

EVALUATION OF THE INCREMENTAL CREEP FOR CRACKING AT LOW TEMPERATURE TEST (iCCL)

Potential BBR Surrogacy and Δ TC Comparison



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OUTLINE

- What is iCCL?
- Objectives
- Methods
- Specimen Prep and Testing
- MaineDOT Testing Plan
- Split Results for T 313 Surrogacy
- Δ TC Results
- Continuous Low Temperature PG Results
- Comparisons
- Conclusions



WHAT IS iCCL?

- iCCL is a surrogate BBR test highlighted in AASHTO PP 112
- Offered as a software package from Pavement Systems LLC
- Compatible with Anton Paar SmartPave 102e Rheometer

Test Features	BBR	iCCL
Sample Prep. and Testing/ Sample	1.5 hrs.	40 min.
Continuous LTPG and ΔT_c	Two Tests	One Test
Technician Time/ Sample	1 hr.	5 min.
Test Variability (d2S)	7%	2.1%
Calibration Check	Every Day	3 Months
Use of Hazardous Liquids	Coolant	None
Testing Original Binder	No	Yes
Pressurized Air	Yes	None
Sample Storage Limit	Two hrs.	None
Molding/Demolding	Required	None
Sample Size	> 10 grams	~30 mg
Small amount Extracted Material	No	Yes



OBJECTIVES

- Evaluate Surrogacy for T 313
 - m-value and Stiffness
- 2 New testing opportunities
 - Δ TC Testing
 - Continuous Grading
- Compare/Contrast
 - Safety
 - Time
 - Cost

METHODS



- iCCL is a composite creep test at 2 stress levels
- 8mm geometry, 0.5mm gap at -5°C
- Results converted to 2 temperatures to calculate ΔTC , creep curves converted to equivalent BBR curves
 - Database comparison and computer intelligence
 - Will grow and become more accurate as data is fed
- PAV aged all material for direct comparison

SPECIMEN PREP AND TESTING

- Hot sample is stirred, and stirrer is used to drip small drops onto coated paper
 - Sample size is 31-33 mg (about the size of a grain of rice)
 - Can be trimmed with hot spatula to get to sample size
- Very Similar to Existing T 315 procedure but with no trimming
- Unified Performance Tests using incremental Method (UPTiM) software from PaveSys
 - Select material type, grade, aging condition, test
 - Load material onto geometry for autotrim and test
 - 30-65 minutes depending on test type, material
 - If high PG grade is desired, then the test takes longer

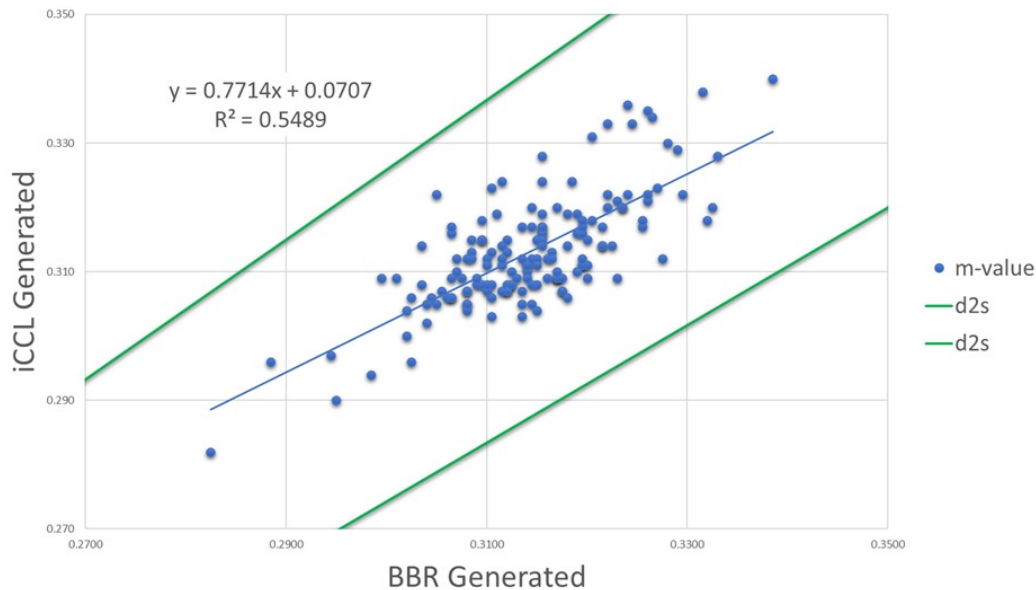
MAINE DOT TESTING PLAN

- Every verification from 2023 (155)
 - BBR and iCCL split sample testing
 - Low PG grade split sample testing
- 10 different grade/supplier combos
 - Δ TC Testing



Split Results for T 313 Surrogacy

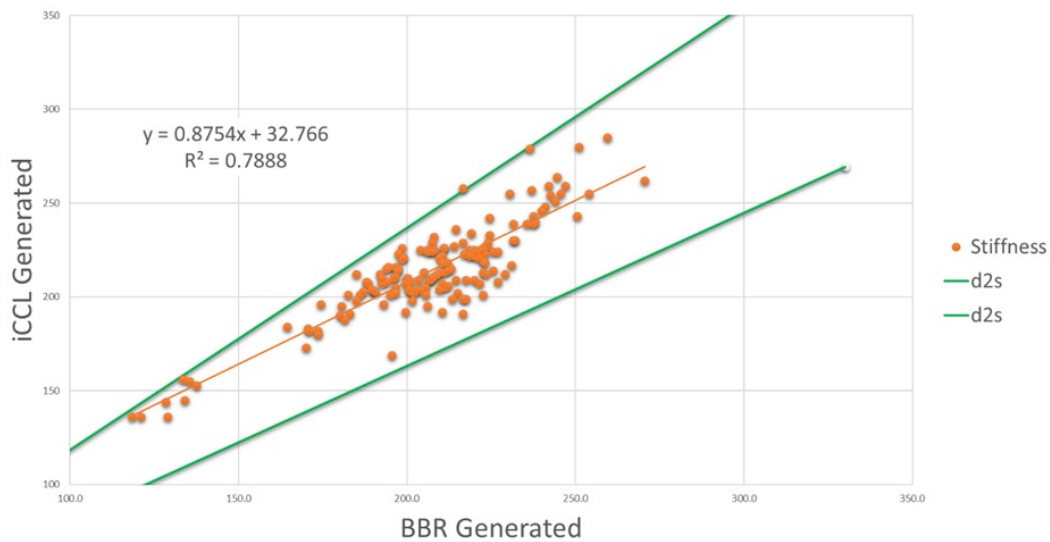
m-value Comparison



- Average difference between BBR/iCCL was 0.62%
- t-test results indicate that the difference in means between datasets was not statistically significant
- All test values well within T 313 d2S (8.6%)

Split Results for T 313 Surrogacy

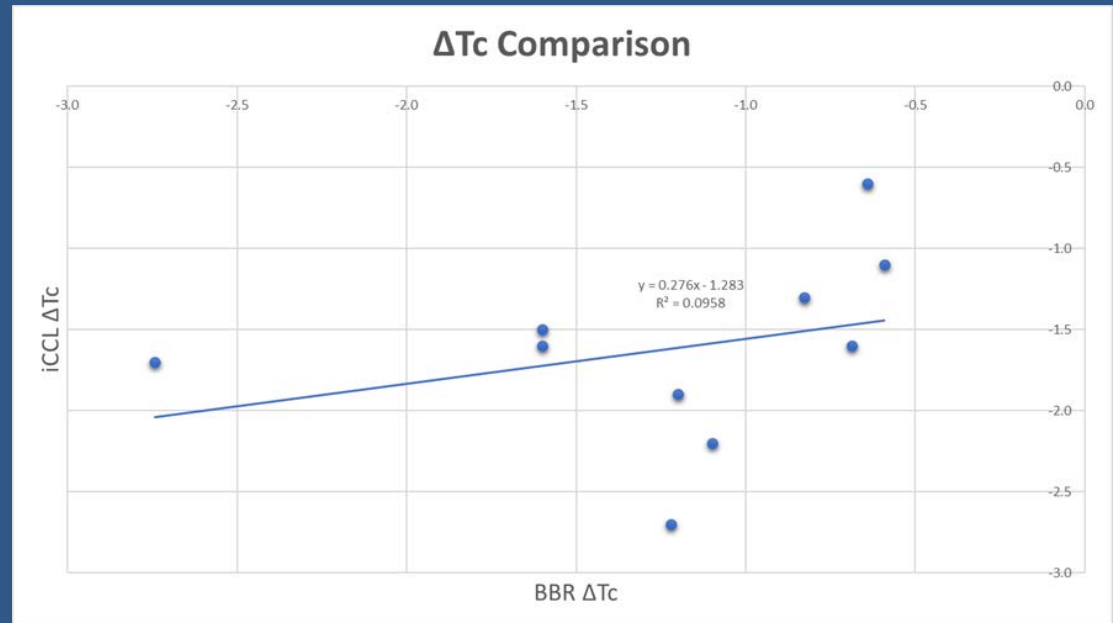
Stiffness Comparison



- Average difference between BBR/iCCL was 5.84%
- Higher r-squared
- t-test results indicate that the difference in means between datasets was statistically significant
 - Higher data spread likely the cause
- 1 test result outside of T 313 d2S (18.4%)

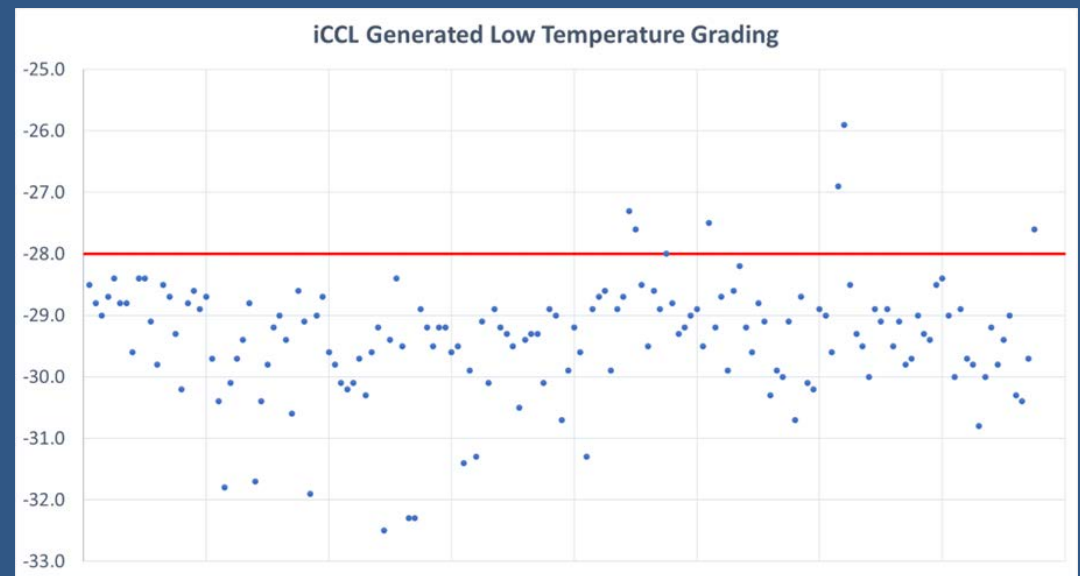
ΔTC RESULTS

- 154/155 MaineDOT verifications were m-controlled (iCCL results)
- 10/10 from split samples were m-controlled
 - 6 different grades from 4 suppliers
- Average difference between iCCL/BBR generated ΔTC was 60.7%



CONTINUOUS LOW TEMP PG RESULTS

- All Maine binders are PGxx-28
- 6 samples tested above red line
 - 5/6 failed T 313 for m-value
 - 1 borderline pass (.301)
 - All 6 failed iCCL
- Correctly identified all 5 failures from 2023



BBR

- BBR fully burdened technician time
 - 5 samples in an 8 hour day, more for Δ TC
- Testing Time for 155 samples:
 - 31 technician days for T 313
 - 62 technician days for Δ TC
- Addition of cold hazard and alcohol usage/disposal



iCCL

- iCCL fully burdened technician time
 - 12 neat samples or 6-7 modified samples in an 8 hour day
- Testing Time for 155 samples:
 - 95 neat binders and 60 polymer modified
 - 17 technician days for T 313 and Δ TC
- No added chemicals/hazards

COMPARING TIME HAZARDS AND COST



- Maine binders are m-controlled
 - Average m-value difference was 0.62%
 - d2S currently 8.6%
 - Average Stiffness difference 5.84%
 - d2S currently 18.4%
- Significant value as a surrogate for T 313
 - Use as a tool to expedite testing
 - Flagged all 2023 failures
 - MaineDOT will likely never abandon T 313
- Δ TC average difference 60.7%
 - More testing needed to verify initial findings

CONCLUSIONS

QUESTIONS?

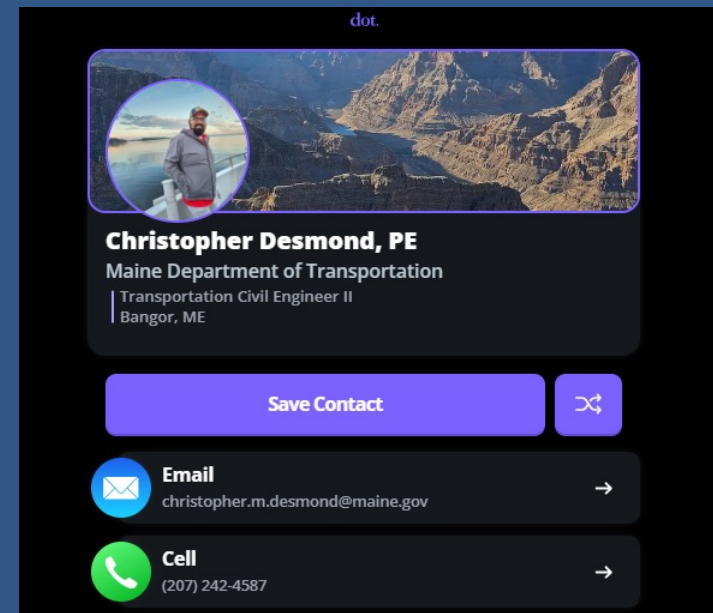
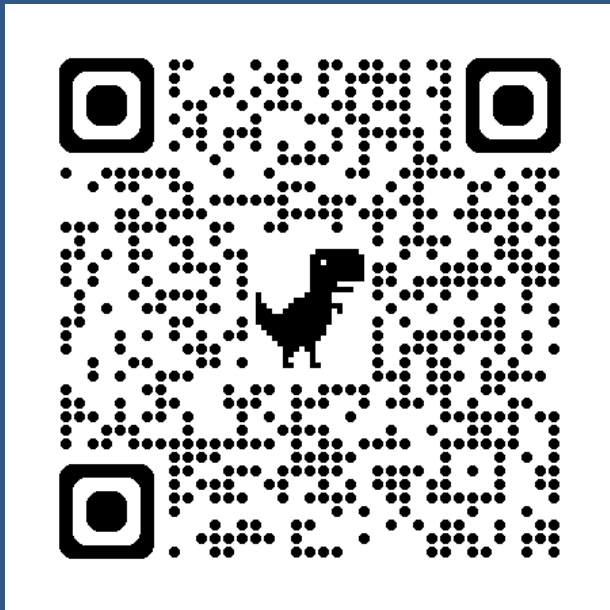


PHOTO CREDIT

- Slide 1: <https://www.tarakross.com/single-post/first-came-the-woodpecker-then-came-the-chickadee>
- Slide 2: <https://www.themainemag.com/1715-bridges/>
- Slide 3 Pavement Systems LLC
- Slide 4 <https://www.directindustry.com/prod/cannon-instrument-company/product-106453-2074657.html>
- Slide 5 https://www.guialat.com.br/?p=detalhar_produto&idproduto=21648
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