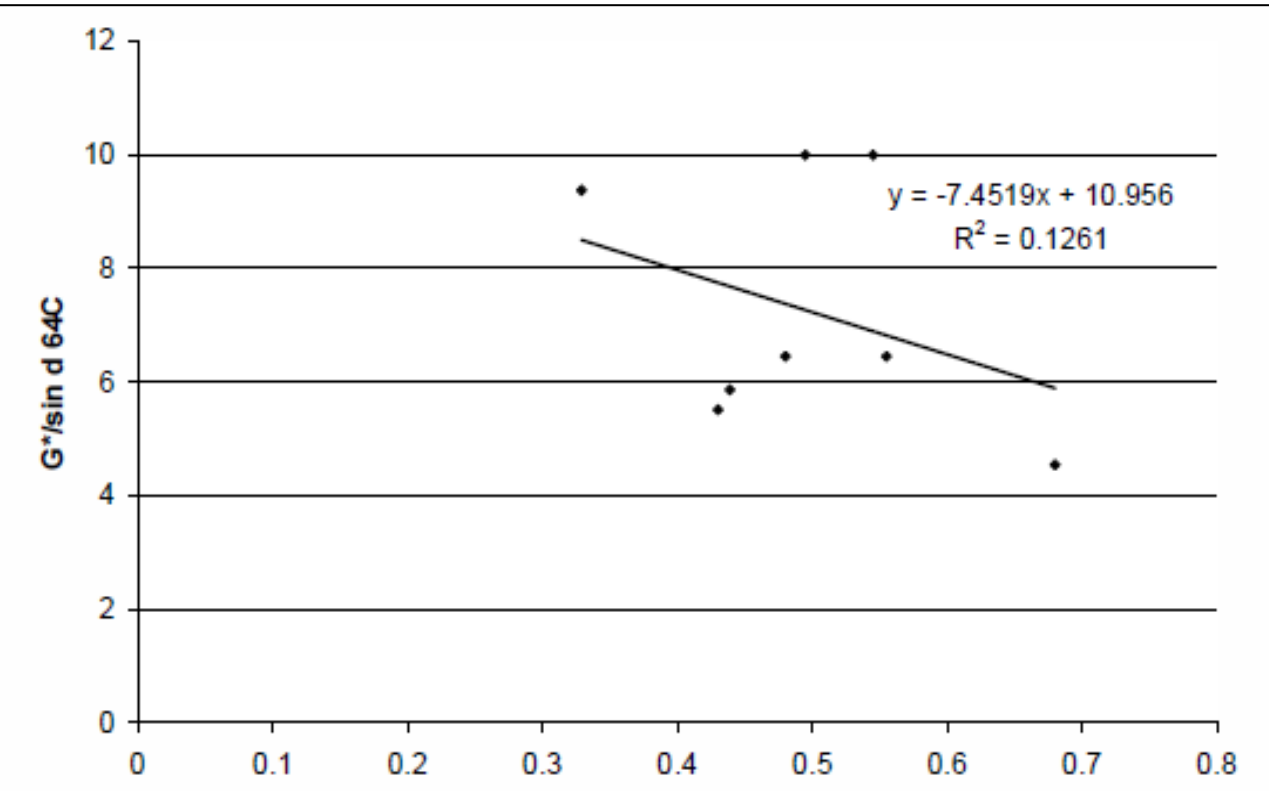
PG 64-22 modified, no rutting



FHWA Accelerated Loading Facility – AASHTO M 320 vs. M 332

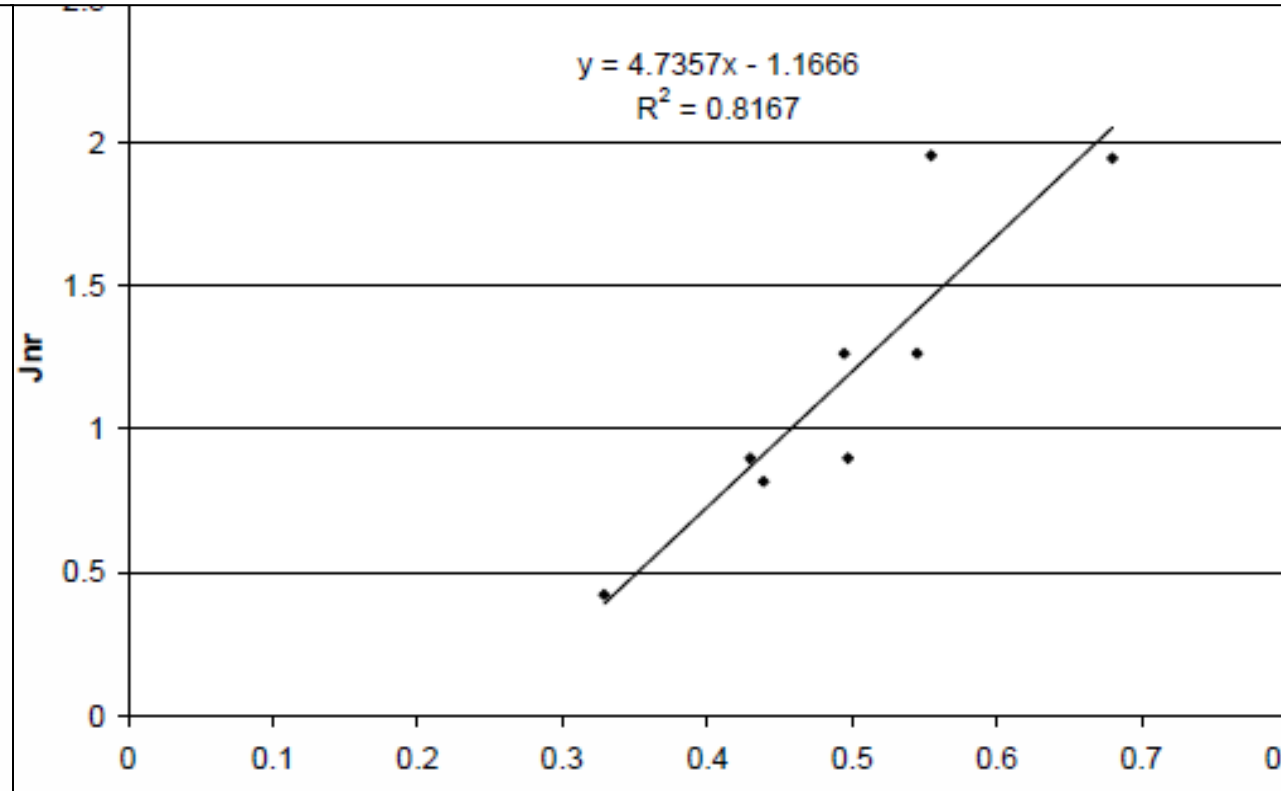
AASHTO M 320

$R^2 = 0.13$



AASHTO M 332

$R^2 = 0.82$



How Asphalt Pavements Behave – Low Temperature

- Thermal Cracks
 - Internal stresses induced by temperature change
 - Stresses exceed strength
- Mixture is Brittle
 - Transverse Cracks
- Depends on...
 - Asphalt binder (lots)
 - Mineral aggregate (little)
 - Volumetric proportioning (some)



NCHRP Report 673

- Research has shown that thermal cracking performance of asphalt mixtures is most strongly affected by the asphalt binder properties.
- If the asphalt binder used in the mixture has the appropriate low temperature properties for the expected use, the expectation for conventional asphalt mixtures will be that they will have adequate laboratory thermal cracking performance.

PG 64 – 22

How Asphalt Pavements Behave – Aging and Intermediate Temperature Cracking

- Durability Cracks
 - Mixture is brittle
 - Random, wandering cracking
 - Longitudinal
- Depends on...
 - Asphalt binder (some)
 - Mineral aggregate (little)
 - Volumetric proportioning (some)



- NCHRP 09-59
 - Relating asphalt binder fatigue properties to asphalt mixture fatigue performance
- NCHRP 09-60
 - Propose changes to current PG binder specifications tests, and practices to remedy gaps related to premature loss of asphalt durability – cracking and raveling.
- NCHRP 09-61
 - Short-and long-term binder aging methods to accurately reflect aging in asphalt mixtures

NCHRP 09-59

- Relating asphalt binder fatigue properties to asphalt mixture fatigue performance.
- Research identified Glover-Rowe parameter as a proposed replacement for the current binder **fatigue parameter** in AASHTO M 320 and M 332

NCHRP RESEARCH REPORT 982

Relationships Between the Fatigue Properties of Asphalt Binders and the Fatigue Performance of Asphalt Mixtures

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NCHRP RESEARCH REPORT 982

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- NCHRP 09-59 recommends use of R-value calculated from BBR data as additional parameter for **durability cracking**
- Recommends intermediate temperatures to be based only on low temperature rather than high and low temperatures

NCHRP 09-60

- Propose changes to current PG binder specifications tests, and practices to address cracking and loss of asphalt durability.
- Draft reports for Phases I, II and III will be published together. Portions have been published in the Transportation Research Record
- Recommendation to use ΔT_c to address **block cracking**, different from fatigue cracking
- There is an apparent relationship between R-value and ΔT_c for unmodified binders, both parameters determined from BBR test data.



NCHRP 09-61

- Asphalt binder aging methods to accurately reflect mixture aging
- No recommended changes to aging protocols for short and long-term laboratory binder aging.
- For extended aging (i.e., 40-hour PAV) use thinner asphalt film with 12.5g sample in standard PAV pan instead of 50g.

NCHRP RESEARCH REPORT 967

Asphalt Binder Aging Methods to Accurately Reflect Mixture Aging

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Thank you!

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CANADIAN MEMBERS



INTERNATIONAL MEMBERS



COMMERCIAL MEMBERS



AFFILIATE MEMBERS



Future of Asphalt Binder Testing

New Test Methods and Parameters in Consideration

(Summary of NCHRP Reports)

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Imperial Oil

Concerns

- **NCHRP 09-59**

- Original GRP modeled to ductility at 15°C w/ testing at lower temperature and frequency
 - Different procedure may results in different rankings
- R-value assumes glassy modulus to be $1e^9$ for all binders, which is not realistic
 - It will not provide reliable info on asphalts which have atypical shapes on black diagram – oxidized, polymer modified, waxy, etc
- Changing intermediate test temperature may negatively impact softer grades
 - It may be possible for asphalts to pass with poorer qualities

- **NCHRP 09-60**

- Procedure for ΔT_f leans towards testing for SBS polymers
 - Limited binders will likely need ΔT_f
 - Minimal data on reproducibility and repeatability
 - Cost to purchase new equipment \$50 - \$60K USD

- **NCHRP 09-61**

- Testing small amounts of binder (12.5 g) in a standard pan will be extremely difficult to ensure variability is minimized
 - Requires fine attention to equipment orientation and technician detail
- Multiple pans will be needed to meet volume demands for BBR testing of a single sample
 - Impedes multiple samples from being run
 - May require additional equipment

Alternative Recommendations

- **NCHRP 09-59**
 - Phase Angle (δ) at Specified Value of $G^* = 8,967$ kPa
 - Correctly ranks asphalts based on their phase compatibility, with universal limits
 - Uses AASHTO T315 protocol without change, historical data can be re-used
 - Variability in terms of d2s% for δ is approximately six times lower than for $|G^*|\sin\delta$
- **NCHRP 09-60**
 - Standard ΔT_c (20hr) or phase angle testing can provide reliable discrimination for unmodified binders

Summary

- Three NCHRP reports were commissioned on asphalt binder
- Goal was to improve testing on fatigue, durability and aging
- Findings require additional testing to ensure they are appropriate measures
- Asphalt Institute Task Force compiling data related to diverse asphalt chemistries
- Alternatives may be simpler and more effective
- Now is the time to discuss proposals and evaluate next steps

Thank You