BMD IMPLEMENTATION STATUS UPDATE

JAY SENGOZ MARCH 14,15,16, 2023

pennsylvania
DEPARTMENT OF TRANSPORTATION

PENNDOT BY THE NUMBERS

40,000
Miles of Roadway

25,400
Bridges

$11.5 Billion Budget

$2.5 Billion
Annual Construction Contracts Bid in 2022

11,579 Employees
7,095 Maintenance Employees

52
Transit Systems

65
Operating Railroads

pennsylvania
DEPARTMENT OF TRANSPORTATION

3
Ports

121
Public Use Airports

10.1 Million
Licensed Drivers & ID Holders

12.1 Million
Registered Vehicles

102.7 Billion
Annual Vehicle Miles Traveled*

2,440
Miles of BicyclePA Routes

*Total miles on all PA roadways

LB (8/22)

SOL 481-22-01

- Dated January 21, 2022
- IMPLEMENTATION OF BMD FOR WEARING COURSE MIX DESIGNS
- FULL IMPLEMENTATION WILL BE PHASED OVER 3 YEARS
- BULLETIN 27 CHAPTER 2A REVISED TO INCLUDE THE SUBMISSION OF BMD DATA

SOL 481-22-01

YEAR 2023

- ALL < 0.3 MILLION DESIGN ESAL WEARING COURSE JMFs

YEAR 2024

- ALL WEARING COURSE JMFs

IMPLEMENTATION PHASES

- Less than 0.3 Million ESAL (50 gyration) wearing course JMFs submitted for the 2023 design year. **(This year)**
  - Will **require** performance testing to be input into eCAMMS for information only.
  - DMEs **may** approve less than 0.3 million ESAL wearing course JMFs without performance testing on a case-by-case basis. (The data still needs to be input.)

- All wearing course JMFs submitted for the 2024 JMF design year.

  (Next Year)
  - Performance testing entry into eCAMMS is **required before JMF approval is given**.

- **Only effects wearing course mixtures.**

- After the 2024 construction season either limits will be set or the data acquisition process will be adjusted and continued so that **meaningful and achievable limits** can be established.

BALANCED MIX DESIGN

- Adding Performance Testing **(No required limits yet. Just Testing)**
  - Hamburg Wheel Track Testing (HWT, AASHTO T 324):
    - Rutting
  - Cracking Tolerance Index Testing (CT-Index, ASTM D8225):
    - Cracking
  - Characterizing the Relaxation Behavior of Asphalt Binders Using the Delta Tc (ΔTc) Parameter (AASHTO PP 113-21):
    - Only for JMFs over RBR of 0.35 and above
    - High RAP/RAS/Recycled mixtures cracking.

PSU RESEARCH PROJECT

- EVALUATION OF ASPHALT TESTING PROTOCOLS IN PA
- NTP – July 15, 2022
- DURATION: 38 Months
- ESTIMATED COMPLETION: September 15, 2025
- SCOPE: Assist PennDOT with the validation and implementation of asphalt-related performance testing methods, limits, and protocols that best predict asphalt rutting and cracking in the Pennsylvania climate, using aggregates and other materials used in PA.

PSU RESEARCH PROJECT

TIMELINE

Task	Description	Estimated Task Delivery	
1	Summary Report of Literature Review	3 months	Complete
2	Database of Available Experimental Data	4 months	Complete
3	Summary Report of Data Analysis and Gap Identification	10 months	In progress
4	Experimental Plan	12 months	
5	Summary Report of Test Results in Database	27 months	
6	Summary Report of Data Analysis and BMD Verification	30 months	
7	Summary Report of Demand Driven Verification Testing	30 months	
8	Summary Report of Performance Limits Validation	33 months	
9	Draft Final Report	35 months	
10	Final Report	38 months	

PSU RESEARCH PROJECT

Table 1 Parameters Included in the NECEPT Database of Performance Test Results

Control Parameters	Description	Response Parameters		
		IDEAL-CT	**HWTT**	**I-FIT**
Aggregate Source	Limestone, sandstone, and gravel	Peak Load (N)	SIP	Peak Load (N)
NMAS	9.5 and 19mm	Fracture Energy (J/m^2)	Strip Creep Ratio	Fracture Energy (J/m2)
Binder Grade	PG64-22, PG58-28	IDEAL-CT Index (NECEPT)	Max Rut Depth (mm)	Flexibility Index
Binder Source	UR and AA	IDEAL-CT Index (TTI)	No. of Passes to Max. Rut Depth	Stiffness (MPa)
Virgin binder content	3.2 to 7.8%	Peak Tensile Stress (KPa)	No. of Passes to 10 mm Rut Depth	Stiffness Index (N/m)
Recycled Binder Content	0.0 to 1.9%	Peak Tensile Stress (PSI)	No. of Passes to 12.5 mm Rut Depth	Strain at Peak Stress (%)
Total Binder Content	4.8 to 7.8%	Strain at Peak Stress (%)	Rut Depth at 10,000 Passes (mm)	Displacement at Peak Load (mm)
Aging Condition	Unaged, ST, LT (both loose and compacted)	Displacement at Peak Load (mm)	Creep Slope (mm/1000 passes)	Work of Fracture (J)
Additive Type	RAP, RAS, Rej, CRM, antistrip	Work of Fracture (J)	Stripping Slope (mm/1,000 passes)	Accumulated Energy to Peak Load (J/m^2)
Additive Content	RAP:0-35%, RAS:0-8%, CRM:0-15%, Rej:0-0.3%			
Testing Temperature	IDEAL:25°C, HWTT: 50°C, I-FIT: 20°C			

ECAMMS UPDATE

eCAMMS

Home | Sample | JMF | ESB | Product Evaluation | Maintenance | Tools | TR-447 Ref #: | Sample #: | Search

Current System Status :

There are currently no known issues. If you experience any issues, report them immediately to eCAMMS Support at 717.425.5815 or email eCAMMSSupport@pa.gov.

E-TICKETING – Learning Opportunity

PennDOT and HaulHub representatives discuss some of the frequently asked questions about moving towards an all-electronic ticketing program for PennDOT projects.

If you missed the live webinar or would like to review the information that was shared, please use the link below to access the video.

Click Here To Watch

NEW! - 2023 JMF Reference Data Type Submissions (CT Index & Hamburg Tests)

Suppliers are required to submit additional JMF Reference Data for the 2023 Wearing Course N_{design} = 50 Gyration JMFs. Click here for the full list and definitions of the new JMF Reference Data fields.

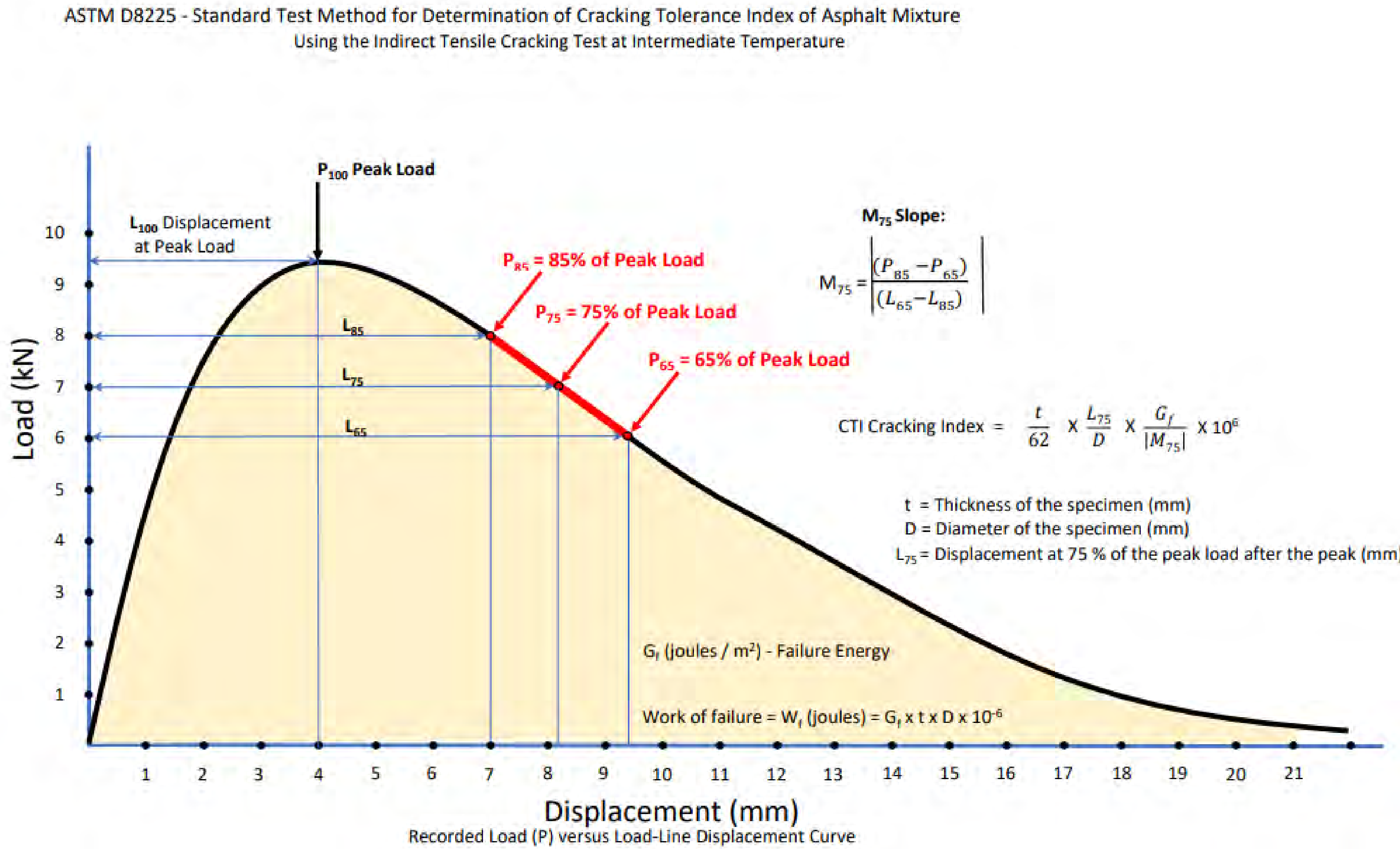
ECAMMS UPDATE

E-mail notification dated 12/7/2022

eCAMMS Reference Data Type fields			Description
CT INDEX ASTM D8225	Existing	CT-Index: CTI Cracking Index	Average Cracking Tolerance Index of all specimens, (unitless)
	Existing	CT-Index: Gf (joules/m2)	Average Failure Energy of all specimens [Area under the load vs. the average Load-Line Displacement (LLD) curve], (Joules/m^2)
	Existing	CT-Index: L75 (mm)	Average Post peak displacement at 75% of peak load of all specimens, (mm)
	Existing	CT-Index: M75 Slope (N/m)	Average post-peak slope at 75% of peak load of all specimens, (N/m)
	Existing	CT-Index: Wf (joules)	Average Work of failure of all specimens, (Joules)
	New	CT-Indx: Avg Peak Load (kN)	Average of the Peak Loads of all specimens, (kN)
	New	CT-Indx: Avg Disp.@Peak Ld	Average Displacement of all specimens at Peak Load, (mm)
	New	CT-Indx: Pk Tens.Str. (kPa)	Average Peak Tensile Strength of all specimens, (kPa)
	New	CT-Indx: No. of Specimns (n)	Number of specimens, (n)
	New	CT-Indx : Cracking Index COV	COV = Coefficient of variation for the CT Index, (%)
	New	CT-Indx: Average Air Voids	Average air voids of all specimens (Each individual specimen air void has to be within 7% ± 0.5%), (%)
	New	CT-Indx: Test Equip.Man/Modl	Testing Equipment Manufacturer and Model, (Text)
	New	CT-Indx: Testing Lab	Name of the Testing Lab, (Text)
HAMBURG WHEEL-TRACK (HWT) AASHTO T 324	Existing	HWT: 10K Impression	Average maximum rut depth of test specimens in Left and Right Wheel Tracks at 10,000 passes, (mm)
	Existing	HWT: 12.5 mm Passes	Average Number of Passes on test specimens in Left and Right Wheel Tracks at 12.5 mm rut depth, (N passes)
	Existing	HWT: 20K Impression	Average maximum rut depth of test specimens in Left and Right Wheel Tracks at 20,000 passes, (mm)
	Existing	HWT: SIP Passes	Average Number of Passes to Stripping Inflection Point (SIP) on test specimens in Left and Right Wheel Tracks, (N passes)
	New	HWT: Creep Slope - Avg	Average Creep Slope of test specimens in Left and Right Wheel Tracks, (Calculated)
	New	HWT: Stripping Slope - Avg	Average Stripping Slope of test specimens in Left and Right Wheel Tracks, (Calculated)
	New	HWT: 10K Impression-Lt (mm)	Maximum rut depth of test specimens in Left Wheel Track at 10,000 cycles, (mm)
	New	HWT: 12.5 mm Passes - Left	Number of passes to reach 12.5 mm rut depth on test specimens in Left Wheel Track, (N passes)
	New	HWT: 20K Impression-Lt (mm)	Maximum rut depth of test specimens in Left Wheel Track at 20,000 cycles, (mm)
	New	HWT: Creep Slope - Left	Creep slope of test specimens in Left Wheel Track, (Calculated)
	New	HWT: Stripping Slope - Left	Stripping slope of test specimens in Left Wheel Track, (Calculated)
	New	HWT: No.of passes@max rut-Lt	Number of passes reached for test specimens in Left Wheel Track at maximum rut depth, (N passes)
	New	HWT: Specimen #1 Air Void-Lt	Air Voids of test specimen #1 in Left Wheel Track (has to be within 7% ± 0.5%), (%)
	New	HWT: Specimen #2 Air Void-Lt	Air Voids of test specimen #2 in Left Wheel Track (has to be within 7% ± 0.5%), (%)
	New	HWT: 10K Impression-Rt (mm)	Maximum rut depth of test specimens in Right Wheel Track at 10,000 cycles, (mm)
	New	HWT: 12.5 mm Passes - Right	Number of passes to reach 12.5 mm rut depth on test specimens in Right Wheel Track, (N passes)
	New	HWT: 20K Impression-Rt (mm)	Maximum rut depth of test specimens in Right Wheel Track at 20,000 passes, (mm)
	New	HWT: Creep Slope - Right	Creep slope of test specimens in Right Wheel Track, (Calculated)
	New	HWT: Stripping Slope - Right	Stripping slope of test specimens in Right Wheel Track, (Calculated)
	New	HWT: No.of passes@max rut-Rt	Number of passes reached for test specimens in Right Wheel Track at maximum rut depth, (N passes)
	New	HWT: Specimen #1 Air Void-Rt	Air Voids of test specimen #1 in Right Wheel Track (has to be within 7% ± 0.5%), (%)
	New	HWT: Specimen #2 Air Void-Rt	Air Voids of test specimen #2 in Right Wheel Track (has to be within 7% ± 0.5%), (%)
	New	HWT: Test Equip.Man./Model	Testing Equipment Manufacturer and Model, (Text)
	New	HWT: Testing Lab	Name of the Testing Lab, (Text)

ECAMMS UPDATE

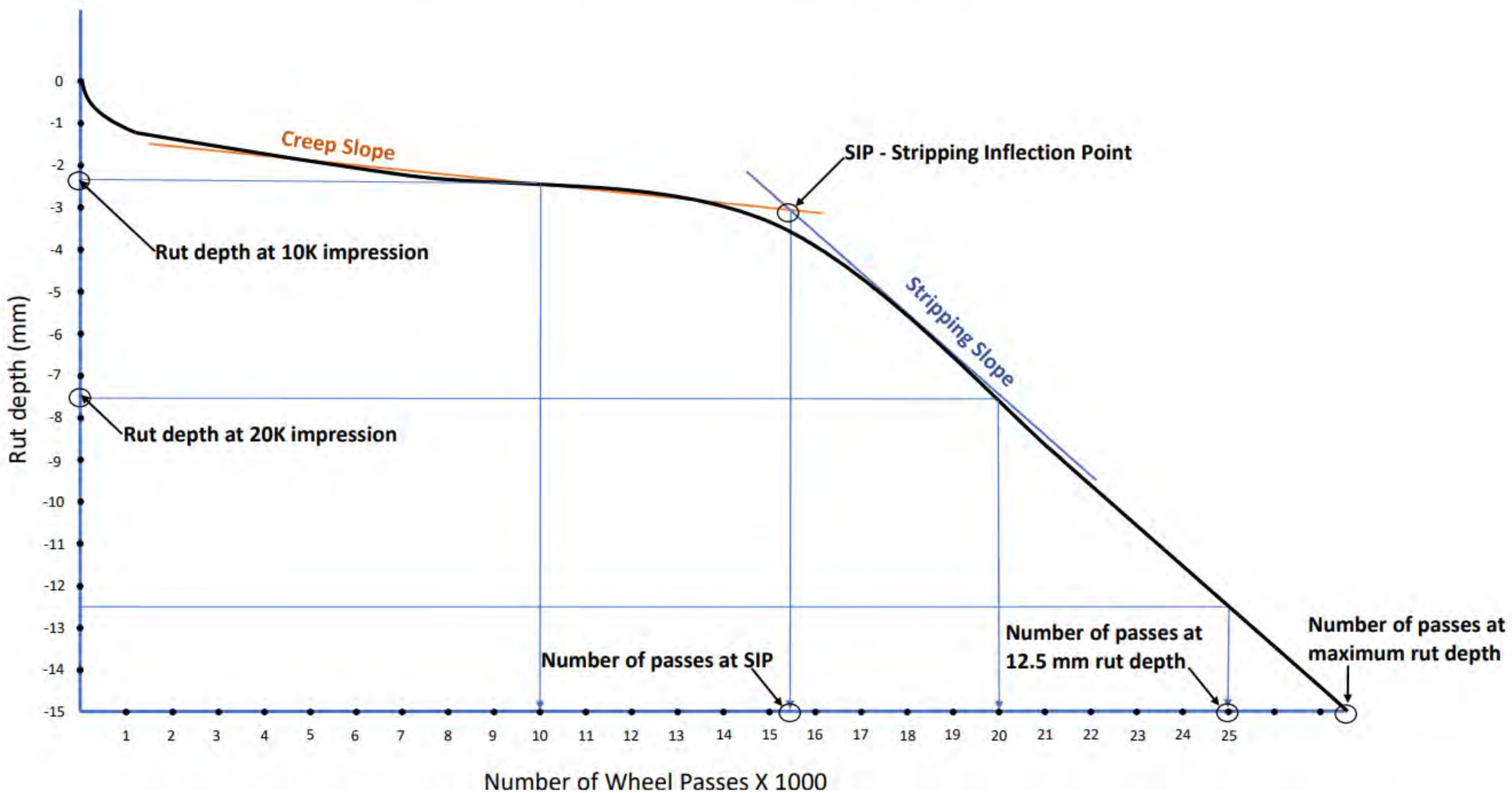
E-mail notification dated 12/7/2022



ECAMMS UPDATE

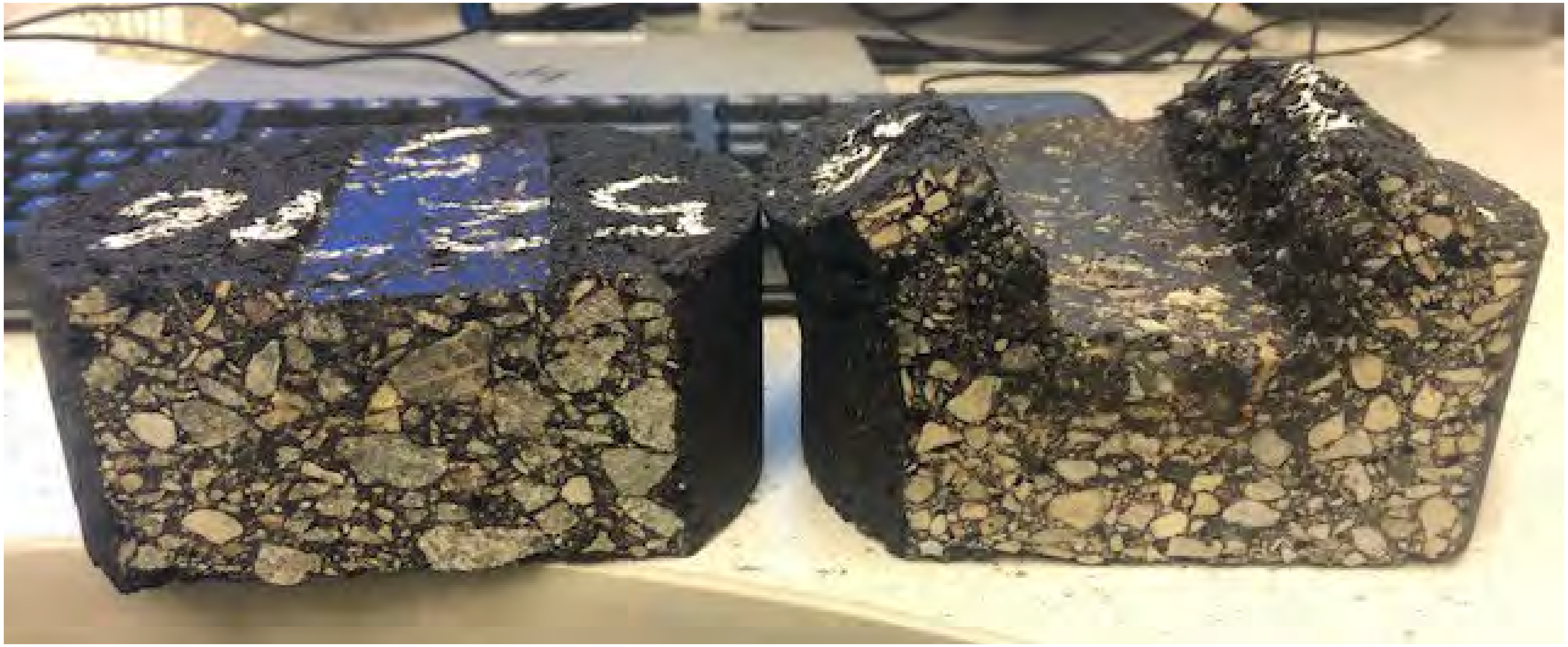
E-mail notification dated 12/7/2022

AASHTO T 324 Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures



CHALLENGES

CHALLENGES



CHALLENGES

HWT: 10K Impression-Lt (mm)	HWT: 10K Impression-Rt (mm)
6.447	4.419
2.836	2.356
2.726	3.960
9.654	20.070
0	0.000
5.637	10.014
7.340	17.221
4.62	4.05
14.866	17.643
14.866	17.643
7.716	10.672

CHALLENGES

IDEAL TESTING REPORT

Date	Time	Diameter mm	Thickness mm	Starting Load (kN)	Stopping Load (%)	Max SP GR	Voids	%AC	Displace @ 75% mm	Peak Load Stability kN	IDT Strength kPa	Peak Displacement mm	Flow (0.01 inch)	Total Energy (Joules)	Energy to Peak (Joules)	FAILURE ENERGY joules m^2	Temp	IDEAL-CT Index	Post-Peak Slope 75% N/MM
6/23/2021	9:58 AM	150	62	0.1	0.1	2.527	7.1	4.4	3.9	14.97	1025	2.31	9.1	79.83	27.83	8584.2	25	65.038	-3461.3
6/23/2021	10:01 AM	150	62	0.1	0.1	2.527	7.0	4.4	3.5	16.01	1096	2.17	8.5	66.17	23.56	7115.1	25	36.288	-4575.8
6/23/2021	10:02 AM	150	62	0.1	0.1	2.527	6.9	4.4	4.8	13.83	947	2.04	8	82.17	22.04	8835.7	25	97.315	-2909.5
6/23/2021	10:06 AM	150	62	0.1	0.1	2.523	7.0	4.4	5.1	14.26	976	2.87	11.3	86.88	30.6	9342.3	25	95.039	-3355.9
6/23/2021	10:08 AM	150	62	0.1	0.1	2.523	6.8	4.4	4.6	15.16	1037	2.52	9.9	85.96	30.56	9243.3	25	95.945	-2926
6/23/2021	10:10 AM	150	62	0.1	0.1	2.523	6.7	4.4	5.3	16.4	1123	3.22	12.7	104.91	38.89	11281	25	139.341	-2854.6
6/24/2021	7:51 AM	150	62	0.1	0.1	2.479	7.2	5.8	4.5	14.57	998	2.68	10.5	80.52	30.55	8658.5	25	77.358	-3359
6/24/2021	7:52 AM	150	62	0.1	0.1	2.479	7.1	5.8	4.7	15.16	1038	2.62	10.3	77.06	28.68	8285.7	25	68.09	-3788.3
6/24/2021	7:54 AM	150	62	0.1	0.1	2.479	7.0	5.8	4.6	14.63	1002	2.61	10.3	82.32	30.27	8851.5	25	86.44	-3131.2

CHALLENGES

- ESTABLISHING THE DATABASE
  - IDENTIFYING THE PARAMETERS
  - IDENTIFYING OUTLIERS
    - SAMPLE VARIABILITY ISSUES
- USING MULTIPLE SOURCES IN A JMF

Material Supplier	Material Code - Class	Product Name	% Material	Spec. Grav.	% Absorptior
[redacted]	207 (Aggregate Fine) - B1	ls sand	18.800	2.674	0.78
	207 (Aggregate Fine) - B1	brown sand	18.800	2.568	1.85
	203 (Aggregate) - A8	ls 8's	21.200	2.629	1.00
	203 (Aggregate) - A8	ls 8's	21.100	2.693	0.81
	187 (WMA Technology) - AQUABL	MAXAM	0.000	0.000	0.00
	186 (Asphalt Mixture Additive) - ASTRIP	Sonnegreen AS IV	0.250	1.040	0.00
	17 (Hot Rap Design) - RAP	RAP	15.000	2.715	0.00
UNRC0 15	1 (Asphalt Binder) - PG64S-22	PG 64S-22	5.100	1.030	0.00
UNRC1 15	1 (Asphalt Binder) - PG64S-22	PG 64S-22	5.100	1.030	0.00
MARA7 15	1 (Asphalt Binder) - PG64S-22	PG 64S-22	5.100	1.030	0.00
MARA3 15	1 (Asphalt Binder) - PG64S-22	PG 64S-22	5.100	1.030	0.00
MARA8 15	1 (Asphalt Binder) - PG64S-22	PG 64S-22	5.100	1.030	0.00
ERIEM 15	1 (Asphalt Binder) - PG64S-22	PG 64S-22	5.100	1.030	0.00

- OTHER POTENTIAL VARIABILITY ISSUES
  - EQUIPMENT
  - TECHNICIANS
  - ETC.

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QUESTIONS

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