N E C E P T

Plant Technician Certification Program

An Update on

PennDOT Asphalt Specifications

2025

Northeast Center of Excellence for Pavement Technology

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PennDOT Specifications

Which Specifications Are Most Significant?

- The specifications that cover your project and affect YOU are the most important.

- Be aware of the effective change dates and your project let date.

What you need to know...

- **PennDOT Specifications Publication 408**
- **Sections covering Asphalt & the important aspects of these specifications**

Publication 408/2020

- PennDOT Pub 408/2020 contains Construction Specifications
- Initial Edition, (Effective April 10, 2020)

- For PennDOT Projects Let after April 10, 2020
- PennDOT Website (Initial Edition): http://www.dot.state.pa.us/public/PubsForms/Publications/Pub_408/408_2020/408_2020_IE/408_2020_IE.pdf

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PennDOT Specifications (Publication 408)

Version	Effective Date
Initial Edition	April 10, 2020
Change No. 1	October 2, 2020
Change No. 2	April 9, 2021
Change No. 3	October 8, 2021
Change No. 4	April 1, 2022
Change No. 5	October 7, 2022
Change No. 6	April 14, 2023
Change No. 7	October 6, 2023
Change No. 8	April 12, 2024
Change No. 9	**October 11, 2024**

2020

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Sections of Publication 408

Question:

How Many Major Sections Are There in Spec 408?

Answer:

Twelve

Contents of Publication 408

- Sections 1 through 12
- Appendix A - Metric (SI) Information
- Appendix B – Standard Special Provisions (SSP)
  - as set forth in the Bid Proposals
  - need further tailoring for use on specific projects
  - includes seven indices (C, D, G, I, N, P, S)
  - SSP Contents accessible through ECMS Website
- Appendix C – Designated Special Provisions
  - Standard documents previously included in PennDOT Bid Proposals.
- General Index (indexing the Publication)
- Change Letters and Indices

Sections of Publication 408

- 100 - General Provisions
- 200 - Earthwork
- 300 - Base Courses
- 400 - Flexible Pavements
- 500 – Rigid Pavements
- 600 – Incidental Construction

Sections of Publication 408

- 700 - Materials
- 800 - Roadside Development
- 900 - Traffic Accommodation & Control
- 1000 - Structures
- 1100 - Manufactured Materials
- 1200 - Intelligent Transportation System Devices

Sections of Publication 408

- 100 - General Provisions
  - Abbreviations and definitions
  - Bidding requirements and conditions
  - Award and contract execution
  - Scope and control of work
  - **Control of materials (Section 106)**
  - Measurement of quantities
  - Payment
  - Several others

Sections of Publication 408

- 300 – Base Courses
  - SP Asphalt Mix Design & Construction, Base Course (**Section 313**)
  - Asphalt Rich Base Course (**Section 314**)
  - Cold Mixes (**Sections 341 and 342**)
  - Asphalt Treated Permeable Base (**Section 360**)

Sections of Publication 408

- 400 – Flexible Pavements
  - SP Asphalt Mix Design & Construction, Plant Mixed Courses with PWL and LTS Testing (**Section 413**)
  - SP Mixture Design & Construction of Plant Mixed 6.3 mm Thin Asphalt Overlay Courses (**Section 412**)
  - SMA (**Section 419**)

Sections of Publication 408

- 700 – Materials
  - Asphalt Materials (Section 702)
  - Aggregates (Section 703)

Discussion
of
Specification Changes

Relevant Sections Added in Pub 408 Since April 2020:

Date	Section	Description
April 2020	**313**	Plant Produced Asphalt Mixes (base course) – Merging 309 and 311
April 2020	**413**	Plant Produced Asphalt Mixes (wearing and binder courses) – Merging 409 and 411
April 2022	**314**	Asphalt Rich Base Courses

Relevant Sections Removed from Pub 408 within the Last 5 Years:

Date	Section	Description
April 2020	309	SP Asphalt Mixtures, HMA Base Course – Merged into 313.
April 2020	311	SP Asphalt Mixture, Warm Base Course – Merged into 313.
April 2020	320	Aggregate-Bituminous Base Course.
April 2020	409	SP Asphalt Mixtures, HMA wearing and binder courses – Merged into 413.
April 2020	411	SP Asphalt Mixtures, WMA wearing and binder courses – Merged into 413.

Major Asphalt Related Changes in Pub 408 Since April 2020

Date	Section	Description
October 2021	341 & 342	Allow foamed asphalt in cold recycling in addition to emulsified asphalt
October 2021	413	Once sublot size established, the sublot size will remain unchanged throughout the project
October 2022	413	Increase VMA by 0.5% in Table B
April 2024	419	Allow fiberless SMA mixes

Major Asphalt Related Changes Since April 2020 (PennDOT Bulletin 27 and SSPs)

Effective Date	Publication #	Comments
10/6/2023	SSP a00137	Allow PG 64S-22 with 6.3-mm thin lay asphalt mix
4/3/2024	Bulletin 27	Mechanical (Performance) Testing (SOL 481-24-1)
10/25/2024	SSP c00200	Requirements for recycling agents used in hot-in-place recycling
1/1/2025	SSP c0015	Environmental Protection Declaration for Asphalt

Major Asphalt Related Changes Since April 2020 (Project Office & Design Manuals)

Effective Date	Publication #	Comments
October 2020	**72M: RC-25M**	Safety Edge Drawings
12/21/2020	**2 (POM)**	Report delivered material using Electronic Ticketing System

Sections of Publication 408 Containing Asphalt Specifications (2020, Chg. 9)

Base Courses

106	Controls of Material Statistics
313	SP Asphalt Mixture Design & Construction of Base Courses
314	Rich Asphalt Base Courses
316	Flexible Base Replacement
341	Cold Recycled Asphalt Base Course (In-Place)
342	Cold Recycled Asphalt Base Course (Central Plant)
344	Full Depth Reclamation
360	Asphalt Treated Permeable Base

Sections of Publication 408
Removal of Some Sections related to Base Courses

320	Aggregate Bituminous Base Course – REMOVED from SPEC
321	Aggregate-Cement Base Course– REMOVED from SPEC
322	Aggregate-Line Pozzolan Base Course– REMOVED from SPEC

Sections of Publication 408 Containing Asphalt Specifications (2020, Chg. 9)

314	Asphalt Rich Base Courses
344	Full Depth Reclamation
360	Asphalt Treated Permeable Base

Section 314 **Q**: What is Design # of Gyrations? **50**

Section 314 **Q**: What is Design Air Voids? **2.5%**

Section 314 **Q**: What is minimum required VMA? **13%**

Section 344 **Q**: What stabilizing additives used in FDR?

Asphalt Emulsion, cement, hydrated lime, calcium chlor

Section 360 Q: What is the required mat density for ATPB?

No density requirement

Section 314: Asphalt Rich Base Courses

- Asphalt Rich Base Course (ARBC)
- Max. RAP ≤ 20% by weight of mix
- No RAS Allowed
- Mix Design Requirements for ARBC for all Traffic Levels:

Volumetric Mix Design Property	25 mm NMAS
N_{design}	50
Design Air Voids (%)	2.5
VMA for all Production QC Samples (%)	13.0
VFA (%)	80-85

Sections of Publication 408 Containing Asphalt Specifications (2020, Chg. 9)

Surface & Binder Courses

404	Evaluation and Payment of Asphalt Pavement Ride Quality Incentive
405	Evaluation of Asphalt Pavement Longitudinal Joint Density, Payment of Incentive/Disincentive
410	SP. Mix Design, Stand. and RPS Construction of Plant-Mixed Asphalt Fine Graded Courses
412	6.3-mm thin asphalt overlays
413	Superpave Asphalt Mixture Design, Construction of Plant-Mixed Courses with PWL and LTS Testing

Sections of Publication 408 Containing Asphalt Specifications (2020, Chg. 9)

419	SMA Design & RPS Construction of Wearing Course
420	Pervious Asphalt Pavement System
460	Asphalt Tack Coat
470	Asphalt Seal Coat
471	Asphalt Seal Coat using Precoated Aggregate
480	Asphalt Surface Treatment

Section 420 Q: Is RAP allowed in Pervious Asphalt Pavement? **Yes, up to 10%**

Section 460 Q: What is asphalt residue range for tack coat? **0.03 to 0.08 gal/yd^2**

Section 471 Q: How much asphalt residual for precoated agg.? **0.6 to 1.2% by weight of mix**

Section 480 Q: How is surface treatment different from seal coat? **It is 2 layers of seal coat.**

Sections of Publication Containing Asphalt Specifications (2020, Chg. 9)

481	Asphalt Surface Treatment using Precoated Aggregate
482	Slurry Seal
483	Polymer-Modified Emulsified Asphalt Paving System (Micro Surfacing)
489	Ultra-Thin Bonded Wearing Course
496	Asphalt Concrete Pavement, 60-month Warranty

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Section 412, Superpave Mixture Design, Construction of Plant Mixed Asphalt 6.3 mm Thin Overlay Courses

- Used in Thin Lifts (3/4" min, 1 ¼" max.)
- Useful Tool for Pavement Preservation
- An alternative to microsurfacing and seal coats.

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Section 412
6.3 mm Thin Overlay Courses

Mixture Details

- PG **64E-22** binder required
- Coarse aggregate: Type A
- Sand fine aggregate must be from the same source as coarse aggregate with SRL rating in Bulletin 14
- **Q:** RAP or RAS in mix? **NO**
- Q: Min. Design VMA (%)? **16.5**
- Q: Design Air Voids (%)? **3.5 – 4.0**

Note: SSP a00137 of 10/6/23 allows PG 64S-22.

Section 412
6.3 mm Thin Overlay Courses

Construction details:

- air and surface temperature > **50°F**
- MTV required, unless waived by Rep.
- Box samples from roadway, hopper, or screed
- Density acceptance by ?

Optimum rolling pattern or non-movement

Section 412
6.3-mm Thin Overlay Courses

Critical points for success:

- Clean existing surface.
- Proper, uniform tack application
- Selection of compaction rollers
- Begin Rolling immediately.
- Time available for compaction is limited.
- Do not use pneumatic-tire rollers.

413–Superpave Asphalt Mixture Design and Construction of Plant Mixed Courses with PWL and LTS Testing

- 413.1 Description
- 413.2 Materials
- 413.3 Construction
- 413.4 Measurement & Payment

Where most changes have occurred in Specs.

.2 Deals with Materials
.3 Deals with Construction

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Section 413.2: MATERIALS

TABLE A

JMF – Composition Tolerance Requirements

Gradation	Single Sample (n=1)	Multiple Sample (n≥3)
Passing 12.5 mm (1/2 inch) and Larger	± 8.0 %	± 6.0 %
Passing 9.5 mm (3/8 inch) to 150 µm (No 100) Sieves (Inclusive	± 6.0%	± 4.0 %
Passing 75 µm (No. 200) Sieve	± 3.0%	± 2.0%
Asphalt Content		
19.0 mm asphalt mixtures and smaller	± 0.7%	± 0.4%
25.0 mm asphalt mixtures and larger	± 0.8%	± 0.5%

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Section 413.2: Materials
Table A

Temperature of Mixture (F)				
Class of Material	**Type of Material**	**Chemical, Organic, Foaming Additives, Minimum**	**Mechanical Foaming Equip/Process Minimum***	**Maximum***
PG 58S-28	Asphalt Binder	215	230	310
PG 64S-22	Asphalt Binder	220	240	320
PG 64E-22	Asphalt Binder	240	260	330
All other binders	Asphalt Binder	The higher of 215 or the minimum temp. specified in Bulletin 25 minus 45F	The higher of 230 or the minimum temp. specified in Bulletin 25 minus 30F	As specified in Bulletin 25

* Outline in the Producer QC Plan and follow more restrictive temperature requirements provided by the WMA technology manufacturer or Technical Representative(s) for production and placement of the mixture. Determine the SGC compaction temperature for the production QC which yields the same target air voids as the designed JMF . Include the SGC compaction temperature in the Producer QC Plan. Compact the completed mixture in the SGC for QC volumetric analysis at the SGC compaction temperature according to the guidelines provided by the Technical Representative.

Section 413.2:Materials
TABLE B

JMF – Volumetric Tolerance Requirements

Nominal Max Agg. Size (mm)	Each Specimen	Multiple Specimens
Air Voids at N_{des} (V_a)	±2%	±1.5%
Min. VMA% for 4.75 mm mixes	16.0	-
Min. VMA% for 9.5 mm mixes	15.5	-
Min. VMA% for 12.5 mm mixes	14.5	-
Min. VMA% for 19.0 mm mixes	13.5	-
Min. VMA% for 25.0 mm mixes	12.5	-
Min. VMA% for 37.0 mm mixes	11.5	-

Section 413.2: MATERIALS

TABLE C

Mixture Acceptance

Acceptance Level	Acceptance Method
Certification Acceptance	Producer Certification of Mixture Section 413.2 (i) 2
Lot Acceptance	Mixture Acceptance Sample Testing Section 413.3(h) 2

Section 413.3(h) 2: Mixture Lot Acceptance

- Normal Lot Size: 2,500 tons, 5 equal sublots
- Each sublot: 500 tons
- Special circumstances may change the size of a completed lot:
  - Minimum possible number of sublots: **3**
  - Maximum possible number of sublots: **7**

Section 413.3(h) 2: Sublot Size

(Specified in Change 3 of Spec Edition 2020 (October 2021))

- Once the sublot size for each specific JMF has been established based on the project's plan quantity, the sublot size **will remain unchanged** throughout project completion.

- A completed sublot has a mixture acceptance box sample and either a core or other density acceptance measures

Section 413.3: Construction

- **TABLE D.** - Re-adjustment of Lot Size and Associated Number of Sublots

- **TABLE E.** - Density Limits for Partially Completed Lots

- **TABLE F.** - Density Acceptable Levels & Criteria

- **TABLE G.** - Minimum Mixture Compacted Depths

Section 413.2(h): Density Acceptance

TABLE E

Density Limits for Partially Completed Lots (n ≤ 2)

Mixture NMAS	Density Limits
All RPS 9.5 mm, 12.5 mm, 19 mm, and 25 mm Wearing or Binder Course	≥ 92.0% and ≤ 98.0%
All Standard 9.5 mm, 12.5 mm, 19 mm, and 25 mm Wearing or Binder Course	≥ 91.0% and ≤ 98.0%
All 25 mm and 37.5 mm Base Course	≥ 90.0% and < 100.0%

- **PAYMENT:**
- If density meets Table E Criteria: **100% Pay**
- If density no more than **2%** below min. or no more than **2%** above max: **90% Pay**
- Other cases: Defective work. Remove & Replace unless directed otherwise by the District

Section 413.2(h): Density Acceptance

Back to TABLE A

Composition Limits for Partially Completed Lots (n ≤ 2)

Gradation	Single Sample (n=1)
Passing 12.5 mm and larger sieves	±8%
Passing 9.5 mm to 150 µm sieves	±6%
Passing 75 µm Sieve	±3%
Asphalt Content	
19.0 mm asphalt mixtures and smaller	±0.7%
25.0 mm asphalt mixtures and larger	±0.8%

- **PAYMENT:**
- If Criteria of Table A Met: **100% Pay**
- If Not: Defective work

Section 413.2(j): Density Acceptance

TABLE F

Density Acceptance

Density Acceptance Level	Acceptance Criteria
Non-movement	Table H
Optimum Rolling Pattern	Table H
Pavement Cores*	Table I
* Only when mixture is accepted by lots	

Section 413.2(j): Density Acceptance

Min. Thickness Requirement if Density Acceptance by Cores for Standard Construction

TABLE G

Mixture Minimum Compacted Depths

Mixture	Minimum Depth
9.5-mm Wearing Course	1 ½" (≈ 40 mm)
12.5-mm Wearing Course	2" (≈ 50 mm)
19-mm Wearing and Binder Course	2 ½" (≈ 60 mm)
25-mm Binder Course	3" (≈ 80 mm)

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Section 413.4: Measurement & Payment

- **TABLE H - Mixture Acceptance by Certification**
  - **Asphalt Content**

NMAS	Criteria	Value		PF, %
All sizes	Printed Tickets	<u>Al least </u>90% is ± 0.2 of JMF		100
		<u>Less than </u>90% is ± 0.2 of JMF		85
19 mm and smaller	QC Sample Testing	Single, n=1	n≥ 2	--------------
		±0.7%	±0.5%	100
		±0.8% to 1.0%	±0.6%	85
		> ±1.0%	≥ ±0.7%	RR or 70%
25 mm and larger	QC Sample Testing	±0.8%	±0.6%	100
		±0.9% to 1.2%	±0.7%	85
		> ±1.2%	≥ ±0.8%	RR or 70%

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Section 413.4: Measurement & Payment

- **TABLE H - Mixture Acceptance by Certification**
  - **Gradation**

NMAS	Criteria	Value		PF, %
		n=1	$n \geq 2$	
All sizes	QC Sample Testing for % Passing #200 Sieve	±3.0%	±2.1%	100
		±3.1% to ±4.0%	±2.2% to ±2.7%	85
		> ±4.0%	≥ ±2.8%	RR or 50%
All sizes	QC Sample Testing for % Passing #8 Sieve	±6%	±4%	100
		±7% to ±8%	±5%	85
		> ±8%	≥ ±6%	RR or 50%

Section 413.4: Measurement & Payment

- **Mixture Acceptance by Lots**

  TABLE I: Upper & Lower Spec Limits for Calculating Percent Within Tolerance

  TABLE J: : Dispute Resolution Retest Cost Table

Spec 408/2020 - Section 413

Weather and Seasonal Limitations

Place between **April 1 to October 15** for

- all PG 76-22 wearing courses, **(now PG 64E-22)**
- >10 million ESALs wearing courses,
- 4.75 mm wearing courses,
- wearing courses placed less than 1.5 inches (compacted)

Place between **April 1 to October 31** for other mixes

Spec 408/20206 - Section 413

Paving in extended season

- Submit requests in writing at least 14 days prior to work
- Group 1: **April 1 to November 15**
- Group 2: **March 1 to December 15**
- Density acceptance will be by pavement cores.
- Utilize a Material Transfer Vehicle (MTV) on any day when the paving length will exceed 1,500 linear feet.

Spec 408/2020 - Section 413

Paving in extended season

Paving work completed during the fall portion of the Extended-Season will be subject to a spring evaluation and manual survey by the Department to be conducted by May 1.

Manual surveys will be conducted in accordance with Publication **336.**

Spec 408/2020 - Section 413

Materials for Painting
Existing Vertical Surfaces in Contact with an Asphalt Mix:

Paint existing vertical surfaces … in contact with asphalt mixtures with a uniform coating of either emulsified asphalt, consisting of PennDOT Material Class TACK or NTT/CNTT, applied in two or more applications, or hot asphalt material of the class and type designated for the bituminous course.

NTT: Non-Tracking Tack Coat (Anionic) & CNTT: Non-tracking Tack Coat (Cationic)

Removed the following materials for painting vertical surface:
Class E-6 (AASHTO SS-1 or CSS-1), E-8 (AASHTO SS-1h or CSS-1h), Class AET applied in two or more applications, or of the class and type designated for the asphalt course.

Spec 408/2020- Section 420
Pervious Asphalt Pavement System

Table B

Mixture Composition		
Gyrations	**N_{design}**	**50**
Air Voids	ASTM D6752	16.0% - 20.0%
	AASHTO T 275	18.0% - 22.0%
	AASHTO T 269	18.0% - 22.0%
Draindown	AASHTO T 305	≤0.3%

Are you ready for
Challenge Questions?

Spec 408/2020- Section 483 Microsurfacing

What emulsion is allowed for use in PennDOT micro surfacing?

CQS-1hPM (breaks and cures quickly)
(polymer modified cationic quick setting, with hard base asphalt)

What emulsion was previously used? **CSS-1hPM (E-8CPM)**

What is minimum percent of asphalt content in CQS-1h emulsion?

62%

Spec 408/2020- Section 412 and 413

Question: What methods are allowed for density acceptance of 6.3-mm and 4.75-mm mixes?

Non-movement (no movement of mixture under the roller)

Optimum Rolling Pattern using Nuclear Gauge (PTM 402)

Question: 4.75-mm mixes cannot be used if required SRL is higher than what level? **L**

Section 419: SMA

Question: Can WMA be used with SMA?

Answer: Yes

Question: Can crumb rubber be used in SMA as stabilizer? (and if yes, How much?)

Answer: Yes (0.3 to 1% by total mix weight)

Question: How much RAP is allowed in SMA?

Answer: Up to 10%

Section 420: Pervious Asphalt

Question: What is typical range of air voids in pervious asphalt? **Answer: 16%-22%**

Question: What is design number of gyrations for pervious asphalt? **Answer: 50**

Question: How much RAP is allowed in Pervious Asphalt? **Answer: Up to 10%**

Summary

- Discussed PennDOT Spec. 408
- Reviewed changes in Asphalt Specifications.
- Major additions within the last 5 years:
  - SP Mixes with PWL-LTS (413) – April 2020
  - SP Mixes for Base Course (313) – April 2020
  - SP Asphalt Rich Base Course (314) – April 2022

Summary

- **Major Changes within the Last 6 years:**
  - **Allowing fiberless SMA (Apr. 2024)**
  - **Increase of Design VMA by 0.5% (Oct. 2022)**
  - **Allow foamed asphalt with cold recycling in addition to emulsified asphalt (Oct. 2021)**
  - **Revised compacted depth for 12.5-mm mixes (Oct. 2019)**

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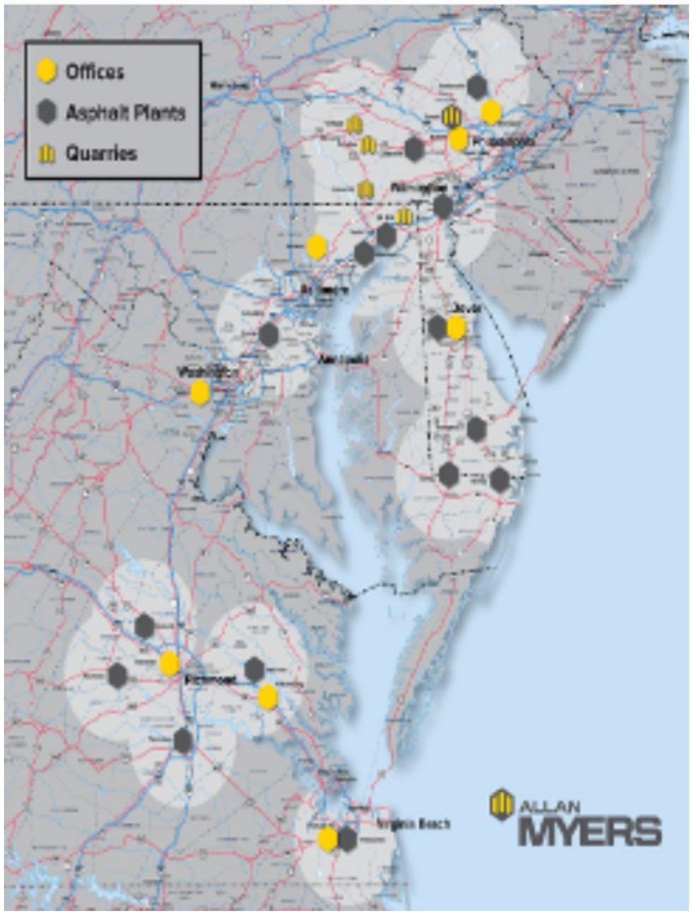
Thank You!

A Producer's Perspective of a successful Implementation of Balanced Mix Design.

ALLAN MYERS

Allan Myers is currently in 4 States with 4 different DOT approaches to BMD implementation.



2018 VDOT implemented a High RAP BMD option.

- Required testing of production mix.
- Daily APA Rut Testing 4 cores @ 7% voids less than 8.0 mm rut. Samples ran by VRTC – T340 except 120psi.
- Cantabro – every 500 tons volumetric cores - less than 7.5% loss.
- CTindex – every 500 tons 7% voids – At least 70 CT-index.
- Gradation AC – every 500 tons
- Volumetrics – every 500 tons – these cores can be used for Cantabro

- No Producers in Virginia volunteered

Allan Myers BMD Prep 2018 – 2025 updates in red

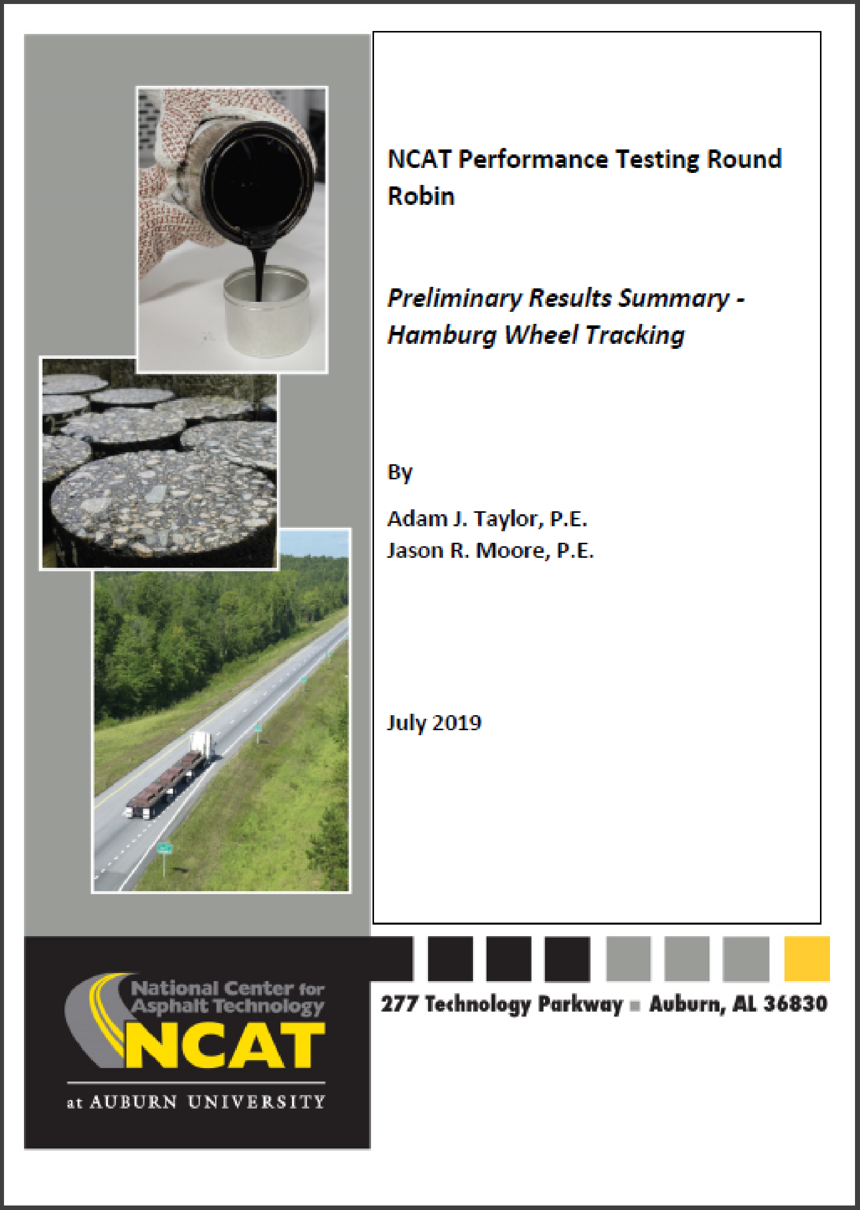
- Purchased APA Junior from PTI – Still using
- Purchased Smart Jig from Instrotek – Moving to SmartLoader
- Serviced and Calibrated Pine Presses – Moving to Smart Loader
- Got permission from Quarry QC to use LA Abrasion Machine for Cantabro Testing. - We now have 4 LA Abrasions in the Company at 15K a piece.
- Plan was to begin establishing baseline values for mixes. Recordkeeping could of ben better. Now in Plaid aka Ecamms.

- Concerns
- Distance and travel from Virginia, Maryland and Delaware to Paradise Pennsylvania Central Lab.
- 7% +/- 0.5% Air Voids. Sometimes took multiple tries and material was in the oven for extended periods of time. - Some great calculators available
- Keeping CT-Index cores dry while bath at 77F – non-factor now

BMD Testing

- APA Junior for APA Rut Test

2019 NCAT Round Robin


NCAT Performance Testing Round Robin

Preliminary Results Summary - Hamburg Wheel Tracking

By

Adam J. Taylor, P.E.
Jason R. Moore, P.E.

July 2019

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

277 Technology Parkway ▪ Auburn, AL 36830

At 10,000 passes we reported 2.62 mm of rut.

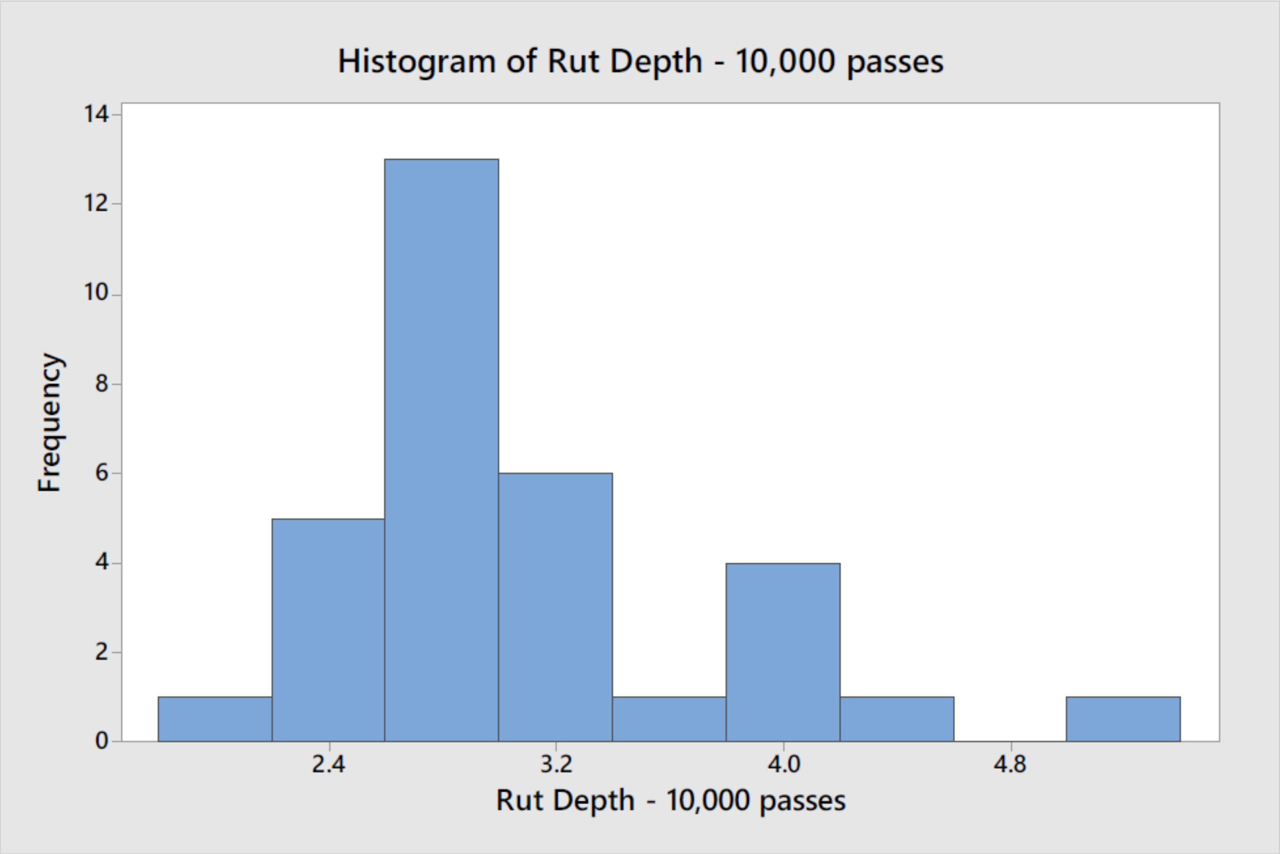


Figure 1: Boxplot and Histogram of Hamburg Rut Depths at 10,000 passes

ALLAN MYERS

At 20,000 passes we reported 3.06

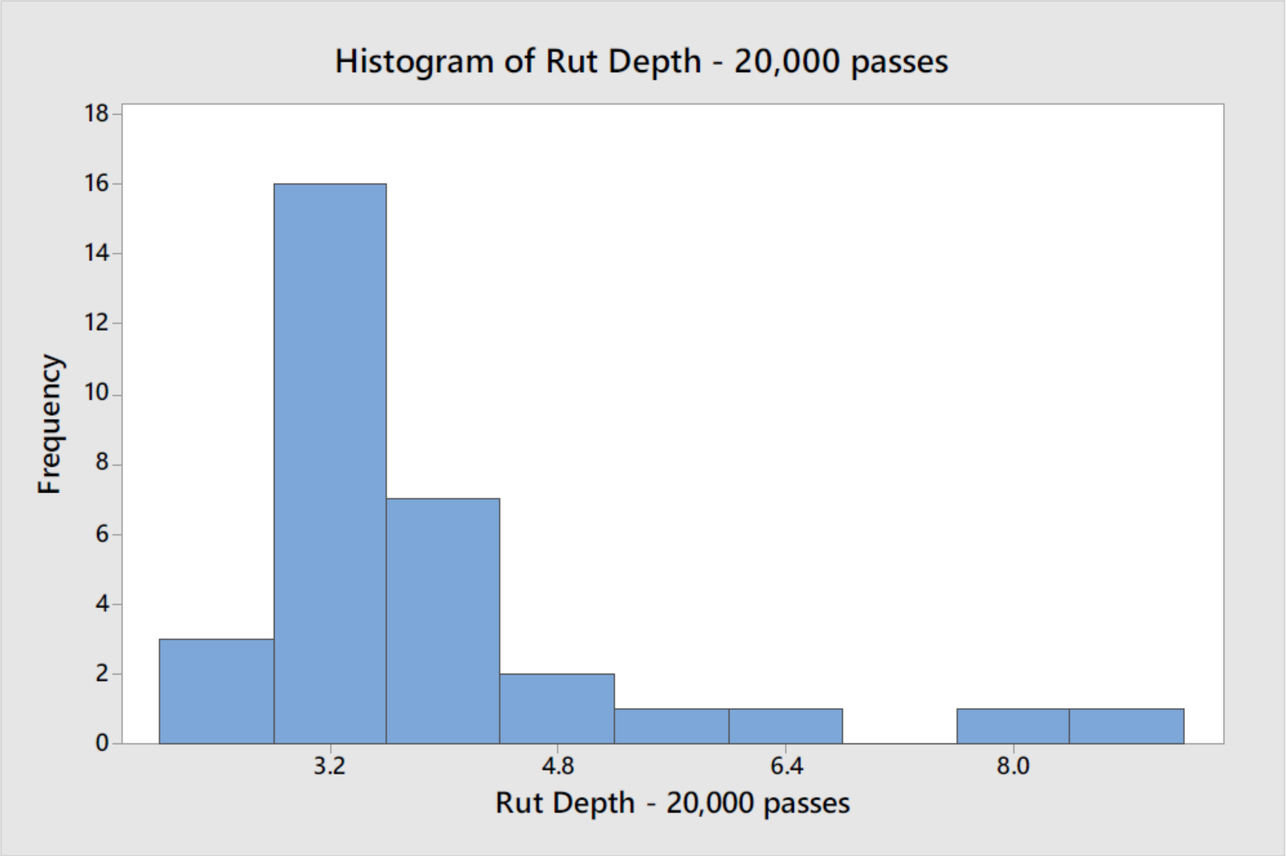


Figure 2: Boxplot and Histogram of Hamburg Rut Depths at 20,000 passes

2020 CT Index Round Robin Ph. 1

VDOT Round Robin Testing Program for the Indirect Tensile Cracking Test (IDT-CT) at Intermediate Temperature: *Phase I.*

Summary of Allan Myers results

Summary Data

Table 2. Summary of IDT-CT Parameters for Package 5.

Package ID	Package 5				
Lab Name	Allan Myers Paradise Central			Test Operator	Tim Peffer
Equipment	Instrotek Smart Jig – Pine 850T			Machine Type	Screw-Drive
ID	Data Collection Frequency (Hz)	Average Loading Rate (mm/min)	Reported CT_{index}	Calculated CT_{index}	Observations
A5	100.0	52.9	38	38	Loading rate outside 50±2 mm/ min
A59	100.0	52.8	41	41	Loading rate outside 50±2 mm/ min
A129	100.0	53.1	34	34	Loading rate outside 50±2 mm/ min
A167	100.0	52.7	50	50	Loading rate outside 50±2 mm/ min
A221	100.0	52.4	67	67	Loading rate outside 50±2 mm/ min
Average / Mean			46	46	
Standard Deviation			13.3	13.2	
Coefficient of Variation			28.8	28.8	
B5	100.0	51.9	218	218	No issues
B63	100.0	51.2	193	192	No issues
B119	100.0	52.6	107	106	Loading rate outside 50±2 mm/ min
B176	100.0	51.7	169	169	No issues
B240	100.0	52.2	127	127	Loading rate outside 50±2 mm/ min
Average / Mean			163	162	
Standard Deviation			45.9	45.8	
Coefficient of Variation			28.2	28.2	

General Comments:
For test results with loading rate outside the 50±2 mm/min range, the data was only considered in the 2nd analysis "30 data sets per mix type".

ALLAN MYERS

Our results were 46 and 163 with COV of 28.8 and 28.2.

A concern with loading rate.

COV over 15 is a concern.

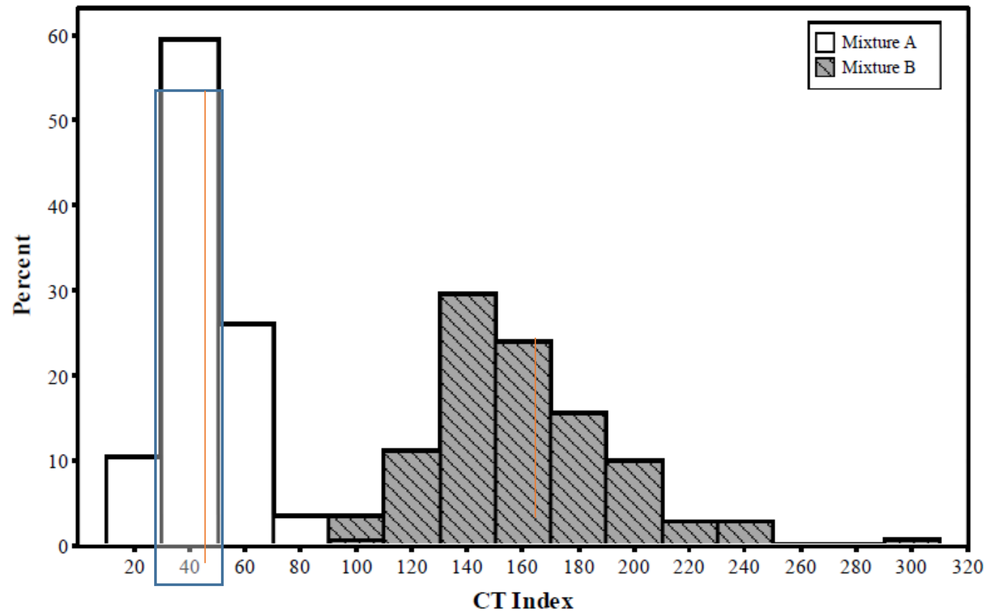


Figure 2. Individual Reported CT_{index} Values for Mixture A and Mixture B.

2021 VDOT BMD Production Testing

Initial Special Provision

2021 Special Provision:

Mix design

- Cantabro - design AC and -0.5% AC
- APA - design AC and +0.5% AC
- CTindex - design AC and ±0.5%, and design AC with long-term aging

Production (4,000T lot)

Property/Test	Frequency (tons)	Total Specimens per Lot
CTindex – QC	1,000	20
Cantabro – QC	1,000	12
CTindex – VDOT QA	2,000	10
Cantabro – VDOT QA	2,000	6
Rutting – VDOT QA	2,000	8

Contractor will make VDOT specimens.

2021 VDOT BMD Pilot at Rockville, Va. Lab

- Design asphalt content stayed the same
- Removed natural sand in order to meet APA Rut.
- Adjusted gradation accordingly
- RAP stayed at 30%. The maximum allowed for the mix spec.
- 2 Lab Technician working exclusively on the BMD testing requirements. A 3rd. Lab Tech worked a second shift to complete Cantabro and CT-Index testing
- Cantabro results were 2% to 5%. Well under the 7.5% maximum.
- CT-Index results were all over 100 but COV's were often over 15%.
- No APA Rut results from VDOT yet.
- Air Voids started at over 5% but were tuned in to 3-4% by end of the project.
- Full incentive pay for AC content = At target and less than .15 StDev

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title

Refine Special Provision

2022 Pilot Projects

Testing Frequency (4,000T lot)

Property/Test	Frequency (tons)	Total Specimens per Lot
CTindex – QC	2,000	10
Cantabro – QC	2,000	6
CTindex – VDOT QA	4,000	5
Cantabro – VDOT QA	4,000	3
Rutting – VDOT QA	Once per mix	4 per mix

Testing halved from 2021

Contractor will make VDOT specimens.
Report results w/in 1 week (recommended 48hrs)

No pay adjustment for performance tests

- If failure, stop production and make corrective actions
- Acceptance ranges for volumetrics/gradation follow section 211
- BMD is eligible for Std. Deviation Bonus (and asphalt price adjustment)

2022 VDOT BMD Pilot at Leesburg, Va. Lab

- Design asphalt content increased 0.1 to 0.2% to increase CT-Index
- Removed natural sand to meet CT-Index and Cantabro.
- Adjusted gradation accordingly.
- RAP stayed at 30%. The maximum allowed for the mix spec.
- 2 Lab Technicians working exclusively on the BMD testing. We did not require a 3rd with reduced requirements from 2021
- Cantabro results on 12.5mm were higher, up 6%
- CT-Index for 12.5mm were lower but still over 100. COV on 5 sample sets were almost always over 15%.
- No APA Rut results yet from VDOT
- Air voids all within spec. Lessons learned from 2021
- Full Incentive Pay for AC content

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VDOT BMD Production Criteria (2024)

Distress	Test	Limit
Cracking	IDT-CT (reheat)	70 (min)
	IDT-CT (non-reheat)	95 (min)
Rutting	APA rut test	8mm (max)
	IDT-HT	Report
Durability	Cantabro	7.5% (max)
Moisture	Tensile Strength Ratio	80% (min)

PennDOT Pilot Projects

- CT-Index as low as the 80's
- Hamburg Rutting approaching 7
- Lab Mix Only
- Requires additional design time
- 2023 Design submittal season so far has seen results in line with prior results.
- No significant changes to existing designs. – SO FAR

Test	AASHTO	DelDOT	Maryland SHA	PennDOT	VDOT
APA Rut	T340	Yes	Design Only		Yes
Hamburg	T324			Design Only	
CT-Index		Yes	Yes	Design Only	Yes
HT-IDT	AMRL 8225		Yes		Yes
Cantabro	TP108				Yes
Texas Overlay		Yes			

Current tests in our footprint

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Lessons Learned

- Hamburg Testing – make sure side spacers are fully locked to the bottom of the spacer plate
- Hamburg Testing – Allow bottom reservoir to rinse often after test completion. Especially if breakdown of aggregate occurred.
- CT-Index make sure LVDT is slightly compressed at the start of testing 2-5mm
- Reheating material will typically lower CT-Index results???
- Cantabro results are impacted by temperature, Test area should be 75-80F
- Calibration and maintenance of APA Jr. is important.
- Consistency when preparing samples. CT-Index is getting more consistent.

2025 Updates

- Concern with Dwell and Lag Times. We never considered the time between making the cores and how long until we tested. Many cores were transported from Virginia to Pennsylvania for testing. Some of our early results might be questionable.
- The HT-IDT test is being looked at more seriously in Virginia, much less expensive equipment and less time. Could replace APA testing. APA is now Engineer's Discretion in Virginia.
- Current VDOT proposals for 2026 Spec changes lower Air Voids for BMD design and increase CT-Index. We are concerned this could lead to over-asphalting some mixes as many BMD designs already see 0.1 to 0.2 increase of AC. CT-Index moving to 100 vs. 70 reheat. 130 vs. 95 for non reheat.
- Currently both Maryland and Virginia are specifying HT-IDT testing, a surrogate test to APA Rut. However, they differ on specimen size – 62 vs 95mm, and temperature. We would like to see uniformity.

2025 and Beyond

- Allan myers completed one of the initial Maryland BMD projects in the fall of 2024.
- Continuing to submit BMD values with PennDOT designs.
- No real movement at DelDOT.
- In Virginia BMD is now a part of everyday testing, No real problems as testing frequency has decreased.

Allan Myers is hopeful that State DOT’s continue “wading” into the transition of BMD and specification changes. Training and uniformity of testing will be important.

Thanks!

- Tim Peffer
- Director of Asphalt QC
- Tim.Peffer@allanmyers.com
- 484-368-2906

Environmental Product Declarations (EPDs)

Mary Robbins, Ph.D., P.E.(OH),
Director of Technical Services

PA Asphalt Pavement Association

April 1, 2025

NECEPT Plant Technician

Update & Refresher Course - Virtual

Why

CONSTRUCTION MATERIALS:

- **Asphalt**
- Concrete
- Flat Glass
- Steel

~50% of all manufacturing GHG emissions,

98% of government's purchased construction materials

Federal Buy Clean Initiative | Office of the Federal Chief Sustainability Officer

Why: Inflation Reduction Act

Agency	Amount	Purpose
EPA	$250 million	to standardize EPDs
	$100 million	to develop "low-embodied carbon construction material labeling program"
US DOT/FHWA	$2 billion	to procure "substantially lower" embodied carbon
FEMA	Funds available for agencies	to specify low carbon materials
GSA	$2.2 billion	to procure low embodied carbon materials for construction/renovation

Why: EDC-7

Construction materials (aggregate, asphalt, cement, asphalt mixtures, concrete mixtures, and steel) have environmental impacts.

Environmental Product Declarations (EPDs) document those impacts.

This tool helps state DOTs support decisions related to procurement and quantify the reduction in embodied carbon for sustainable pavements.

Environmental Product Declaration

In 2025, all JMFs submitted to PennDOT will be required to have an accompanying EPD

2025

pennsylvania
DEPARTMENT OF TRANSPORTATION

An Environmental Product Declaration for Asphalt Mixtures

PRODUCT DESCRIPTION
Gradation Type: dense
Mix Design Method: superpave
Nominal Maximum Aggregate Size: 12.5 mm
Performance Grade of Asphalt Binder: PG 58-28
This mix producer categorizes this product as a Hot Mix Asphalt (HMA) asphalt mixture.
This asphalt mixture was produced within a temperature range of 150 to 161°C.

IMPACT CATEGORY	POTENTIAL IMPACT PER METRIC TONNE ASPHALT MIXTURE (PER TON ASPHALT MIXTURE)
Global warming potential (GWP-100)	*71.05 (64.46) kg CO2 Equiv.*
Ozone depletion potential (ODP)	*9.92e-08 (9.00e-08) kg CFC-11 Equiv.*
Eutrophication potential (EP)	*1.24e-02 (1.13e-02) kg N Equiv.*
Acidification potential (AP)	*1.72e-01 (1.56e-01) kg SO2 Equiv.*
Photochemical ozone creation potential (POCP)	*4.51 (4.09) kg O3 Equiv.*

DECLARED UNIT: The declared unit is 1 metric tonne (1 short ton) of an asphalt mixture

PRODUCT INGREDIENTS

Component	Material	Weight %
Aggregate	*Natural Stone*	*15*
Aggregate	*Natural Stone*	*21*
Aggregate	*Natural Stone*	*13*
Aggregate	*Natural Stone*	*14*
Aggregate	*Natural Stone*	*8*
RAP	*Reclaimed Asphalt Pavement*	*24*
Binder	*Unmodified*	*4*

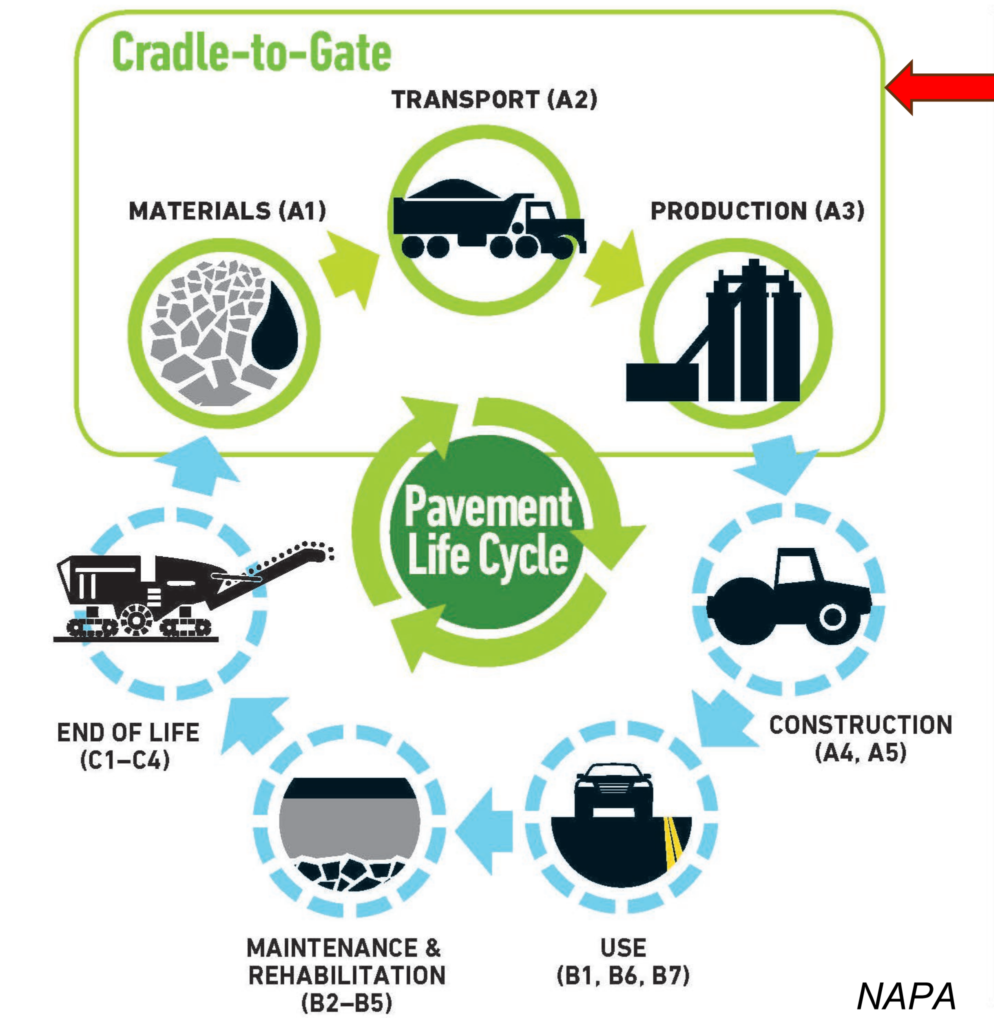
Source: FHWA Innovator Newsletter

Environmental Product Declaration

NM	1	1	2
NV	2	2	44
NY	18	32	303
OH	7	10	98
OK	2	10	51
ON *Canada*	1	4	47
OR	6	11	59
PA	20	76	1481
SC	2	6	6
TN	1	1	30
TX	7	22	108
UT	5	8	47
VA	8	23	207

What is an Environmental Product Declaration?

Pavement Life-Cycle



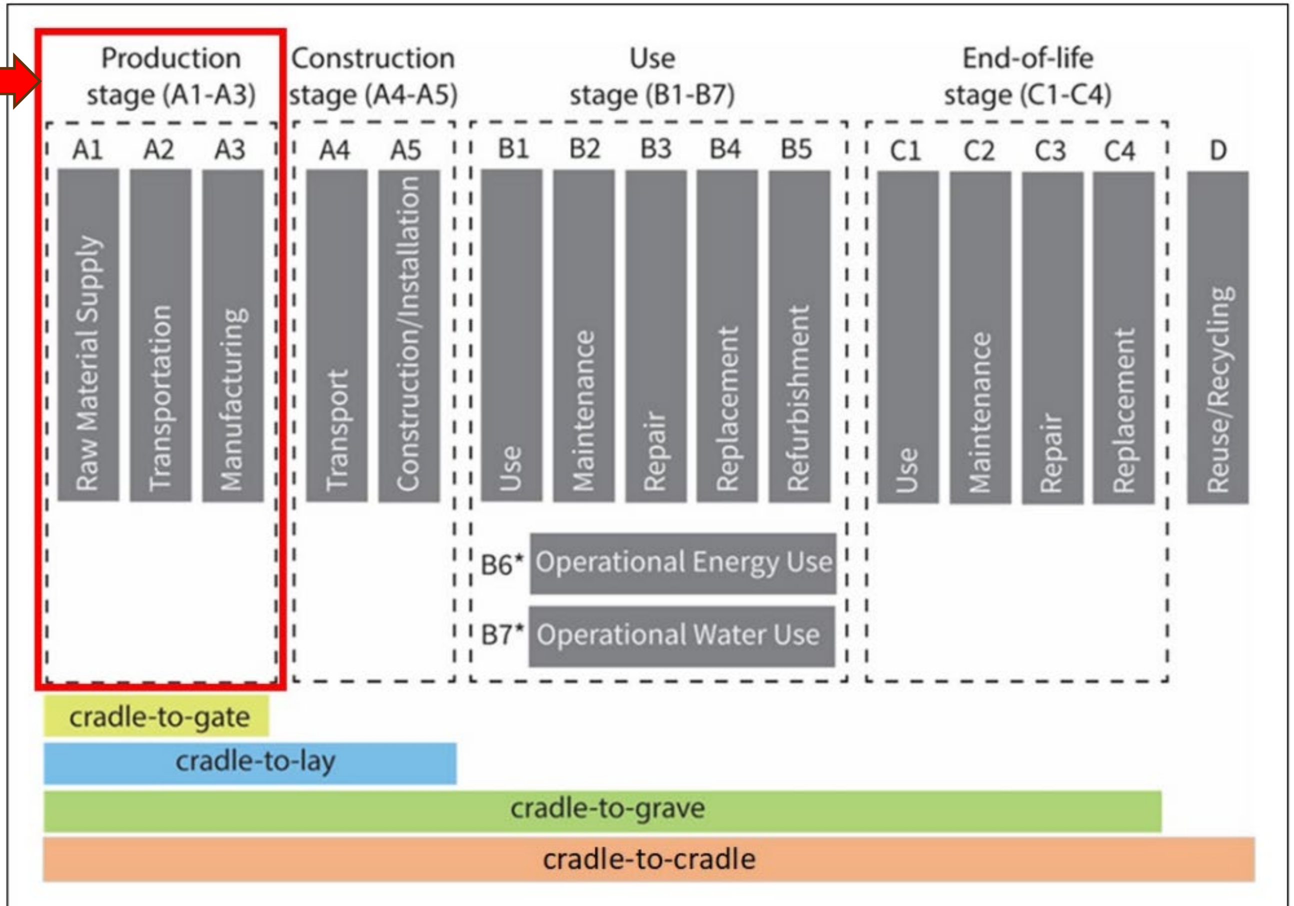


Figure 1. Life cycle stages for building products (adapted from ISO 21930:2017) with boundary conditions for different LCA scopes.

Image source: NAPA

EPD

The Guidelines

Product Category Rule (PCR)

Tells you how to do a

The Analysis

Life Cycle Assessment (LCA)

Which gets detailed in an

The Communication

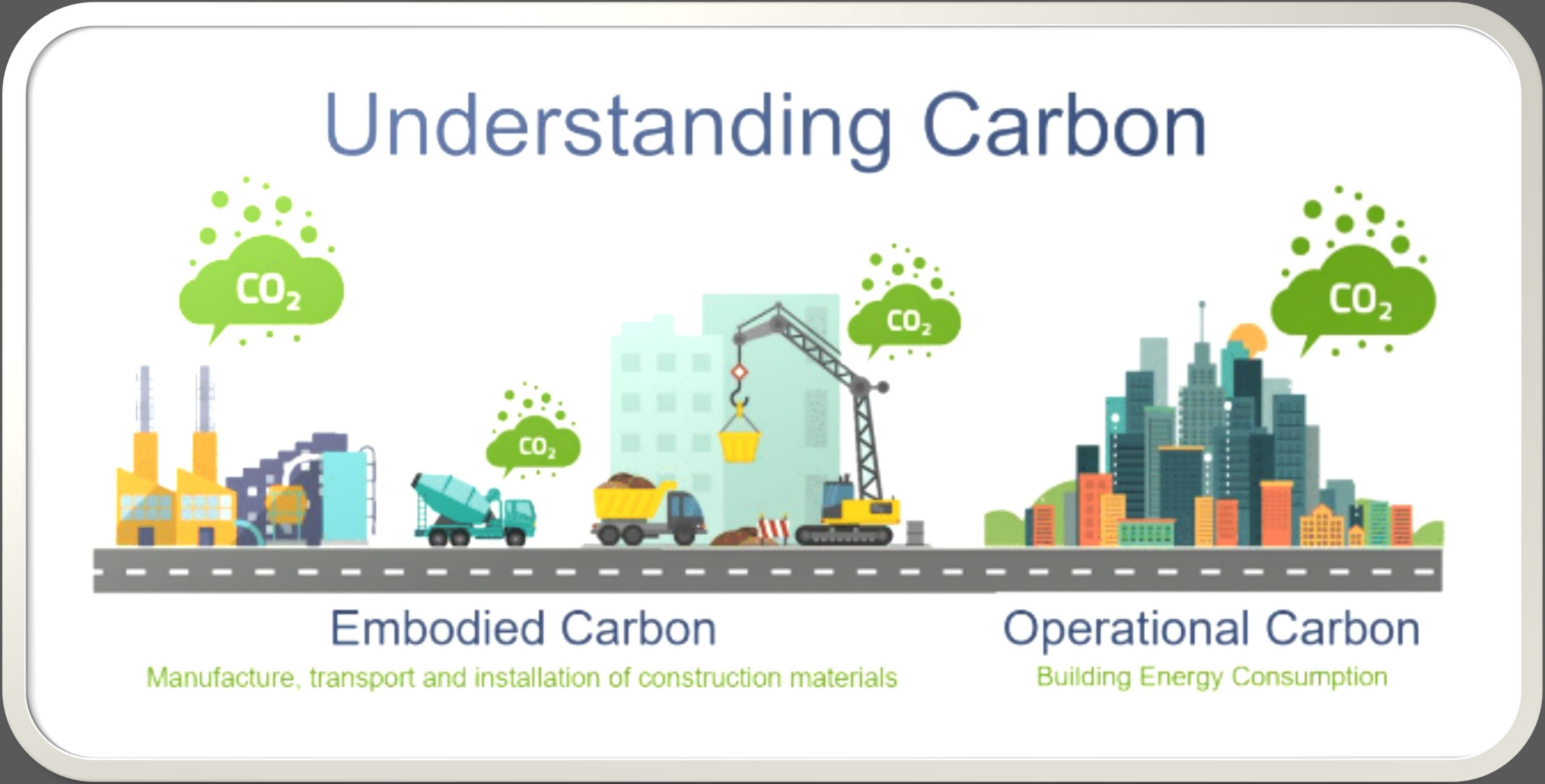
Environmental Product Declaration (EPD)

Say what….? (Key Terms)

Greenhouse Gas (GHG)

Global Warming Potential (GWP)

Say what….? (Key Terms)



Environmental Product Declaration

Environmental Product Declaration

- Quantified environmental information on the life cycle of a product,
- Enables comparisons between like products fulfilling the same function*

"Nutrition label" for environmental impacts

- ISO Type III Environmental Label

Independently verified

- NAPA Emerald EcoLabel: John Beath Environmental
- National Science Foundation
- Others…

*Source: ISO 14025:2006. **EPDs from different Product Categories should NOT be compared to each other.**

An Environmental Product Declaration for Asphalt Mixtures

PRODUCT DESCRIPTION
Gradation Type: dense
Mix Design Method: superpave
Nominal Maximum Aggregate Size: 12.5 mm
Performance Grade of Asphalt Binder: PG 58-28
This mix producer categorizes this product as a Hot Mix Asphalt (HMA) asphalt mixture.
This asphalt mixture was produced within a temperature range of 150 to 161°C.

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Acidification potential (AP)	*1.72e-01 (1.56e-01) kg SO2 Equiv.*
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Aggregate	*Natural Stone*	*15*
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Aggregate	*Natural Stone*	*13*
Aggregate	*Natural Stone*	*14*
Aggregate	*Natural Stone*	*8*
RAP	*Reclaimed Asphalt Pavement*	*24*
Binder	*Unmodified*	*4*

Source: FHWA Innovator Newsletter

Environmental Product Declaration

Description of the asphalt mixture

Emerald ECO LABEL

An Environmental Product Declaration (EPD) for Asphalt Mixtures

Company Information

A. Colarusso & Son, Inc. is an asphalt mixture producer.

Colarusso Blacktop, a stationary asphalt plant at

91 Newman Rd, Hudson, NY 12534, USA

A. COLARUSSO & SON, INC.
HUDSON, NY

Product Description

This EPD reports the potential environmental impacts and additional environmental information for an asphalt mixture, which falls under the United Nations Standard Products and Services Code 30111509. Asphalt mixtures are typically incorporated as part of the structure of a roadway, parking lot, driveway, airfield, bike lane, pedestrian path, railroad track bed, or recreational surface.

Mix Name: 121WC (H015523410) / 64S-22

Specification Entity: NYSDOT

Specification: 12.5<0.3

Gradation Type: dense

Mix Design Method: superpave

Nominal Maximum Aggregate Size: 12.5 mm

Performance Grade of Asphalt Binder: PG 64S-22

Customer [Project/Contract] Number: Not Reported

This mix producer categorizes this product as a Warm Mix Asphalt (WMA) asphalt mixture produced using chemical additive. This asphalt mixture was produced within a temperature range of 135 to 149°C (275.0 to 300.0°F) f. Energy and environmental impacts are based on a plant's average performance over a 12-month period and are not adjusted for mix-specific production temperatures.

Environmental Product Declaration

This declaration is an EPD in accordance with ISO 14025:2006[1] and ISO 21930:2017[2]. The PCR is *Product Category Rules for Asphalt Mixtures*[3,4]. This EPD transparently describes the potential environmental impacts associated with the identified life cycle stages of the described product.

Declaration Number: 311.968.3997 v4 **Software Version:** 2.2.0

Date of Issue: Sept. 13, 2024 **Period of Validity:** March 31, 2027

This EPD is valid for asphalt mixtures produced at the location indicated on this page. Data used to inform this EPD reflect plant operations from a 12-month period beginning on Jan. 1, 2023.

This EPD can be found at https://asphaltepd.org/epd/d/keUja8/

LCA performed by: Ben Ciavola, PhD

Environmental Product Declaration

An Environmental Product Declaration for Asphalt Mixtures

Product Ingredients

The product ingredients as identified in the mix design are provided in the table below.

TABLE 1. PRODUCT INGREDIENTS

COMPONENT	MATERIAL	WEIGHT %
Aggregate	*Natural Stone*	*31*
Aggregate	*Natural Stone*	*10*
Aggregate	*Natural Stone*	*30*
Aggregate	*Natural Stone*	*5*
RAP	*Reclaimed Asphalt Pavement*	*19*
Binder	*Unmodified*	*5*
Binder Additive	*Warm Mix Additive - Chemical**	*< 1%*

*Indicates that this material is a data gap. Upstream data associated with extraction and processing is not accounted for in this EPD.

Environmental Product Declaration

Regulated Hazardous Substances

Regulated hazardous substances, if applicable, are listed on the safety data sheet (SDS) associated with this asphalt mixture. The chemical names and composition of the mix from the SDS are provided here for transparency.

TABLE 2. REGULATED HAZARDOUS SUBSTANCES

CHEMICAL NAME	CAS NO.	WEIGHT %
Mineral Aggregates	*None*	*90.0 < 95.0*
Asphalt Cement	*8052-42-4*	*5.0 < 10.0*
Crystalline Silica	*14808-60-7*	*0.5 < 3.0*

Environmental Product Declaration

An Environmental Product Declaration for Asphalt Mixtures

TABLE 3. ENVIRONMENTAL IMPACT SUMMARY TABLE

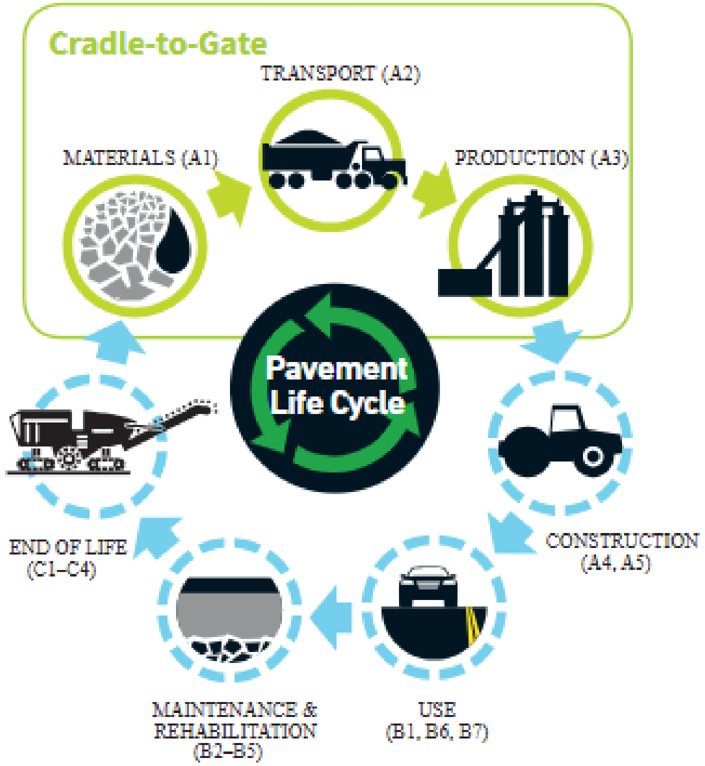
IMPACT CATEGORY	POTENTIAL IMPACT PER METRIC TONNE ASPHALT MIXTURE (PER TON ASPHALT MIXTURE)
Global warming potential (GWP-100)	*52.45 (47.58) kg CO2 Equiv.*
Ozone depletion potential (ODP)	*2.47e-08 (2.24e-08) kg CFC-11 Equiv.*
Eutrophication potential (EP)	*1.03e-02 (9.37e-03) kg N Equiv.*
Acidification potential (AP)	*1.25e-01 (1.14e-01) kg SO2 Equiv*
Photochemical ozone creation potential (POCP)	*3.01 (2.73) kg O3 Equiv.*

Environmental Product Declaration

Methodological Framework

DECLARED UNIT

The declared unit is 1 metric tonne (1 short ton) of an asphalt mixture (UNSPSC Code 30111509: Asphalt Based Concrete), which is defined as "a plant-produced composite material of aggregates, asphalt binder, and other materials." [3]



LIFE CYCLE STAGES AND INFORMATION MODULES

This is a cradle to gate EPD. It covers the raw material supply, transport, and manufacturing life cycle stages (modules A1-A3). It does not include construction (placement and compaction), use, maintenance, rehabilitation, or the end-of-life life cycle stages (modules A4-5, B1-7, and C1-4).[3]

Materials (A1): This stage includes raw material extraction and manufacturing (e.g., quarry operations for aggregates, petroleum extraction and refinery operations for asphalt binder production, etc.) based on the relative proportion of ingredients in the mix design.

Transport (A2): This stage includes transport of raw materials to the asphalt plant based on actual transportation distances and modes for ingredients in the mix design.

Production (A3): This stage comprises plant operations involved in the production of asphalt mixtures, including generation of electricity and heat used during asphalt mix production (e.g., extraction, refining, and transport of fuels). Data for this stage is plant specific.

Environmental Product Declaration

LIFE CYCLE INVENTORY

This EPD was created using plant-specific data for asphalt mix production of the production stage (A1-A3). Potential variations due to asphalt mixture design, supplier locations, manufacturing processes, efficiencies, and energy consumption are accounted for in this EPD. All upstream data sources are prescribed in the Product Category Rules (PCR) and are publicly available and freely accessible to enhance transparency and comparability. Use of the prescribed data sources improves comparability among the EPDs developed by limiting variability due to differences in the upstream data within the system boundaries.[3]

ALLOCATION PROCEDURES

Impacts from upstream production and transportation of raw materials are subdivided based on the relative material quantities (percentages) in the mix design. For conventional asphalt plants that produce both hot-mix asphalt (HMA) and warm-mix asphalt (WMA) mixtures, allocation of energy and other resources for asphalt mix production is on a mass basis. Mix-specific production temperatures are not used to separately allocate energy inputs to HMA and WMA mixtures. For conventional asphalt plants that also produce asphalt mixtures at ambient temperatures using cold central plant recycling (CCPR) technologies, HMA and WMA mixtures are subdivided from CCPR mixtures by segregating burner fuel consumption from CCPR mixtures.

Environmental Product Declaration

For input materials that are manufactured using processes that produce one or more co-products, the prescribed upstream datasets allocate the material production impacts according to principles outlined in the PCR for Asphalt Mixtures and ISO 21930. Examples of these processes include petroleum refining (which produces multiple co-products including asphalt binder, petroleum fuels, and other products) and iron and steel manufacturing (which produces iron and steel along with slag aggregates).

Waste materials and other outputs such as byproducts generated during asphalt mixture production exit the asphalt mixture product system burden free. Materials, energy, and environmental impacts are not allocated to waste materials or byproducts.

CUT-OFF PROCEDURES

Secondary (recycled) materials are evaluated using the cut-off approach. The cut-off boundary is defined as the point beginning after secondary materials are transported to a central storage or processing location. Material flows and potential environmental impacts associated with the previous product system, including deconstruction, demolition, disposal, and transport to the processing location, are not accounted for in this EPD because the recycled materials are modeled as entering the asphalt mixture product system burden-free. In some cases, limitations in upstream datasets require these recovery and transportation processes to be included, which is a conservative approach.

Processing of secondary materials for use in asphalt mixtures and transport to the asphalt plant are included in modules A1 and A2, respectively. Processing and transport of secondary fuels to the asphalt plant are included in module A3.

LIMITATIONS

This EPD reports the results of a cradle to gate life cycle assessment (LCA) for asphalt mixtures. This EPD may be used as a data input for full LCAs to compare the environmental impacts of different asphalt roadway, parking lot, or recreational pavement design alternatives.

COMPARABILITY

EPDs that comply with the PCR for Asphalt Mixtures (and, by extension, ISO 21930) are comparable if the mixtures are expected to meet similar functional and design performance criteria as specified by the customer, such as meeting the same customer specification.

Comparability may be limited by the presence of data gaps. EPDs with data gaps should not be compared to each other unless the composition and quantity of material ingredients with data gaps is known to be the same for all products being compared.

When asphalt mixtures have different performance expectations, the asphalt mixtures can only be compared by using EPDs as a data input for an LCA study that includes additional life cycle stages relevant to the functional unit defined in the LCA.

LIFE CYCLE ASSESSMENT

The information presented in this EPD can be used to model the environmental impacts of asphalt mixtures purposed to be part of (but not limited to) roadway, parking lot, or recreational pavements. This EPD alone does not provide the environmental impacts of the entire pavement structure itself and does not make any statements that the product covered by the EPD is better or worse than any other product.

LIFE CYCLE IMPACT ASSESSMENT RESULTS

The life cycle impact assessment results are relative expressions and do not predict actual impacts on category endpoints, the exceeding of thresholds, safety margins, or risks. Calculations are based on the TRACI v2.1 impact assessment methodology.

Environmental Product Declaration

TABLE 4. LIFE CYCLE IMPACT INDICATORS

ACRONYM	INDICATOR	UNIT	QUANTITY PER METRIC TONNE ASPHALT MIXTURE (PER SHORT TON ASPHALT MIXTURE)			
			MATERIALS (A1)	TRANSPORT (A2)	PRODUCTION (A3)	TOTAL (A1-A3)
GWP-100	*Global warming potential, incl. biogenic CO2*	*kg CO2 Equiv.*	*30.06 (27.27)*	*0.22 (0.20)*	*22.17 (20.11)*	*52.45 (47.58)*
ODP	*Ozone depletion potential*	*kg CFC-11 Equiv.*	*1.54e-08 (1.39e-08)*	*1.32e-09 (1.19e-09)*	*8.00e-09 (7.26e-09)*	*2.47e-08 (2.24e-08)*
EP	*Eutrophication potential*	*kg N Equiv.*	*8.06e-03 (7.31e-03)*	*6.49e-05 (5.89e-05)*	*2.21e-03 (2.00e-03)*	*1.03e-02 (9.37e-03)*
AP	*Acidification potential*	*kg SO2 Equiv.*	*8.70e-02 (7.89e-02)*	*1.11e-03 (1.01e-03)*	*3.71e-02 (3.36e-02)*	*1.25e-01 (1.14e-01)*
POCP	*Photochemical ozone creation potential*	*kg O3 Equiv.*	*1.81 (1.64)*	*0.04 (0.03)*	*1.16 (1.05)*	*3.01 (2.73)*

Environmental Product Declaration

Notes:

GWP-100 – Global warming potential. The warming (relative to CO_2) that chemicals contribute to the atmospheric greenhouse effect by trapping the earth's heat. The impact scores for GWP-100 are based on a 100-year time horizon. As prescribed in Section 7.2.7 of the PCR for Asphalt Mixtures, this EPD does not assign a negative flow of CO_2 to GWP-100 when biogenic CO_2 enters the product system through biofuels and bio-based materials unless this information is provided in upstream datasets, in which case the amounts are indicated in Table 7. However, a positive flow of CO_2 is assigned to GWP-100 when biogenic CO_2 is emitted through the combustion of biofuels. This is a conservative approach that may over-estimate GWP-100. Bio-based materials tend to be used in small quantities in asphalt mixtures (<1% by weight of the mix) and biofuels are rarely used for asphalt mixture production, so the impacts are low in most cases. Biogenic carbon uptake for certain biofuels is provided as additional environmental information in Table 9. The location-based accounting method, is used for calculating upstream impacts of purchased electricity. Potential GHG emission reductions associated with the market-based accounting method, if applicable, are provided as Additional Environmental Information in Table 8.

ODP – Ozone depletion potential. The potential damage that chemicals such as chlorofluorocarbons (CFCs) cause to the earth's stratospheric ozone layer, which filters out harmful ultraviolet radiation from the sun. Impact scores for ODP are based on the quantity of ozone-depleting chemicals released to air, normalized to an equivalent mass of CFC-11.

EP – Eutrophication potential. The potential nutrient enrichment to water bodies caused by chemicals that are released to the water or air and subsequently deposited. Impact scores for EP are based on the quantity of nutrients released, normalized to an equivalent mass of N.

AP – Acidification potential. The potential formation of acid rain caused by releases of chemicals to the air. Impact scores for AP are based on the number of hydrogen ions that can be theoretically formed per mass unit of the chemical being releases as compared to SO_2.

POCP – Photochemical ozone creation potential. The release of hydrocarbons and nitrogen oxides that react with sunlight to produce photochemical oxidants, which can cause or aggravate health problems, plant toxicity, and deterioration of certain materials. Impact scores for POCP are based on the quantity of chemicals with POCP equivalency factors released to the air, normalized to an equivalent mass of O_3.

Development of an EPD

EPD Development

- EPDs are
  - plant AND mix specific
  - Published in accordance with
    - ISO 14025
    - ISO 21930
    - Product Category Rule for asphalt mixtures
  - Third party reviewed (meeting ISO 14025)
  - Developed with specialized software (NAPA Emerald EcoLabel)

EPD Development – Who?

- Material supplier is responsible
- Costs:
  - Personnel time
  - NAPA Emerald EcoLabel

EMERALD ECO-LABEL EPD GENERATOR

The Emerald Eco-Label software allows asphalt mix producers to develop and publish verified mix-specific, plant-specific EPDs for asphalt mixtures produced in the United States. The web-based software is hosted on a third-party, secure website. The software was developed for Google Chrome but should work on most web browsers.

Number of EPDs: The per-plant fee covers the initial development and future revisions for an unlimited number of EPDs produced by the asphalt plant. Each plant-produced asphalt mix design or job-mix formula should have its own EPD.

Duration: The software license is valid for 5 years from the date of purchase and includes future software updates.*

LICENSE TERMS

PRICING

NAPA Member: $3000 per plant

Non-Member: $6000 per plant

License duration: 5 years

NAPA's Board of Directors approved a change to Emerald Eco-Label licensing at the 2024 Annual Meeting. Licenses will no longer be pro-rated, but will run for 5 years, regardless of the start date, PCR version, or software updates.

Software updates are generally pushed out to all users automatically at no additional charge. Software updates may include bug fixes, updates to upstream datasets, new features, and necessary updates to comply with revisions to underlying standards, such as the PCR for Asphalt Mixtures. NAPA reserves the right to charge a fee for software updates that add significant new functionality to the software.

EPD Development – How?

Welcome to the Emerald Eco-Label EPD Tool

Portable Plants

The portable plants function is now live! Check out our recent webinar to learn more about this and other new features.

Each company is required to designate a primary/technical lead. Prior to being granted access to use the tool, each primary/technical lead must watch two webinars and take and pass the corresponding quiz for each webinar. The webinars are ***Environmental Product Declarations: What they are and how to use them*** and ***How to Use Emerald Eco-Label, NAPA's EPD tool***.

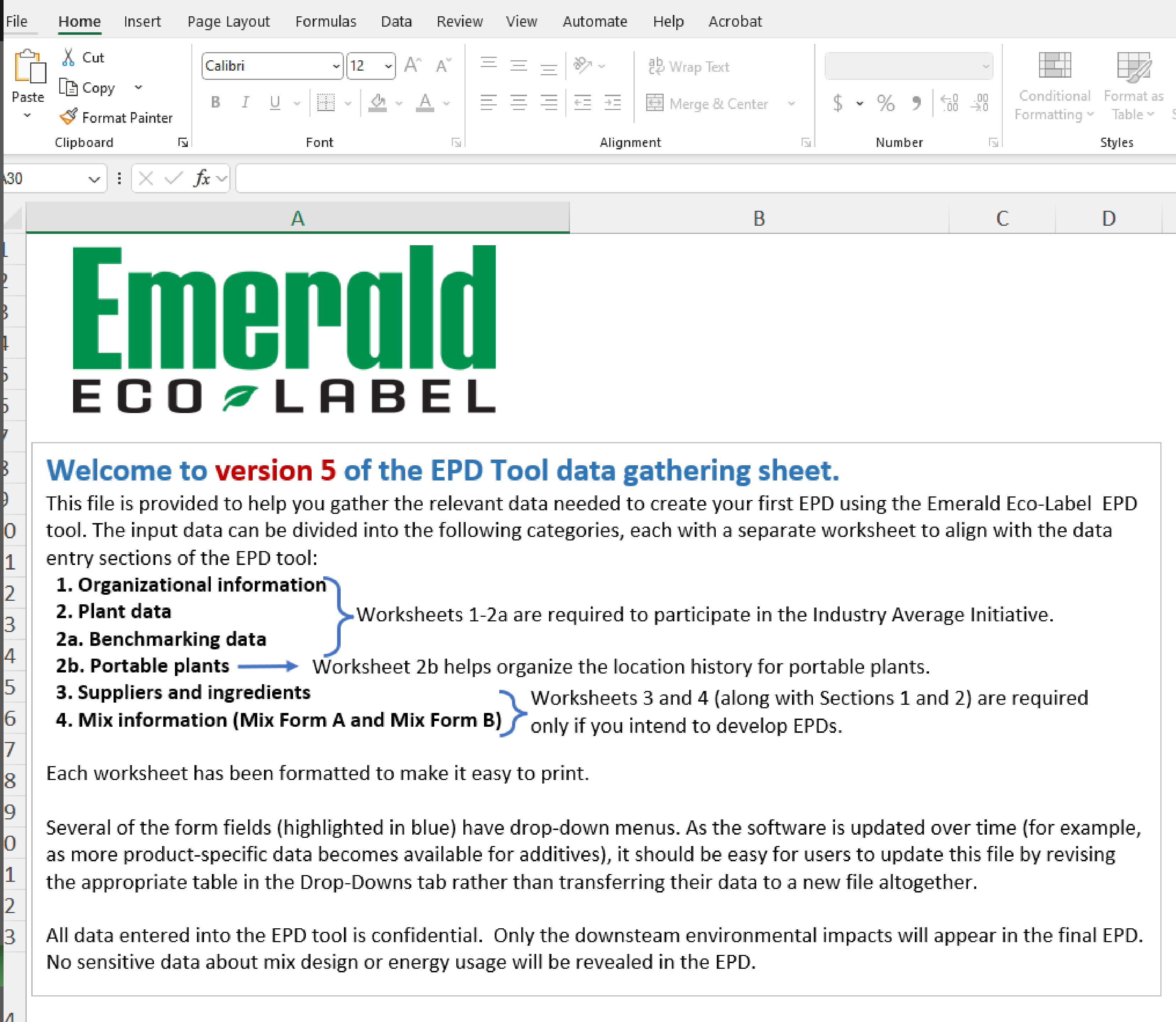
Resources

- Download EPD Data Gathering Sheet v5
- Download Emerald Eco-Label EPD Tool Instructions

Please note, you will need your NAPA username and password to receive a member discount for use of this tool. If you need credentials or for questions regarding use of the EPD tool, please contact NAPA.

Each EPD generated using this tool may be subject to a random audit. Each company must maintain or upload during EPD generation proper documentation of water usage, energy usage, and mix designs and supply them as needed to WAP Sustainability if audited.

EPD Development – How?



Welcome to version 5 of the EPD Tool data gathering sheet.

This file is provided to help you gather the relevant data needed to create your first EPD using the Emerald Eco-Label EPD tool. The input data can be divided into the following categories, each with a separate worksheet to align with the data entry sections of the EPD tool:

1. **Organizational information**
2. **Plant data**
2a. **Benchmarking data**

Worksheets 1-2a are required to participate in the Industry Average Initiative.

2b. **Portable plants** → Worksheet 2b helps organize the location history for portable plants.

3. **Suppliers and ingredients**
4. **Mix information (Mix Form A and Mix Form B)**

Worksheets 3 and 4 (along with Sections 1 and 2) are required only if you intend to develop EPDs.

Each worksheet has been formatted to make it easy to print.

Several of the form fields (highlighted in blue) have drop-down menus. As the software is updated over time (for example, as more product-specific data becomes available for additives), it should be easy for users to update this file by revising the appropriate table in the Drop-Downs tab rather than transferring their data to a new file altogether.

All data entered into the EPD tool is confidential. Only the downsteam environmental impacts will appear in the final EPD. No sensitive data about mix design or energy usage will be revealed in the EPD.

EPD Development – How?

		Production Facility Resource Use	
		Annual Production & Water	
		Data collection start date*	All quantities reported in the Production Facility section will be over a cumulative period of 12-months, within the last five years. Enter the start date of the twelve month period during which the data was recorded. The reported data for all the subsequent categories (in Production Facility) must have been measured for the same twelve month period starting from this date.
	US Short Tons	Total Asphalt Mix Sold (per year)*	For most plants, the total mix sold will be less than the total amount of mix produced, since some of the produced mix is wasted during startup/shutdown, when switching mixes, etc. This must be over the same 12 month period as all the other plant data
	Gal	Total Water	**Include water used for the following purposes:** dust control, aspshalt binder foaming processes for WMA or CCPR, irrigation (landscaping), slurry for wet scrubber operations, slurry for removing excess baghouse fines, and slurry for adding hydrated lime or other mineral fillers. If your plant does not have its own water meter, you may estimate water consumption based on company records such as daily water truck deliveries, flow rates, operational usage of water pumps, etc. Be sure to document your assumptions and calculations.
		Waste	**This section refers to waste materials directly associated with mix production, including baghouse fines, wet scrubber fines, or off-spec production materials (e.g., startup/shutdown waste, mix switching waste).** When these materials are transported off-site for disposal (e.g., in a landfill) or recycling (e.g., for beneficial reuse), they must be declared as hazardous waste, non-hazardous waste, or materials for recycling in a manner that reflects the actual disposition.
	US Short Tons	**Hazardous Waste***	All hazardous waste transported off site in the data collection period.
	miles	Truck transport distance	If your plant transported hazardous waste to more than one facility, enter the weighted average transport distance and for each transport mode.
	miles	Train transport distance	
	miles	Barge transport distance	
	miles	Ocean transport distance	

PAPA

EPD Development – How?

		Burner Fuel	Include fuel consumed for the primary burner, secondary burner, and ancillary combustion equipment such as on-site asphalt-rubber blending plants, if applicable. If your plant is co-located with another facility that shares the same natural gas meter, the recommended approach is to install a submeter for your plant's natural gas consumption. In the meantime, it's acceptable to allocate burner fuel consumption using the same method your company uses for financial accounting purposes. Be sure to document your burner fuel allocation approach and include this information in the supporting documentation.
	Mcf	Natural Gas	Check that you have converted to the correct units -- this is one of the most common mistakes in the EPD creation process.
	Gal	LNG	
	Gal	Propane	
	Gal	Diesel	
	Gal	Used Oil	
	Gal	Residual Oil	
	Gal	Biodiesel	
		Biodiesel Grade	Report biodiesel grade as percent biodiesel in a biodiesel/petroleum diesel mix. E.g. If you are using B20 Biodiesel, enter "20" as the biodiesel grade
	Gal	Brown Grease (grease trap oil)	
	Gal	Yellow Grease (vegetable oil)	
	Gal	Renewable Diesel	
	Mcf	Renewable Natural Gas	
	US Short Tons	Anthracite Coal	
	US Short Tons	Bituminous Coal	
	US Short Tons	Lignite Coal	
	Mcf	Landfill Gas	
		Oil Heater	Enter the amount of each energy source used to power the oil heaters at the plant during the 12 month period. Enter "0" if you do not use a certain type of fuel. If you do not track the fuel usage of the oil heater separately, enter the usage under the "Burners" section.

PAPA

EPD Development – How?

		Equipment	Enter the amount of each energy source used to power equipment (e.g. loaders, skid steers, on-site trucks, air compressors, etc.) at the plant during the 12 month period. Enter "0" if you do not use a certain type of fuel. If you do not track the fuel usage of the equipment separately, enter the usage under the "Onsite Generator" section if diesel, and "Burners" section if natural gas.
	Gal	Diesel	Used in mobile equipment
	Gal	Biodiesel	Used in mobile equipment
		Biodiesel Grade	Used in mobile equipment
	Gal	Propane	Used in mobile equipment
	Gal	Gasoline	Used in mobile equipment
	BTU	CNG, 56 - 560kW	Used in mobile equipmentwith power rating of 56-560kW (75-750hp)
	BTU	CNG, 19 - 56kW	Used in mobile equipment with power rating of 19-56kW (25-75hp)
	Gal	LNG	Used in mobile equipment

EPD Development – How?

		Aggregates	
		Aggregate 1	
		Aggregate Name	In the EPD Tool, you will select from a drop down mix of the sources you have created in the "Ingredients" section. For now, enter the name here for your reference.
	percent	Amount per ton mix	Enter the percent of Aggregate 1 in each ton of mix
	miles	Truck transport distance	Enter the distance traveled by Aggregate 1 by truck to get **from the aggregate quarry to your production facility**. A material may be moved by one or several types of transport.
	miles	Train transport distance	Enter the distance traveled by Aggregate 1 by rail to get to your production facility.
	miles	Barge transport distance	Enter the distance traveled by Aggregate 1 by barge to get to your production facility.
	miles	Ocean transport distance	Enter the distance traveled by Aggregate 1 by ocean to get to your production facility.
		Aggregate 2	See Aggregate 1 for guidance.
		Aggregate Name	
	percent	Amount per ton mix	
	miles	Truck transport distance	
	miles	Train transport distance	
	miles	Barge transport distance	
	miles	Ocean transport distance	
		Aggregate 3	

PennDOT EPD Program

EPD Program

- EPD data (GWP-100) will be used to develop benchmarks specific to Pennsylvania
- Benchmarks will be used to set goals for reducing total GWP for cradle to gate mix production

"You can't really know where you are going until you know where you have been"
~Maya Angelou

"If you don't know where you are going, you might wind up some place else"
~Yogi Berra

EPD Exemptions

- New asphalt plant
  - < 12 months of energy consumption data
- New primary fuel source
  - < 12 months of energy consumption data
- Portable plants
  - < 12 months of energy consumption data at the same location
- Other unforeseen circumstances, if approved by DME/DMM

Data Collection - How?

- EPDs must be submitted as part of the 2025 annual JMF approval process
  - (Bulletin 27, Appendix J lays this out)
- Enter GWP-100 for
  - A1 – A3, Total

Data Collection - How?

- Access the webinar here:

eCAMMS

Procedure for Entering JMF EPD Information into eCAMMS

This document addresses the input of Environmental Product Declaration (EPD) information related to Job Mix Formulas (JMFs) into the electronic Construction and Materials Management System (eCAMMS). Input requirements are as follows:

1. Enter the Reference Data in the "**+ Add Reference Data**" section of eCAMMS. The "**+ Add Reference Data**" button is located at the bottom of the JMF "**Design**" page, as illustrated on pages 3 through 5 of this document. A list of the Reference Data Type fields and their descriptions is provided below. An example of EPD data and an illustration of that information once saved in eCAMMS can be found on page 7.

eCAMMS Reference Data Type fields	Description
EPD A1 – Materials (kg CO2/T)	Materials extraction component of global warming potential, including biogenic CO2 (GWP-100) per short ton* of mixture
EPD A2 – Transport (kg CO2/T)	Material transport component of global warming potential, including biogenic CO2 (GWP-100) per short ton* of mixture
EPD A3 – Production (kg CO2/T)	Production component of global warming potential, including biogenic CO2 (GWP-100) per short ton* of mixture
EPD Total A1-A3 (kg CO2/T)	Sum of A1, A2 and A3 per short ton* of mixture
EPD-Exemption: Date of Change**	Date the Exemption event occurred
EPD-Exemption: Reason**	Event/Reason for EPD Exemption

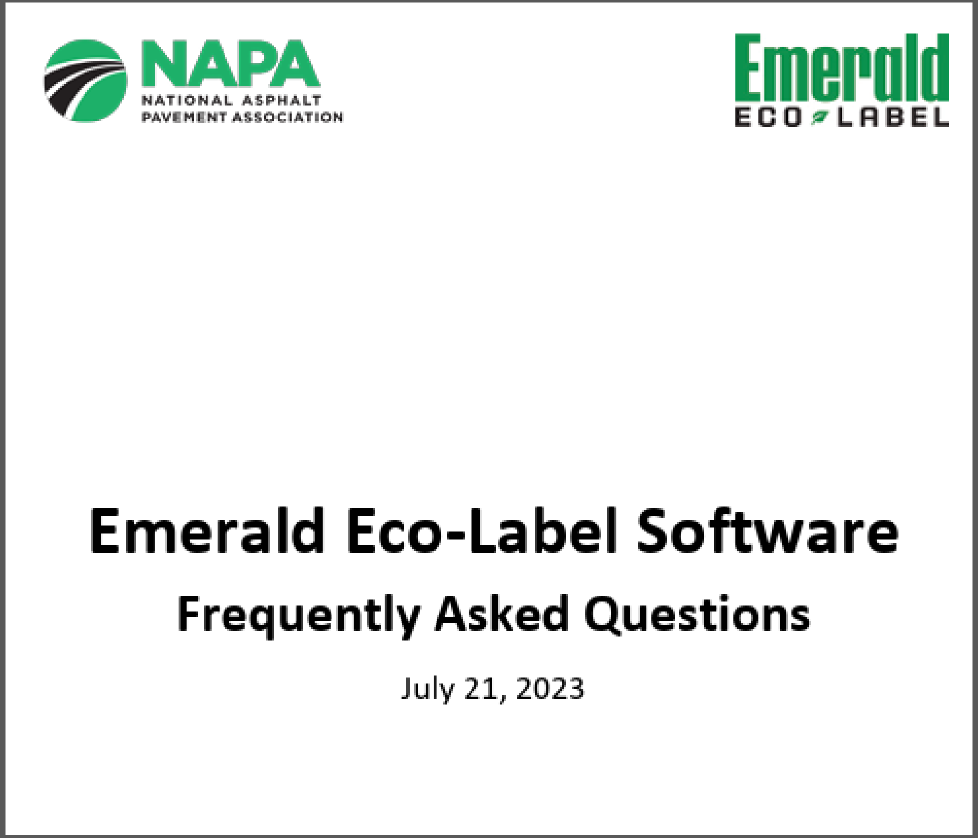
* Short ton is equal to a U.S. ton (2,000 lbs.)

** If 12 months of energy consumption data is unavailable due to a qualifying event (e.g., new plant, change in primary fuel source or a portable plant with less than 12 months operation at the same location), then enter the two EPD-Exemption Reference Data Types instead of the first four EPD Reference Data Types listed in the table above.

NOTE: If multiple asphalt binders are listed on the JMF, only enter JMF EPD Reference Data generated using the anticipated primary asphalt binder supplier.

Additional Resources:

- Emerald EcoLabel Documents
- FAQs and User Guide on PennDOT's eCAMMS
- FHWA webinar on EPDs for sustainable project delivery



NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

Emerald ECO LABEL

Emerald Eco-Label Software

Frequently Asked Questions

July 21, 2023

Upcoming PAPA Events

TO REGISTER: PAPA Events (pa-asphalt.org)

PAPA ENVIRONMENTAL SEMINAR

Harrisburg, PA
April 16, 2025

PAPA/PENNDOT BUS TOUR

District 10
July 29 & 30, 2025

Thank you….

Mary Robbins, Ph.D., P.E.
DIRECTOR OF TECHNICAL SERVICES
PA Asphalt Pavement Association
mary@pa-asphalt.org
(717) 657-1881 ext. 2
(419) 290-6360

Handling Modified Binders

Contractor's View

Presented by: Michael Worden

Prepared for the Association of Modified Asphalt Producers Training Program

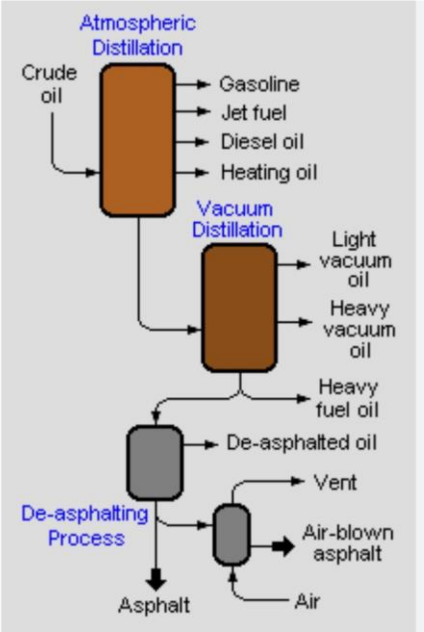
Association of Modified Asphalt Producers

Outline

- What is “Modified Binder”?
- Handling of Modified Binders at the Terminal
- Handling of Modified Binders at the Hot Mix Asphalt Plant
- Recommended Plant Operations
- Laydown of Modified Binder Mix
- Contractor’s Liquid Asphalt Binder QC Plan

What is asphalt binder?

It is a waterproof, thermoplastic adhesive. It acts as the “glue” that holds asphalt pavement mixes together. In its most simple definition, it is the “bottom of the barrel” when refining crude oil.



What is asphalt binder?

- It is a thermoplastic, viscoelastic material and behaves as a glass-like elastic solid at low temperatures or during high loading frequencies, and as a viscous fluid at high temperatures or low loading frequencies.
  - At high temperatures – fluid like
  - At low temperatures – a semi-solid

What is "Modified Binder"?

- Most typically, PMA (Polymer Modified Asphalt) is considered "Modified Binder"
  - Most agencies require SBS (Styrene-Butadiene-Styrene) for PMA
  - Can be used in HMA, WMA, and emulsion type applications
- Binders can also be modified with PPA (Polyphosphoric Acid), GTR(Ground Tire Rubber), and GTRH ("H" stands for "Hybrid", and means GTR with SBS)
- A binder could also be considered "modified" anytime an ingredient/constituent has been added to "neat" (unmodified) asphalt binder, to change/enhance/improve it's grade, properties, or performance
- Newer technologies include isocyanates and recycled plastics

PMA (Polymer Modified Asphalt)

Base asphalt modified with SBS (Styrene-Butadiene-Styrene)

+

GTR and GTRH modified binder

Base asphalt modified with GTR or GTRH

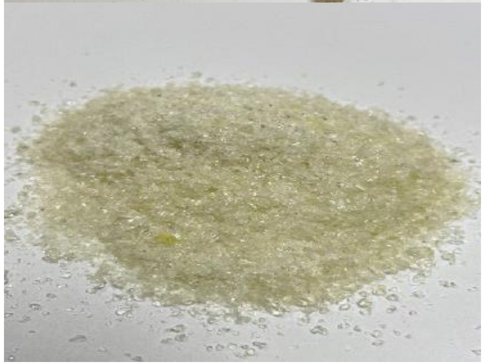
+

Chemically Modified Asphalt Binder

PPA (Polyphosphoric Acid), Isocyanates, WMA additives, rejuvenators, others…

Asphalt Binder modified with Recycled Plastic

New and evolving technology, considered “wet process” when added to binder



HANDLING MODIFIED ASPHALT BINDERS

HANDLING MODIFIED ASPHALTS

More and more asphalt binders are being modified

Most modified binders are in the PG 64-28 to 76-22 range

Be safe and follow manufacturer's recommendations

HANDLING MODIFIED ASPHALT

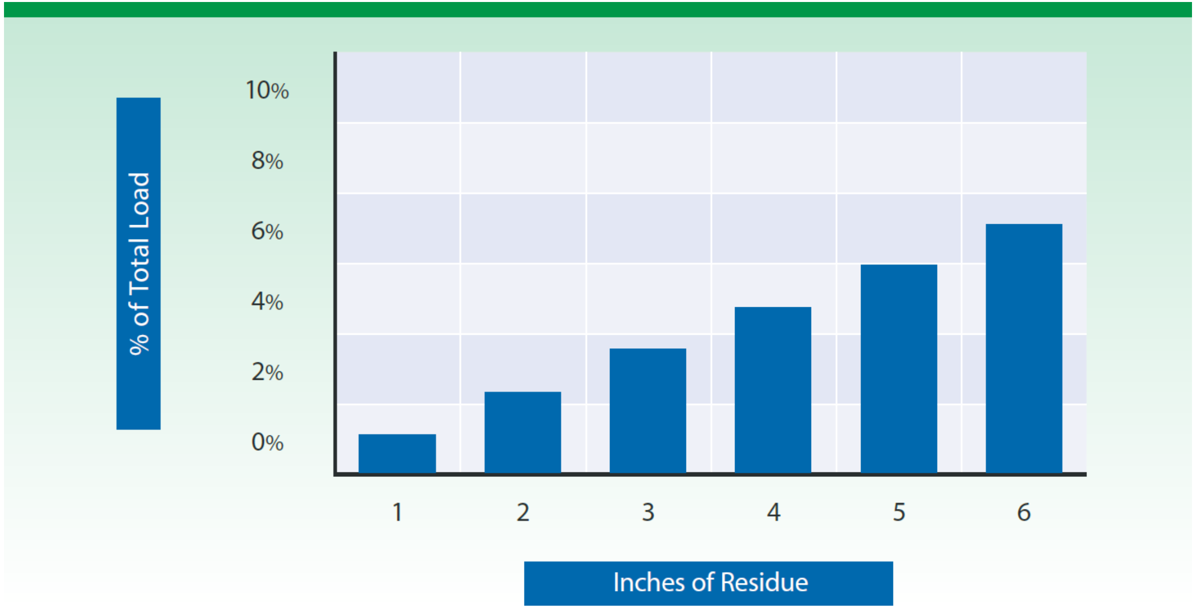
Mixing different asphalt binders ("neat" or modified) can cause the asphalt to fail

Reduce contamination at the terminal

Ensure tanker truck is empty before loading at terminal

Load from the correct loading arm at terminal

RESIDUE AS % OF LOAD



HANDLING Modified Binders AT THE PLANT

Reduce contamination at the HMA plant

- Pump into correct tank at HMA plant
- Use dedicated tanks, if possible
- If dedicated tank is not available
  - Empty tank as much as possible if previous material was different
  - Add 2 or 3 full loads of PMA before testing and/or using the material in the tank

Diluted Modified Binder may fail PG grade!!!

HANDLING Modified Binders AT THE PLANT

Vertical Tanks

- Vertical tanks provide more efficient agitation
- Very few PMAs require agitation to prevent separation
- Agitation is recommended for some GTR modified asphalt
- Not sure with new technologies
- Check with supplier

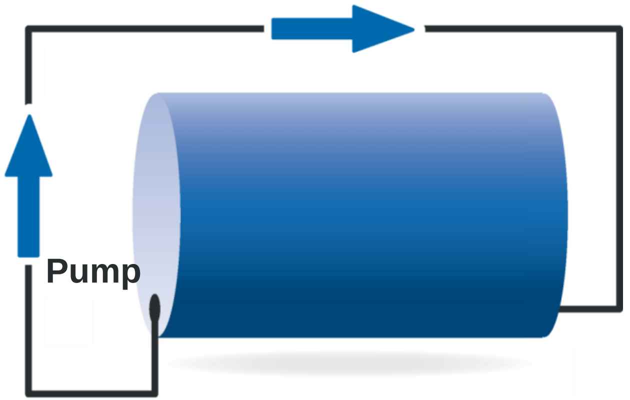
Check and Maintain Proper Temperatures!

HANDLING Modified Binders AT THE PLANT

Horizontal Tanks

- Horizontal tanks work fine for most PMAs
- Circulate to achieve uniform temperatures above and below heating coils

PROPER CIRCULATION IN HORIZONTAL TANKS



Suction and return lines at opposite ends of tank to completely circulate material

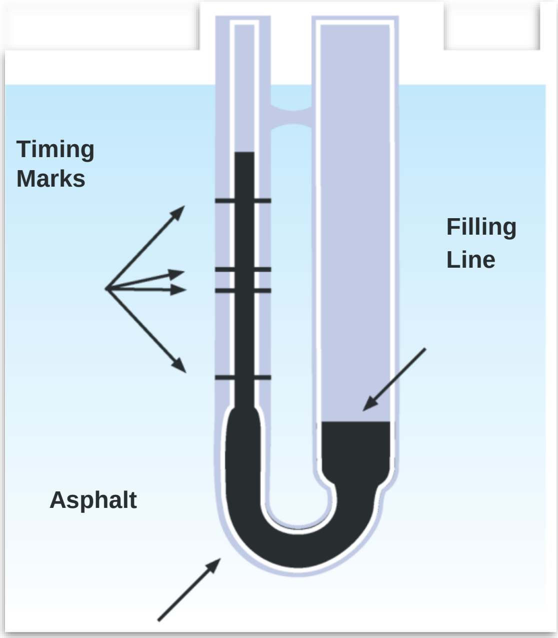
Return line near bottom of tank to prevent oxidation

HANDLING
Modified Binders
AT THE PLANT

BEWARE OF MIXING MODIFIED BINDERS FROM DIFFERENT SUPPLIERS!!!

- Different suppliers may use different technologies & chemistries
- Differing technologies & chemistries may not be compatible
- Mixing incompatible technologies & chemistries will cause failures!

MIXING & COMPACTION TEMPERATURE GUIDANCE



Asphalt Institute developed procedure in 1970's for determining laboratory mixing and compaction temperatures (MS-2)

Equiviscous laboratory mixing and compaction temperatures

- Viscosity at 135˚C and 165˚C
- Lab mixing range of 150-190 centistokes
- Lab compaction range of 250-310 centistokes

NOT FOR FIELD TEMPERATURES!!!

MIXING AND COMPACTION TEMPERATURE GUIDANCE

Superpave adopted AI procedure using rotational viscometer

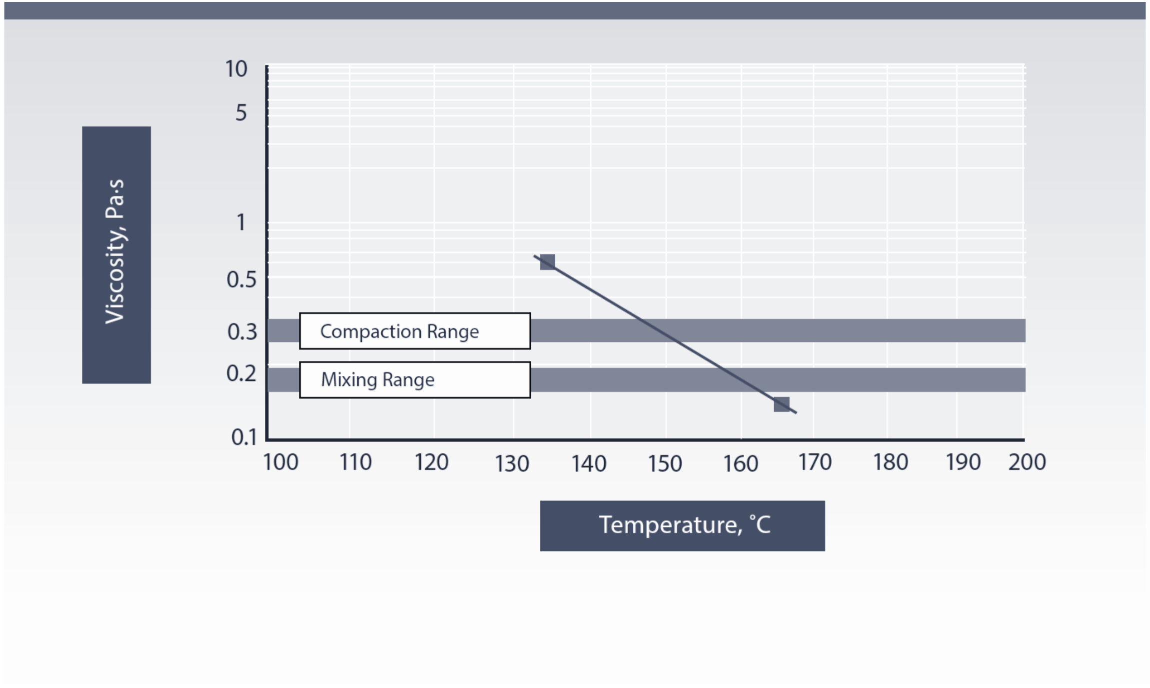
Equiviscous laboratory mixing and compaction temperatures

Does not work for PMA

- Yields extremely high temperatures
- Use suppliers' recommendations

Not For Field Temperatures for Unmodified or Modified Asphalts!!!

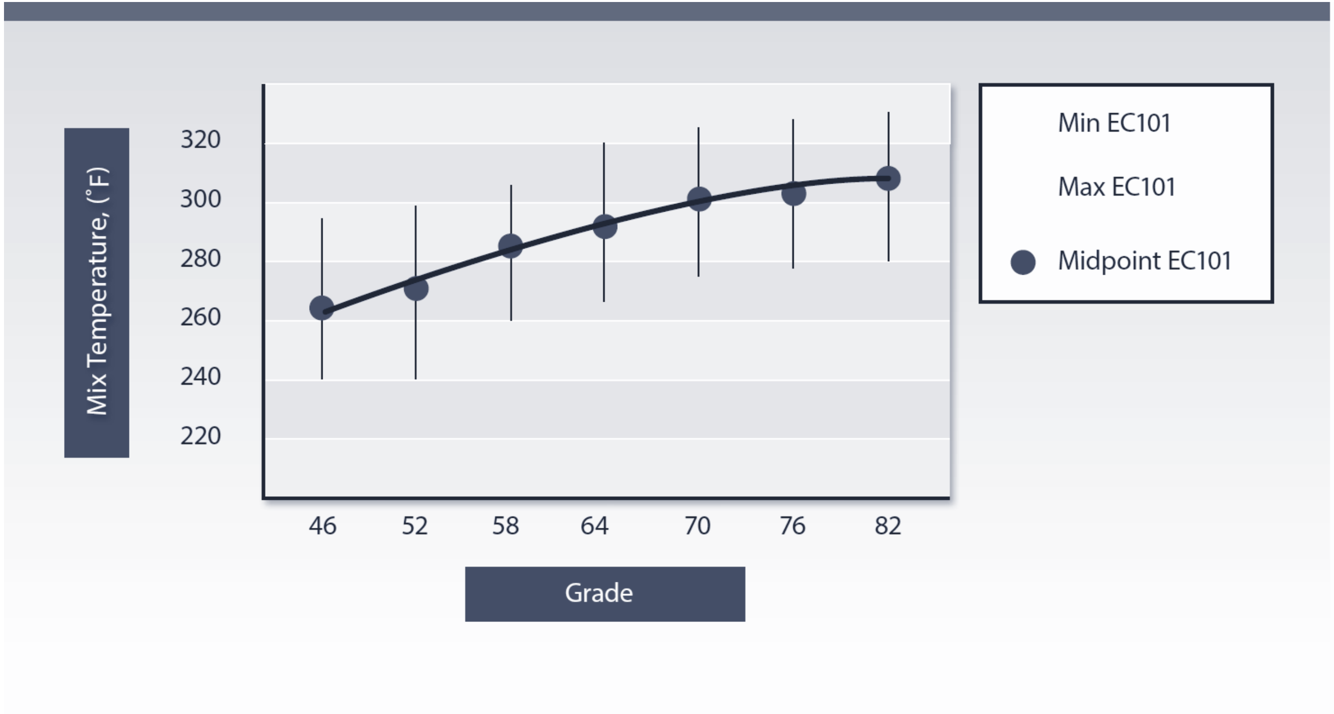
Method for "neat" (unmodified) **ONLY**!



Lab Compaction 0.28 ± 0.03 Pa.s

Lab Mixing 0.17 ± 0.02 Pa.s

EC-101 GENERAL RECOMMENDATIONS



Typical Asphalt Binder Temperatures

Binder Grade	HMA Plant Asphalt Tank Storage Temperature (°F)		HMA Plant Mixing Temperature (°F)	
	Range	Midpoint	Range	Midpoint
PG 46 -28	260 – 290	275	240 – 295	264
PG 46 -34	260 – 290	275	240 – 295	264
PG 46 -40	260 – 290	275	240 – 295	264
PG 52 -28	260 – 295	278	240 – 300	270
PG 52 -34	260 – 295	278	240 – 300	270
PG 52 -40	260 – 295	278	240 – 300	270
PG 52 -46	260 – 295	278	240 – 300	270
PG 58 -22	280 – 305	292	260 – 310	285
PG 58 -28	280 – 305	292	260 – 310	285
PG 58 -34	280 – 305	292	260 – 310	285
PG 64 -22	285 – 315	300	265 – 320	292
PG 64 -28	285 – 315	300	265 – 320	292
PG 64 -34	285 – 315	300	265 – 320	292
PG 67 -22	295 – 320	308	275 – 325	300
PG 70 -22	300 – 325	312	280 – 330	305
PG 70 -28	295 – 320	308	275 – 325	300
PG 76 -22	315 – 330	322	285 – 335	310
PG 76 -28	310 – 325	318	280 – 330	305
PG 82 -22	315 – 335	325	290 – 340	315

Use mid-point temperature for test strip construction.

ASPHALT PAVEMENT ENVIRONMENTAL COUNCIL

APEC is comprised of the following organizations: National Asphalt Pavement Association, Asphalt Institute, State Asphalt Pavement Associations

EC-101

EC-101 General Storage and Plant Mixing Temperature GUIDANCE

GENERAL GUIDELINES FOR STORAGE AND MIXING TEMPERATURES

PG Binder	Storage Temperature (˚F)	Mixing Temperature (˚F)
64-22	285-315	265-320
70-22	300-325	280-330
76-22	325-340	285-335
Extended Storage <275˚F		

Source: EC-101

HMA PLANT ASPHALT PUMP

Adequately sized AC pump

- Modified Binders can cause higher amperage draw

AC pump in good condition

Calibrated

Strainer

- Larger than standard holes – 1/4”
- Clean

Circulate “neat” (unmodified) binder first, before start-up

Switch to Modified Binder, and circulate before start-up

Switch back to unmodified asphalt and circulate through pump after shutdown at end of shift

Do NOT leave the Modified Binder in the plant’s AC pumps, meters & strainer until next shift

HMA PLANT ASPHALT PUMP OPERATION

HMA PLANT SLAT CONVEYOR

Properly Sized

Good Condition

Mix produced with Modified Binder can increase amperage draw on conveyor

- Start at reduced tonnage rate
- Start on unmodified mix to heat conveyor

MODIFIED HMA STORAGE

IMPORTANT:

DO NOT STORE OVERNIGHT!!!

TRANSPORTING MODIFIED HMA TO PAVER

Clean, smooth truck beds

Release agent

- Type
- Amount
- “More” is not “Better”

Tarps, Tarps, Tarps

PLACING MODIFIED HMA

Typically, no modifications to equipment

Handwork can be more difficult

Attention to detail is KEY

Weather Conditions – 50°F minimum

COMPACTING MODIFIED HMA

Compaction Equipment

- Number–3 or 4
- Type–high frequency
- Size

Mix temperature

- Only high enough to allow proper compaction
- Follow manufacturer’s recommendations

Roller pattern

- Front roller close to paver

Field monitoring

- Temp
- Density

COMPACTING MODIFIED HMA

Compacting mixes with PMA may actually be easier than un-modified asphalt mixes

- Compaction requires confinement
- PMA may eliminate tender zone

CONTRACTOR QC PLAN

Contractors need to establish QC plan to prevent PG asphalt contamination and failing test results

- Identify all hardware–label or number
  - Tanks
  - Pumps
  - Piping
  - Valves
  - Sample points
  - Heat system
- Establish standard procedures and hardware settings for asphalt flow into storage and into HMA plant

SUMMARY

Proper modification can improve the performance of HMA pavements

Understand the product you are using… Modified Binders and "Neat" (Unmodified) Binders are **NOT THE SAME**!

- Follow suppliers' recommendations
- Use Best Practices
- Be Safe

Thank You!

Michael Worden

mworden@associatedasphalt.com

Modifiedasphalt.org

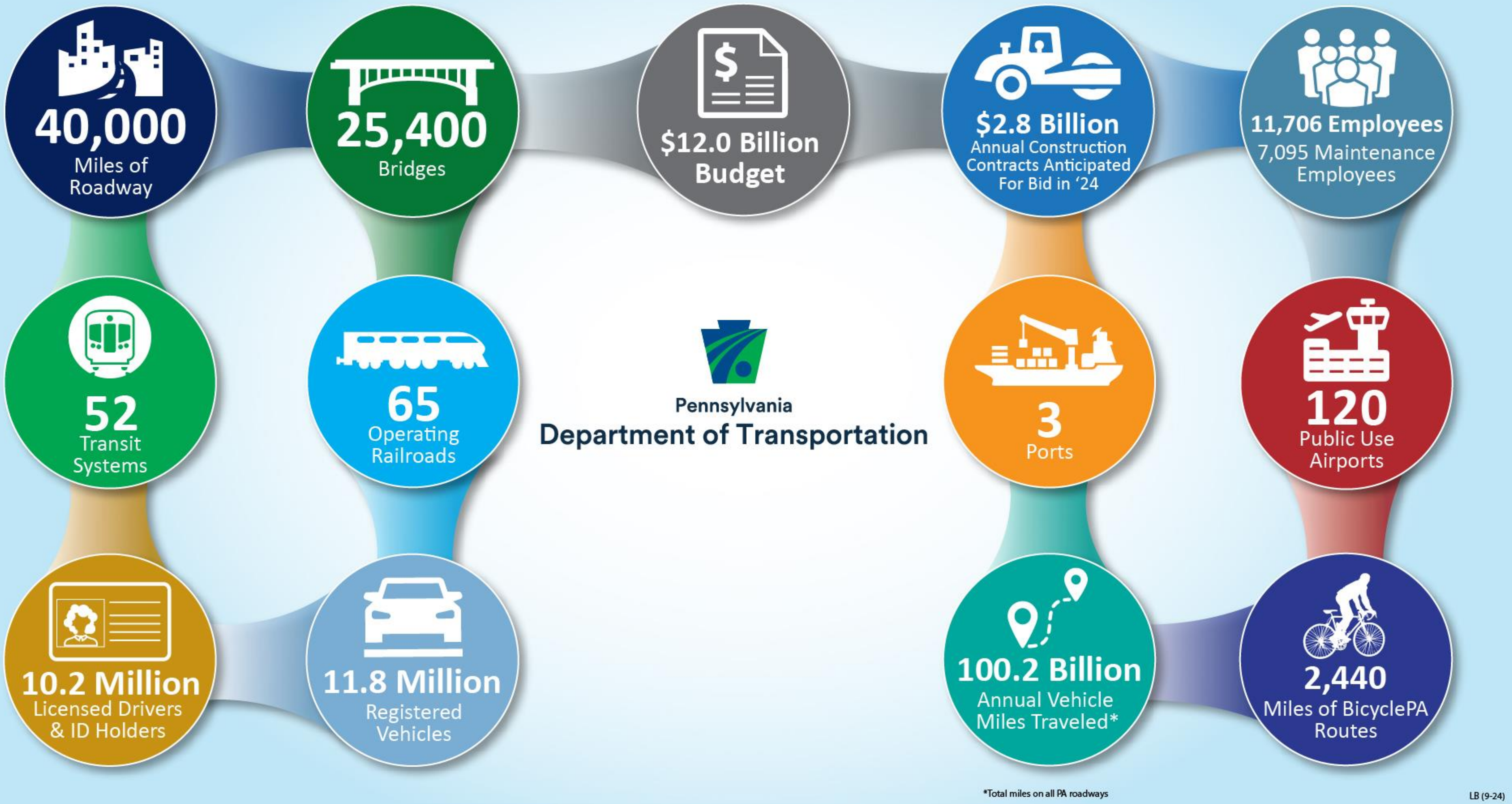
UPDATE ON PENNDOT BULLETIN 27

2025 PennDOT/NECEPT Asphalt Plant Technician Annual Update/Refresher Course

TIMOTHY L. RAMIREZ, P.E., ENGINEER OF TESTS, PENNDOT

pennsylvania
DEPARTMENT OF TRANSPORTATION

PENNDOT BY THE NUMBERS



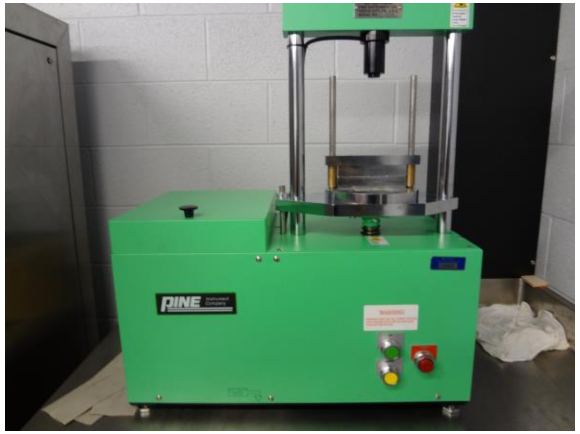
LB (9 -24)

OUTLINE

1. Bulletin 27, 2003 Edition, Changes

2. eCAMMS Release 45 Enhancements for Asphalt JMFs

3. AASHTO Standards, Changes
   (If time allows)



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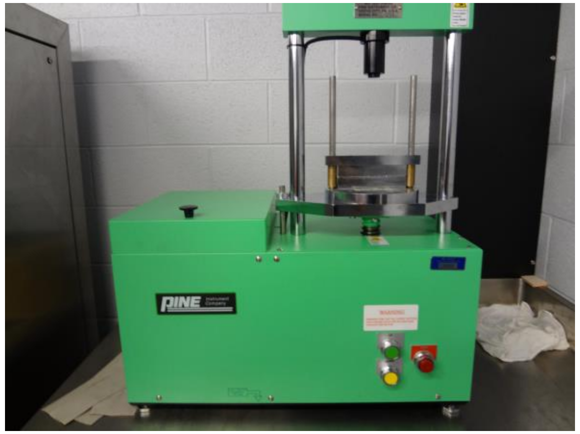
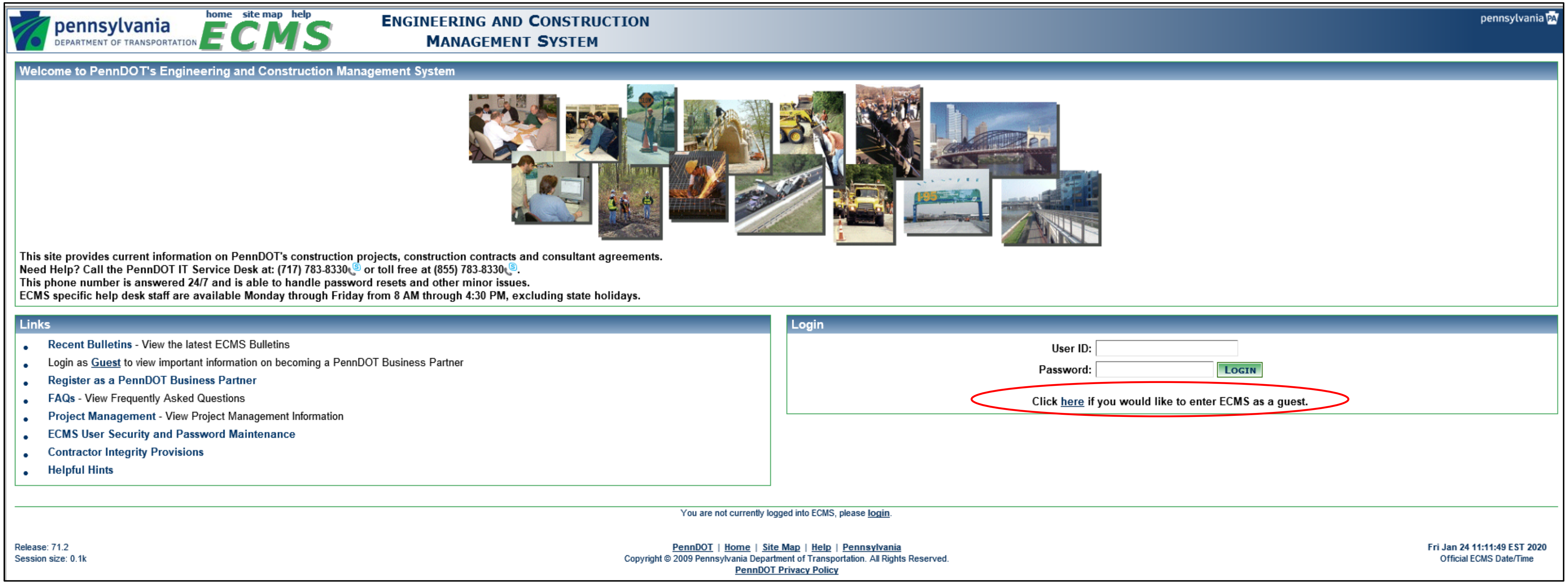


BULLETIN 27, 2003, CHANGES

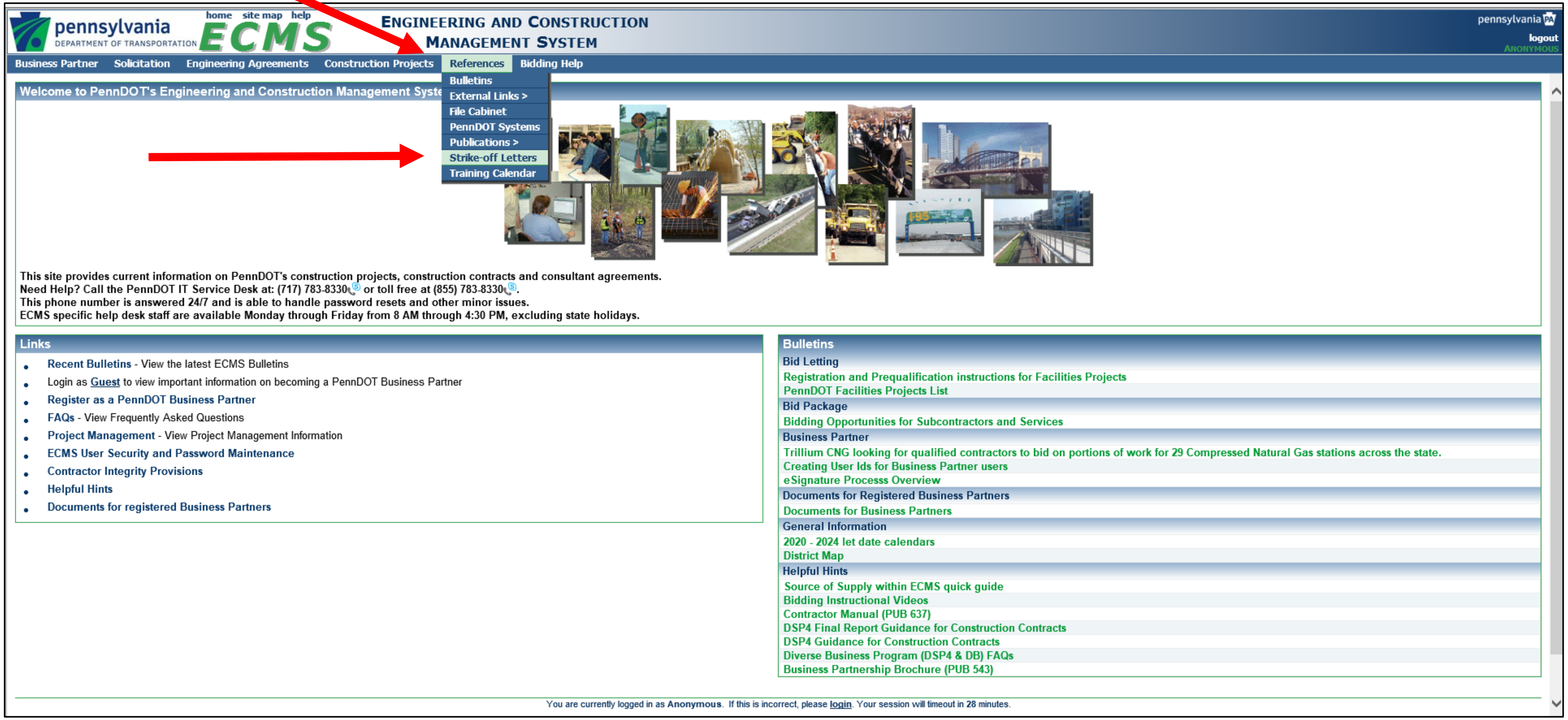
- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

ACCESSING PENNDOT STRIKE-OFF LETTERS (SOL)

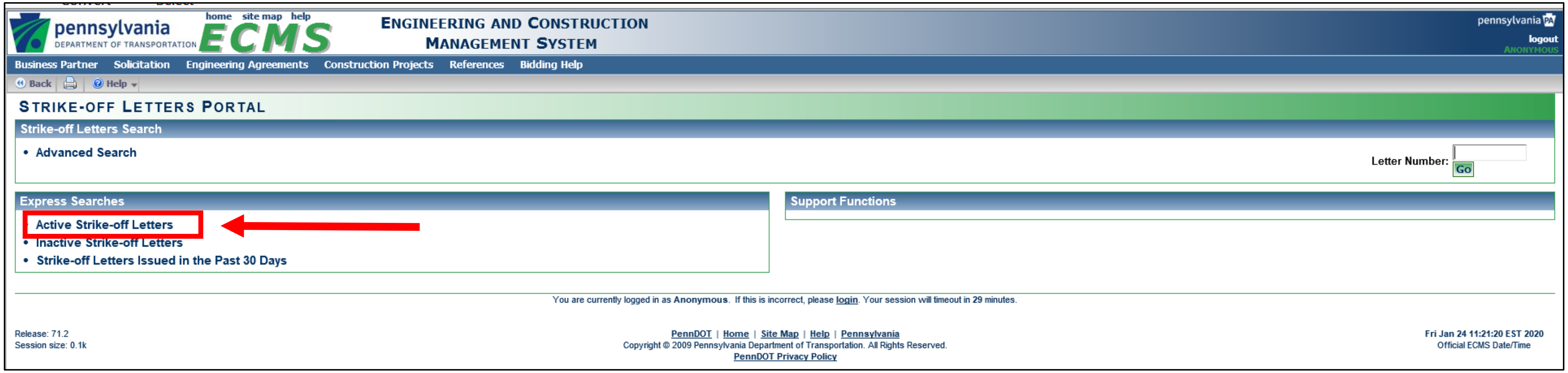
- ECMS - https://www.ecms.penndot.pa.gov/ECMS/



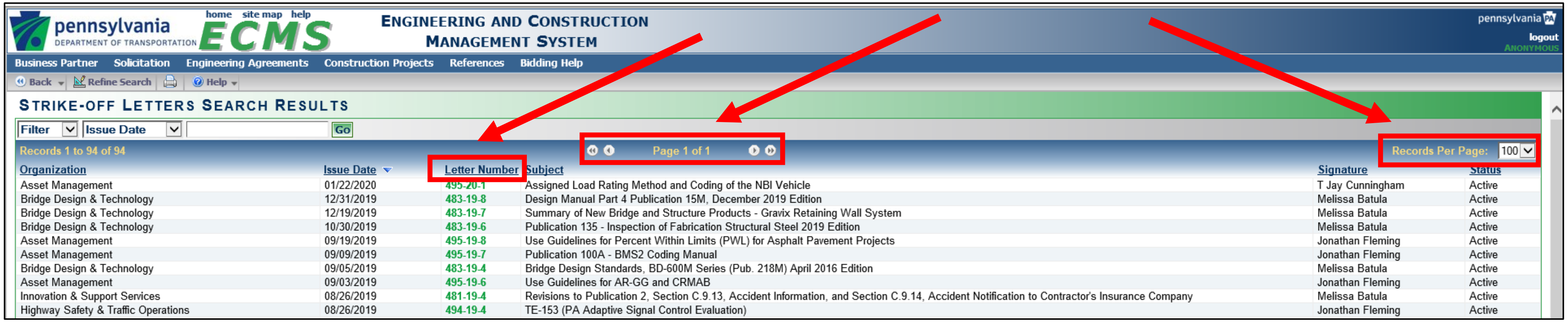
ACCESSING PENNDOT SOLS



ACCESSING PENNDOT SOL



ACCESSING PENNDOT SOL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STRIKE-OFF LETTERS SEARCH RESULTS

Filter | Issue Date | Go

Records 1 to 94 of 94 | Page 1 of 1 | Records Per Page: 100

Organization	Issue Date	Letter Number	Subject	Signature	Status
Asset Management	01/22/2020	495-20-1	Assigned Load Rating Method and Coding of the NBI Vehicle	T Jay Cunningham	Active
Bridge Design & Technology	12/31/2019	483-19-8	Design Manual Part 4 Publication 15M, December 2019 Edition	Melissa Batula	Active
Bridge Design & Technology	12/19/2019	483-19-7	Summary of New Bridge and Structure Products - Gravix Retaining Wall System	Melissa Batula	Active
Bridge Design & Technology	10/30/2019	483-19-6	Publication 135 - Inspection of Fabrication Structural Steel 2019 Edition	Melissa Batula	Active
Asset Management	09/19/2019	495-19-8	Use Guidelines for Percent Within Limits (PWL) for Asphalt Pavement Projects	Jonathan Fleming	Active
Asset Management	09/09/2019	495-19-7	Publication 100A - BMS2 Coding Manual	Jonathan Fleming	Active
Bridge Design & Technology	09/05/2019	483-19-4	Bridge Design Standards, BD-600M Series (Pub. 218M) April 2016 Edition	Melissa Batula	Active
Asset Management	09/03/2019	495-19-6	Use Guidelines for AR-GG and CRMAB	Jonathan Fleming	Active
Innovation & Support Services	08/26/2019	481-19-4	Revisions to Publication 2, Section C.9.13, Accident Information, and Section C.9.14, Accident Notification to Contractor's Insurance Company	Melissa Batula	Active
Highway Safety & Traffic Operations	08/26/2019	494-19-4	TE-153 (PA Adaptive Signal Control Evaluation)	Jonathan Fleming	Active

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- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-04 – ISSUED ON 04/13/2016

- General:
  - Changes to reduce the number of annual JMFs submitted for review and approval
  - Bulletin 27, Appendix J – Revisions
  - Bulletin 27, Appendix K – New
    - Standardized JMF Naming (Numbering) System
  - Bulletin 27, Chapter 2A – Revisions
  - Bulletin 27, Chapter 2B – Revisions

- Submit JMFs meeting following conditions:
  - Existing JMFs produced and placed for a PennDOT or Municipal Project (Liquid Fuels Funds) during previous construction year
    - QC results must be in eCAMMS ESB
  - New JMFs that producer identifies will be used on an <u>awarded</u> PennDOT or Municipal Project (Liquid Fuels Funds)
  - In select cases, new JMFs the DME/DMM elects to review after receiving request in writing from Producer

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-04 – APPENDIX J REVISIONS

- Archive all other existing JMFs
  - Submit archived JMFs on an as-needed basis where the JMF will be used on newly awarded PennDOT or Municipal Project (Liquid Fuel Funds)
  - Submit archived JMFs at least 3 weeks before start of mixture production

- Prior to Any JMF submittals and when the submitted aggregate Gsb values are not within the Table J-1 tolerances of the LTS Bulletin 14 aggregate Gsb values
  - Follow-up testing is required
    - Any testing determined by the DME/DMM
      - Aggregate Gsb and absorption testing
      - Asphalt mixture testing
      - Other

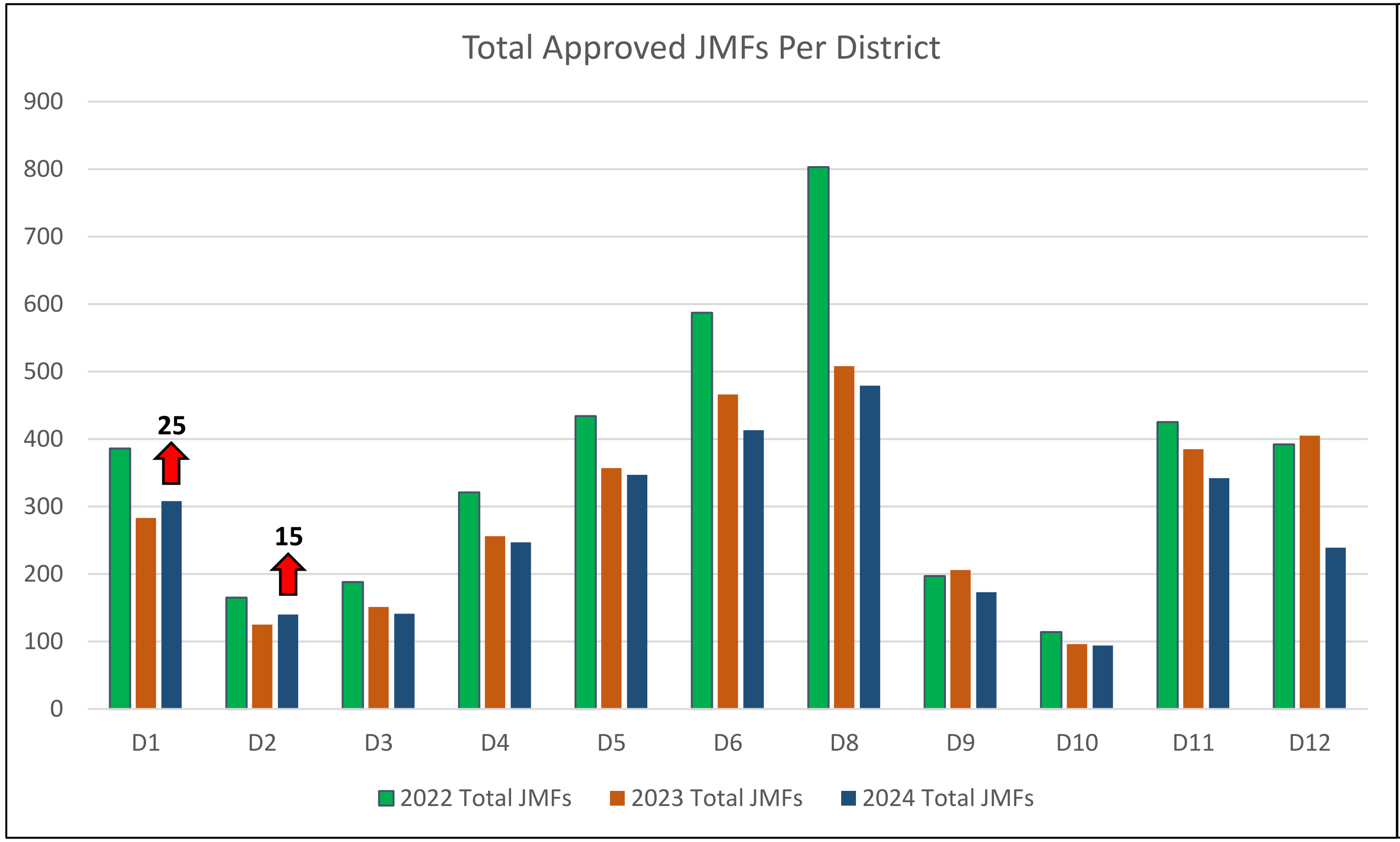
BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-04 – CHAPTER 2A REVISIONS

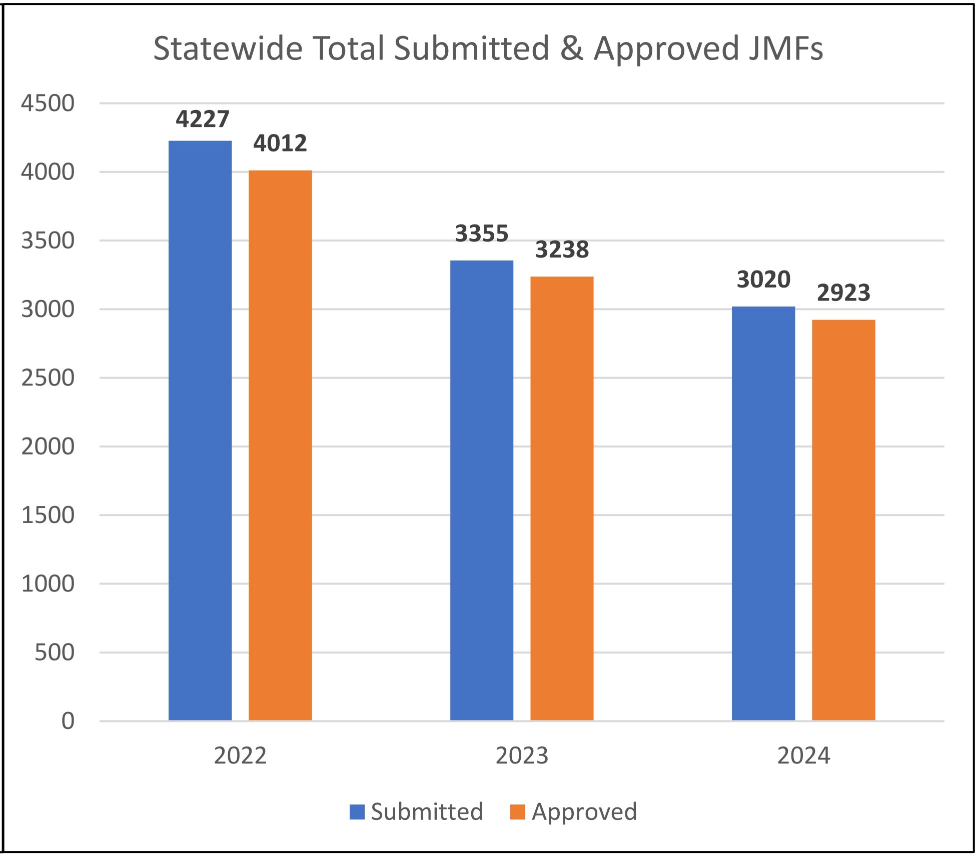
- Bulletin 27, Chapter 2A, Modifications to AASHTO R 35, Section 13. Report
  - Assign a JMF number by using the naming convention shown in Appendix K – Table 1
  - No other changes

SOL# 481-16-04 – CHAPTER 2B REVISIONS

- Bulletin 27, Chapter 2B, Modifications to AASHTO R 46, Section 4. Summary of the Practice
  - Subsection 4.6 Review of the Job Mix Formula (JMF)
  - Assign a JMF number by using the naming convention shown in Appendix K – Table 1
  - No other changes

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-04 (4/13/16) – JMF REDUCTION





57.8% Reduction in Submitted since 2016.
56.0% Reduction in Approved since 2016.

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – ISSUED ON 10/28/2016

- General (Applies to Chapter 2A and Chapter 2B):
  - All JMFs (HMA and WMA) approved after December 30, 2016 required to contain a minimum amount of anti-strip (AS) additive
  - Existing AS requirements associated with WMA JMFs were deleted from Pub. 408, Section 311 and Section 411
    - i.e., WMA Categorized as Mechanical Foaming requiring minimum 0.25 percent AS
  - JMFs containing both coarse and fine aggregate types that are highly moisture susceptible
    - required to be evaluated for moisture susceptibility or contain a higher dosage of AS

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4.4 (Page 2A-7)
    - 1st paragraph – AASHTO T 283 mixture conditioning according to Bulletin 27, Appendix I
      - i.e., 2 hours or 6 hours at 140, 145, or 153°C (285, 293, or 308°F)
- Chapter 2B:
  - Modifications to AASHTO R 46, Section 4. Summary of the Practice
    - Revisions (New) to Subsection 4.4 *Evaluating Moisture Susceptibility* (Page 2B-2)
      - 1st paragraph – AASHTO T 283 mixture conditioning according to Bulletin 27, Appendix I
        - i.e., 2 hours or 6 hours at 153°C (308°F)

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4.4 (Page 2A-7)
    - 1st paragraph – AASHTO T 283 mixture conditioning according to Bulletin 27, Appendix I
      - i.e., 2 hours or 6 hours at 140, 145, or 153°C (285, 293, or 308°F)

- Chapter 2B:
  - Modifications to AASHTO R 46, Section 4. Summary of the Practice
    - Revisions (New) to Subsection 4.4 *Evaluating Moisture Susceptibility* (Page 2B-2)
      - 1st paragraph – AASHTO T 283 mixture conditioning according to Bulletin 27, Appendix I
        - i.e., 2 hours or 6 hours at 153°C (308°F)

- **DO NOT DO!**

Note that the above Chapter 2A modification was removed in the SOL # 481-22-01 version and is correct in SOL # 481-24-01 version.

- Chapter 2A and Chapter 2B:
  - AASHTO T 283 Mixture Conditioning
    - AASHTO T 283, Section 6.4 (LMLC) - After mixing:
      - Mixture cooled at room temperature for 2 ± 0.5 h
      - Mixture placed in a 60 ± 3°C (140 ± 5°F) oven for 16 ± 1 h for curing
      - Place the mixture in an oven for 2 h ± 10 min at the compaction temperature ±3°C (5°F) prior to compaction
    - AASHTO T 283, Section 7.4 (FMLC):
      - No loose-mix curing as described in Section 6.4 shall be performed on the field-mixed samples
      - Next, place the mixture in an oven *for 2 h ± 10 min at the* compaction temperature ±3°C (5°F) prior to compaction

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 4.4 (Page 2A-7)
- Chapter 2B:
  - AASHTO R 46, Section 4.4 (Page 2B-2)

  - Mixtures containing both CA and FA classified as a type of sandstone, siltstone, slag, quartz, shale, or gravel
    - Producer may elect to conduct AASHTO T 283 testing at minimum dosage rate (e.g., 0.25%) and at dosage one level higher (e.g., 0.50%)
    - If all true, set AS, hydrated lime, or alternate AS dosage rate at the higher dosage rate:
      - TSR of higher dosage mixture is higher than TSR of minimum dosage mixture
      - Conditioned and unconditioned tensile strengths of all AASHTO T 283 tests are above the minimum strengths in Bulletin 27, modifications to AASHTO R 35, Section 11.3 or AASHTO R 46, Section 11.3 as appropriate.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 4.4 (Page 2A-7)
- Chapter 2B:
  - AASHTO R 46, Section 4.4 (Page 2A-7)

  - All mixtures shall include either:
    - compatible, heat stable, amine-based liquid anti-strip (AS),
    - hydrated lime, or
    - another alternate compatible AS additive
  - Include AS additive at minimum dosage on manufacturer's tech data sheet (typ. 0.25% by mass AC)
  - Mixtures containing both CA and FA classified as a type of sandstone, siltstone, slag, quartz, shale, or gravel
    - Include AS, hydrated lime, alternate AS at dosage one level higher than minimum dosage rate (typ. 0.50% by mass AC)

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4, Summary of the Practice
    - Subsection 4.5 Review of the Job-Mix Formula (JMF) (Page 2A-3)
- Chapter 2B:
  - Modifications to AASHTO R 46, Section 4. Summary of the Practice
    - Subsection 4.6 Review of the Job Mix Formula (JMF) (Page 2B-2)

- Does not include reference to Appendix K (JMF/Mix Design Numbering/Naming System)

- Must use SOL 481-16-04
  - Assign a JMF number by using the naming convention shown in Appendix K – Table 1
  - Note: Appendix K reference included for Chapter 2B, but not for Chapter 2A

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4, Summary of the Practice
    - Subsection 4.5 Review of the Job-Mix Formula (JMF) (Page 2A-3)
- Chapter 2B:
  - Modifications to AASHTO R 46, Section 4. Summary of the Practice
    - Subsection 4.6 Review of the Job Mix Formula (JMF) (Page 2B-2)

- Does not include reference to Appendix K (JMF/Mix Design Numbering/Naming System)

- Must use SOL 481-16-04
  - Assign a JMF number by using the naming convention shown in Appendix K – Table 1
  - Note: Appendix K reference included for Chapter 2B, but not for Chapter 2A

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 11.3 (Added Page 16)
- Chapter 2B:
  - AASHTO R 46, Section 11.3 (Page 2B-7)

- Moisture susceptibility must be re-evaluated, at a minimum, once every 5 years (when JMF material sources, proportions, & targets remain same)

- Moisture susceptibility must be re-evaluated when material sources change or, material proportions or JMF targets significantly change, as determined by the DME/DMM

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 11.3 (Added Page 16)
    - For virgin mixtures or mixtures falling under Appendix H, Tier 1 design
      - Compute required minimum AS or alternate AS dosage rate based on virgin asphalt binder content
    - For mixtures falling under Appendix H, Tier 2 design
      - Compute required minimum AS or alternate AS dosage rate based on the total asphalt in the mixture
- Chapter 2B:
  - AASHTO R 46, Section 11.3 (Page 2B-7)
    - Compute required minimum AS or alternate AS dosage rate based on total asphalt in the mixture

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 11.3 (Added Page 16)
- Chapter 2B:
  - AASHTO R 46, Section 11.3 (Page 2B-7)

- All WMA versions of same parent HMA JMF must have separate moisture susceptibility evaluations

- If HMA JMF requires anti-strip (AS), the WMA version of that JMF, produced by WMA Technology categorized as foaming or foaming process, must contain the minimum dosage of AS required in the HMA JMF.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 11.3 (Added Page 16)
- Chapter 2B:
  - AASHTO R 46, Section 11.3 (Page 2B-7)

  - If Producer elects to use an alternate AS (not typical amine-based AS), contact DME/DMM
    - If directed by DME/DMM, perform moisture testing using alternate AS at manufacturer’s recommended minimum dosage rate
    - If directed by DME/DMM, provide other documentation of successful use of alternate AS

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 13, Report (Added Page 19)
- Chapter 2B:
  - AASHTO R 46, Section 13, Report (Page N/A)

  - Chapter 2B does not include reference to Appendix K [JMF/Mix Design Naming (Numbering) System]

  - Must use SOL 481-16-04
    - Assign a JMF number by using the naming convention shown in Appendix K – Table 1
    - Note: Appendix K reference included for Chapter 2A, but not for Chapter 2B

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-16-06 – CHAPTER 2A AND CHAPTER 2B REVISIONS

- Chapter 2A:
  - AASHTO R 35, Section 13, Report (Added Page 19)
- Chapter 2B:
  - AASHTO R 46, Section 13, Report (Page N/A)

- Chapter 2B does not include reference to Appendix K [JMF/Mix Design Naming (Numbering) System]

- Must use SOL 481-16-04
  - Assign a JMF number by using the naming convention shown in Appendix K – Table 1
  - Note: Appendix K reference included for Chapter 2A, but not for Chapter 2B

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-21-02 – ISSUED ON 11/30/2021

- General (Applies to Chapter 2A Only):
  - Reduction in number of gyrations at N_{design}
    - AASHTO R 35, Section 8, Table 1 revisions
  - Increase in minimum design VMA for 9.5, 12.5, 19.0, 25.0 and 37.5 mm NMAS
    - AASHTO M 323, Section 7.2, Table 7 revisions
  - Revised VFA Ranges
    - AASHTO M 323, Section 7.2, Table 7 and Table 7 footnotes revisions (*Now Table 8*)
  - Other reference updates (e.g., Section 409 to Section 413)
  - Superseded by SOL# 481-22-01 dated January 21, 2022 and SOL# 481-24-01 dated February 23, 2024.

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-22-01 – ISSUED ON 1/21/2022

- Implementation of Performance Related Testing Results:
  - For eCAMMS JMF Year 2023:
    - All < 0.3 Million Design ESAL Range Asphalt Wearing Courses:
      - Require submission of performance related testing results as part of the JMF.
      - Performance related testing results <u>for information only</u>.
      - DME/DMM may approve 2023 Asphalt Wearing Course JMFs without performance related testing results entered in eCAMMS on a <u>case-by-case</u> basis.
  - Revised Bulletin 27, 2003 Edition, Chapter 2A.
  - Superseded by SOL# 481-24-01 dated February 23, 2024.

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
EMAIL TO DME/DMM DATED 02/14/2022

- Appendix K:
  - Addition of the New, Reduced Gyration, Design Life ESAL Ranges

Superseded by SOL# 481-24-01 issued 2/23/2024.

a. < 0.3 Million(Nd=50)
b. 0.3 to < 3 Million(Nd=75)
c. 0.3 to < 10 Million(Nd=75)
d. 3 to < 10 Million(Nd=75)
e. 0.3 to < 30 Million(Nd=75)
f. 3 to < 30 Million(Nd=75)
g. 10 to < 30 Million(Nd=75)
h. >= 30 Million(Nd=75)
i. < 0.3 Million(Nd=75, BC) – Intended for 25.0 mm and 37.5 mm Base Courses (BC) Only.
j. < 10 Million(Nd=75, BC) – Intended for 25.0 mm and 37.5 mm Base Courses (BC) Only.
k. < 30 Million(Nd=75, BC) – Intended for 25.0 mm and 37.5 mm Base Courses (BC) Only.

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

- **Letter**
  - Revised Timeline for Implementation
    - JMF Years 2023 to 2027
  - General Requirements, Inclusions, and Exclusions
    - Identification of designated lab for AASHTO T 324 (HWT) testing and ASTM D8225 (CT_{Index}) testing.
    - Requirements for third-party commercial laboratories.
    - 48-hour advance notification to DME/DMM before preparing test specimens for mechanical testing.
    - Additional eCAMMS Reference Data Type Fields for identifying the PGAB Supplier, WMA Technology Material Class, and Anti-Strip Additive Product used in the test specimens. (*Now permanent fields within the Hamburg Design and IDEAL CT Design subpages*)
    - Mechanical testing data not required each JMF Year if mechanical testing data was previously submitted in prior JMF Year if primary component materials remained the same and no significant changes in material proportions or gradations.
    - New mechanical testing data required if primary material sources change or if significant changes to proportions or gradations occur prior to submitting an existing JMF.
      - New mechanical data not required if primary material sources change after JMF approval and during production/construction season of JMF.
    - Copying a JMF previously submitted with mechanical testing data.
      - *New Hamburg Design & IDEAL CT Design subpages require reentry of data.*
- **Bulletin 27, Chapter 2A**
  - Nomenclature from mixture performance related testing results to mixture mechanical testing results.
  - Editorial updates to reflect recent AASHTO M 323 (replaced “HMA” with “asphalt mixture”, new Table 8 – VMA, Section numbering) and AASHTO R 35 (replaced “HMA” with “asphalt mixture, Section numbering)
- **Bulletin 27, Appendix K**
  - Added High RAP for Low Volume Roadways Option (4) to RAP/RAS number.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

- Revised Timeline for Implementation of Mixture Mechanical Testing Results:
  - For eCAMMS JMF Year 2025:
    - All < 0.3 Million Design ESAL Range (N_{design} = 50 Gyr.) Asphalt Wearing Courses:
      - NMAS: 6.3 mm, 9.5 mm, 9.5 mm FG, 12.5 mm, & 19.0 mm
      - SRL: E, H, G, M, & L
      - Require submission of mixture mechanical testing results as part of the JMF.
      - Mixture mechanical testing results <u>for information only</u>.
    - All > 0.3 Million Design ESAL Ranges (N_{design} = 75 Gyr.) Asphalt Wearing Courses:
      - NMAS: 6.3 mm, 9.5 mm, 9.5 mm FG, 12.5 mm, & 19.0 mm
      - SRL: E, H, G, M, & L
      - Require submission of mixture mechanical testing results as part of the JMF.
      - Mixture mechanical testing results <u>for information only</u>.
      - <u>No</u> Asphalt Wearing Courses will be approved without submission of mechanical testing results entered in eCAMMS.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

Courses	JMF Year 2024	JMF Year 2025	JMF Year 2026
Wearing Courses (6.3, 9.5, 9.5 FG, 12.5, 19.0 mm) Ndesign = 50 Gyr., SRL E, H, G, M, and L	Yes	Yes	Yes
Wearing Courses (6.3, 9.5, 9.5 FG, 12.5, 19.0 mm) Ndesign = 75 Gyr., SRL = E and H	Yes	Yes	Yes
Wearing Courses (6.3, 9.5, 9.5 FG, 12.5, 19.0 mm) Ndesign = 75 Gyr., SRL = G, M, and L	No (E-HWT-CT-Both)	Yes	Yes
Wearing Courses (4.75 mm)	No	No	No
Binder Courses (19.0, 25.0 mm)	No (E-HWT-CT-Both)	No (E-HWT-CT-Both)	No (E-HWT-CT-Both)
Base Courses (25 mm, 37.5 mm)	No (E-CT)	No (E-CT)	No (E-CT)
SMA (9.5, 12.5 mm)	No (E-HWT-CT-Both)	Yes	Yes
Pervious Courses (9.5, 19.0 mm)	No	No	No
Ultra-Thin Bonded Wearing Courses	No	No	No

Green or Yes = Both HWT & CT-Index Required

Orange or No (E-HWT-CT-Both) = HWT and CT-Index Not Required, But HWT, CT-Index, or Both HWT & CT-Index is Encouraged

Blue or No (E-CT) = HWT and CT-Index Not Required, But CT-Index is Encouraged

Red or No = HWT and CT-Index Not Required

2025 JMFs for WR9.5M will also require both HWT & CT-Index.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

- General (Applies to Chapter 2A Only):
  - Includes SOL# 481-21-02 & SOL# 481-22-01
    - Reduction in number of gyrations at N_{design}
    - Increase in minimum design VMA for 9.5, 12.5, 19.0, 25.0 and 37.5 mm NMAS
    - Revised VFA Ranges
    - Other reference updates (e.g., Section 409 to Section 413 and AASHTO M 323 Table reference updates)

  - Includes previous Non-Pay Item Related Standard Special Provision, a10650 MINIMUM EFFECTIVE ASPHALT FOR 9.5 MM OR 12.5 MM SUPERPAVE MIXTURES

  - Includes Mechanical Testing Requirements, Mechanical Testing Limits, and Exceptions If Limits Are Met

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

- Chapter 2A:
  - Title (Page 2A-1)

  - **Design and Control of Hot-Mix Asphalt (HMA) Mixtures Using the Superpave Asphalt Mixture Design and Analysis System with the Additional Requirement of Mechanical Testing**

- Chapter 2A:
  - Modifications to 1. General Scope (Page 2A-1)

  - “The Department has established procedures for the design and control of asphalt mixture based on the Superpave Asphalt Mixture Design and Analysis System, with the addition of mechanical testing to help ensure that asphalt mixtures achieve optimum performance.”

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4, Summary of the Practice
    - Subsection 4.4 Evaluating Moisture Susceptibility (Page 2A-4)

  - “The DME/DMM may allow JMFs that conform to the Mechanical Testing Limits in the Department's added AASHTO M 323, Section 7.4, Table 10 to use the exceptions in the Department's added AASHTO M 323, Section 7.4, Table 11.”

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4, Summary of the Practice
    - New Subsection 4.5 Evaluating Rutting (Page 2A-4)

  - Perform rut testing according to AASHTO T 324 as modified in the Department's modifications to AASHTO M 323, Section 7.4.

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 4, Summary of the Practice
    - New Subsection 4.6 Evaluating Cracking (Page 2A-4)

  - Perform crack testing according to ASTM D8225 as modified in the Department's modifications to AASHTO M 323, Section 7.4.

- Chapter 2A:
  - Modifications to AASHTO R 35, Section 8. Compacting Specimens of Each Trial Gradation
    - Revisions to Table 1 - Superpave Gyratory Compaction Effort (Page 2A-7)

  - Binder & Wearing Courses:
    - < 0.3 Million Design ESALS – N_{design} = 50
    - ≥ 0.3 Million Design ESALS – N_{design} = 75

  - Base Courses:
    - All Design ESAL Ranges – N_{design} = 75

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-01 – ISSUED ON 2/23/2024

- Chapter 2A:
  - Modifications to AASHTO M 323, Section 7. Asphalt Mixture Design Requirements
    - Complete revision to Section 7.2 (Page 2A-18)

  - The asphalt mixture design, when compacted in accordance with AASHTO T 312, shall meet the relative density, VMA, and dust to binder ratio requirements specified in Table 7, the VFA requirements in Table 8, and the minimum effective asphalt requirements in Table 9.

- Chapter 2A:
  - Modifications to AASHTO M 323, Section 7. Asphalt Mixture Design Requirements
    - Modification to Table 7 – Superpave Asphalt Mixture Design Requirements and to Table 8 – Voids Filled with Asphalt (Page 2A-19)

NMAS	Table 7 Design VMA, % Minimum	Table 8 Design VFA % Minimum	Table 8 Design VFA % Maximum
4.75 mm	16.0	62	79
9.5 mm	16.0	75	81
12.5 mm	15.0	73	79
19.0 mm	14.0	71	76
25.0 mm	13.0	68	74
37.5 mm	12.0	66	72

- Chapter 2A:
  - Modifications to AASHTO M 323, Section 7. Asphalt Mixture Design Requirements
    - New Table 9 – Minimum Effective Asphalt (Pbe) for 9.5 mm and 12.5 mm Superpave Asphalt Mixtures (Page 2A-20)

  - Min. Pbe for each range of Combined Aggregate Bulk Specific Gravity (Gsb) from the Non-Pay Item Related Standard Special Provision, a10650 MINIMUM EFFECTIVE ASPHALT FOR 9.5 MM OR 12.5 MM SUPERPAVE MIXTURES

- Chapter 2A:
  - Modifications to AASHTO M 323, Section 7. Asphalt Mixture Design Requirements
    - New Subsection 7.4 Mechanical Testing (Page 2A-20)

- Mechanical testing at JMF design binder content including all additives.
- Prepare laboratory-mixed, laboratory-compacted test specimens.
- Mixture conditioning for preparation of test specimens for mechanical testing. Different conditioning temperatures by grade of PGAB.
- Air voids for test specimens for performance testing (7.0 ± 0.5%).
- AASHTO T 324 test temperature (50 ± 1°C).
- AASHTO T 324 test to a maximum 20,000 passes or to maximum rut depth of 20 mm, whichever occurs first.
- AASHTO T 324 calculate a stripping inflection point (SIP) when output plot shows two steady state portions of the plot.
- ASTM D8225 test temperature (25 ± 1°C)
- Submit Delta Tc (ΔT_c) results for JMFs having a total reclaimed binder ratio (RBR) of ≥ 0.35, evaluate the JMF blended binder according to AASHTO R 114, Section 7.2, using the AASHTO R 114, Section 7.6 Procedure for Evaluating Specific Mixtures.
- The DME/DMM may allow JMFs that conform to all of the testing criteria in Table 10 to apply the criteria exceptions in Table 11 to the JMF.

- Chapter 2A:
  - Modifications to AASHTO M 323, Section 7. Asphalt Mixture Design Requirements
    - New Table 10 – Mechanical Testing Limits (Page 2A-22)

- Mechanical Testing Limits by Design ESAL Range for:

Property	Criteria
Rutting & Moisture Susceptibility (AASHTO T 324)	Maximum Rut Depth at 20,000 Passes (mm) SIP (minimum passes) Minimum Passes at 12.5 mm Rut Depth
Cracking (ASTM D8225)	CT Index
High RAP / RAS (≥ 0.35 RBR) (AASHTO R 114, Section 7)	ΔT_c

- Chapter 2A:
  - Modifications to AASHTO M 323, Section 7. Asphalt Mixture Design Requirements
    - New Table 11 – Exceptions for JMFs that Meet All Table 10 Requirements (Page 2A-22)

- Exceptions for:

Property	Specification Requirement if Table 10 Limits are Met
Percent Air Voids at N_{Design}	3.0 to 4.1
Moisture Susceptibility	AASHTO T 283 and mandatory anti-strip waived
Asphalt PG Grade	PG grade bumping to meet all performance testing limits allowed

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
- SOL# 481-16-06 – issued on 10/28/2016
  - Active for large portion of Chapter 2B (Chapter 2A in this SOL is no longer active, superseded by SOL# 481-22-01).
- SOL# 481-21-02 – issued on 11/30/2021
  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

- Appendix K:
  - Addition of the New, Reduced Gyration, Design Life ESAL Ranges

a. < 0.3 Million(Nd=50)
b. 0.3 to < 3 Million(Nd=75)
c. 0.3 to < 10 Million(Nd=75)
d. 3 to < 10 Million(Nd=75)
e. 0.3 to < 30 Million(Nd=75)
f. 3 to < 30 Million(Nd=75)
g. 10 to < 30 Million(Nd=75)
h. >= 30 Million(Nd=75)
i. < 0.3 Million(Nd=75, BC) – Intended for 25.0 mm and 37.5 mm Base Courses (BC) Only.
j. < 10 Million(Nd=75, BC) – Intended for 25.0 mm and 37.5 mm Base Courses (BC) Only.
k. < 30 Million(Nd=75, BC) – Intended for 25.0 mm and 37.5 mm Base Courses (BC) Only.

Cheat Sheet for Appendix K

- Asphalt JMF Naming System ESAL # for new eCAMMS JMF Design ESAL Ranges.
- ECMS Standard Item Number Description ESAL Ranges vs. the New, Reduced Gyration, eCAMMS Design ESAL Ranges.

New eCAMMS ESAL Ranges	eCAMMS Appendix K ESAL #
< 0.3 Million(Nd=50)	1
0.3 to < 3 Million(Nd=75)	2
0.3 to < 10 Million(Nd=75)	6
3 to < 10 Million(Nd=75)	6
0.3 to < 30 Million(Nd=75)	7
3 to < 30 Million(Nd=75)	7
10 to < 30 Million(Nd=75)	7
>= 30 Million(Nd=75)	8
< 0.3 Million(Nd=75, BC)	1
< 10 Million(Nd=75, BC)	6
< 30 Million(Nd=75, BC)	7

ECMS Standard Item Number Description ESAL Ranges	Equivalent eCAMMS JMF ESAL Ranges for projects let after December 30, 2021[a]
< 0.3 MILLION	< 0.3 Million(Nd=50)
	< 0.3 Million(Nd=75, BC)[b]
	< 10 Million(Nd=75, BC)[b]
	< 30 Million(Nd=75, BC)[b]
0.3 TO < 3 MILLION	0.3 to < 3 Million(Nd=75)
	0.3 to < 10 Million(Nd=75)
	0.3 to < 30 Million(Nd=75)
	< 10 Million(Nd=75, BC)[b]
	< 30 Million(Nd=75, BC)[b]
3 TO < 10 MILLION	3 to < 10 Million(Nd=75)
	0.3 to < 10 Million(Nd=75)
	3 to < 30 Million(Nd=75)
	0.3 to < 30 Million(Nd=75)
	< 10 Million(Nd=75, BC)[b]
	< 30 Million(Nd=75, BC)[b]
10 TO < 30 MILLION	10 to < 30 Million(Nd=75)
	3 to < 30 Million(Nd=75)
	0.3 to < 30 Million(Nd=75)
	< 30 Million(Nd=75, BC)[b]
>/= 30 MILLION	>= 30 Million(Nd=75)

[a] Colors indicate eCAMMS JMF ESAL Range Spans Multiple ECMS ESAL Ranges.

[b] 25.0 mm and 37.5 mm Base Courses Only.

Asphalt Concrete Mix Design Naming System

- Intended for **JMF/Mix Design Number** field in eCAMMS
- Up to 10 characters

- Gyratory Mix Example: **W95221G1**

  W = Type WMA
  95 = Size 9.5 mm
  2 = ESALS 0.3 to <3 (75 Ndes)
  2 = Asphalt Binder PG 64S-22
  1 = RAP/RAS Tier 1
  G = SRL-G
  1 = Version

- Non-Gyratory Mix Example: **ATPBC201**

  ATPBC = Class ATPBC (Asphalt Treated Permeable Base Course)
  2 = Asphalt Material PG 64S-22
  0 = SRL-N/A
  1 = Version 1

BULLETIN 27, 2003, CHANGES

- Change 5 - issued on 01/19/2011
  - Active, except for Chapters 2A, 2B, and Appendix J.
- SOL# 481-16-04 – issued on 04/13/2016
  - Active for small portion of Chapters 2B (Chapter 2A, Appendix J, and Appendix K in this SOL are no longer active).
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  - Not Active, superseded by SOL# 481-22-01.
- SOL# 481-22-01 – issued on 01/21/2022
  - Not Active, superseded by SOL# 481-24-01.
- Email from Timothy Ramirez to all DME/DMMs and copied to PAPA Representatives dated 02/14/2022
  - Not Active, superseded by SOL# 481-24-01.
- SOL# 481-24-01 – issued on 02/23/2024
  - Active for Chapter 2A and Appendix K.
- SOL# 481-24-02 – issued on 11/08/2024
  - Active for Appendix J.

BULLETIN 27, 2003 EDITION, CHANGES
SOL# 481-24-02 – ISSUED ON 11/08/2024

- Appendix J:
  - Asphalt Job Mix Formula (JMF) Submissions,
    - Environmental Product Declarations (EPDs) (Page J-8).

  - Added the requirement for submission of Environmental Product Declarations (EPDs) and related data entry into eCAMMS.

  - Additional minor updates due to Publication 408 changes and formatting are also included.

  - Submit any questions or additional information requests to EPDS@pa.gov.

1) EPD requirements for JMFs:

   a) Submit “Cradle to Gate” (A1 – A3) EPDs for all JMFs submitted for approval.

   b) EPDs must be plant and product specific, published, and developed conforming to ISO 14025, ISO 21930, and the Product Category Rules (PCR) for asphalt mixtures. ISO 14025 refers to these as a Type III (Third Party Reviewed) EPDs.

   c) Attach the EPD to each annual JMF submission using the attachment feature in eCAMMS.

   d) Enter the Global Warming Potential (GWP) from the attached JMF EPD in the eCAMMS reference data fields as shown in Table J-3.

1) EPD requirements for JMFs (continued):

d) JMFs will not be approved without EPD attachment and GWP data entry, unless the following exemptions apply:

- New asphalt plants with less than 12 months of energy consumption data.
- Asphalt plants with new primary fuel sources with less than 12 months of energy consumption data.
- Portable plants with less than 12 months of energy consumption data at the same location.
- Other unforeseen circumstances preventing EPD creation, as specified in (b) above, if approved by the DME/DMM.
- Additional exemption using Conditionally Approved JMF:
  - If an asphalt producer ***does not supply asphalt to ECMS construction projects***, they have no mechanism to seek reimbursement for the costs of developing their EPDs. For these asphalt producers, they can be granted an exemption on the EPD requirement and have their 2025 JMFs approved without an EPD attachment and the Global Warming Potential data entered as required in SOL 481-24-02. This exemption will allow these producers to continue supplying asphalt to Department maintenance forces and local municipalities. However, JMFs approved with this exemption ***cannot*** be used on an ECMS construction project. A JMF approved using this exemption, will be Conditionally Approved for the District(s) the producer supplies asphalt to using ***Not Aprvd for ECMS Proj*** as the Permitted Application.

OUTLINE

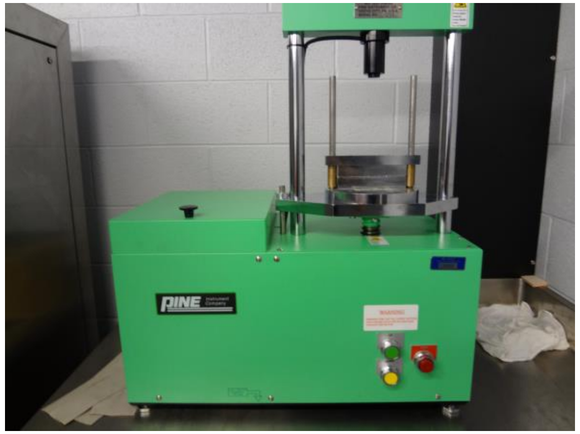
1. Bulletin 27, 2003 Edition, Changes

2. **eCAMMS Release 45 Enhancements for Asphalt JMFs**

eCAMMS

3. AASHTO Standards, Changes
   (If time allows)

AASHTO

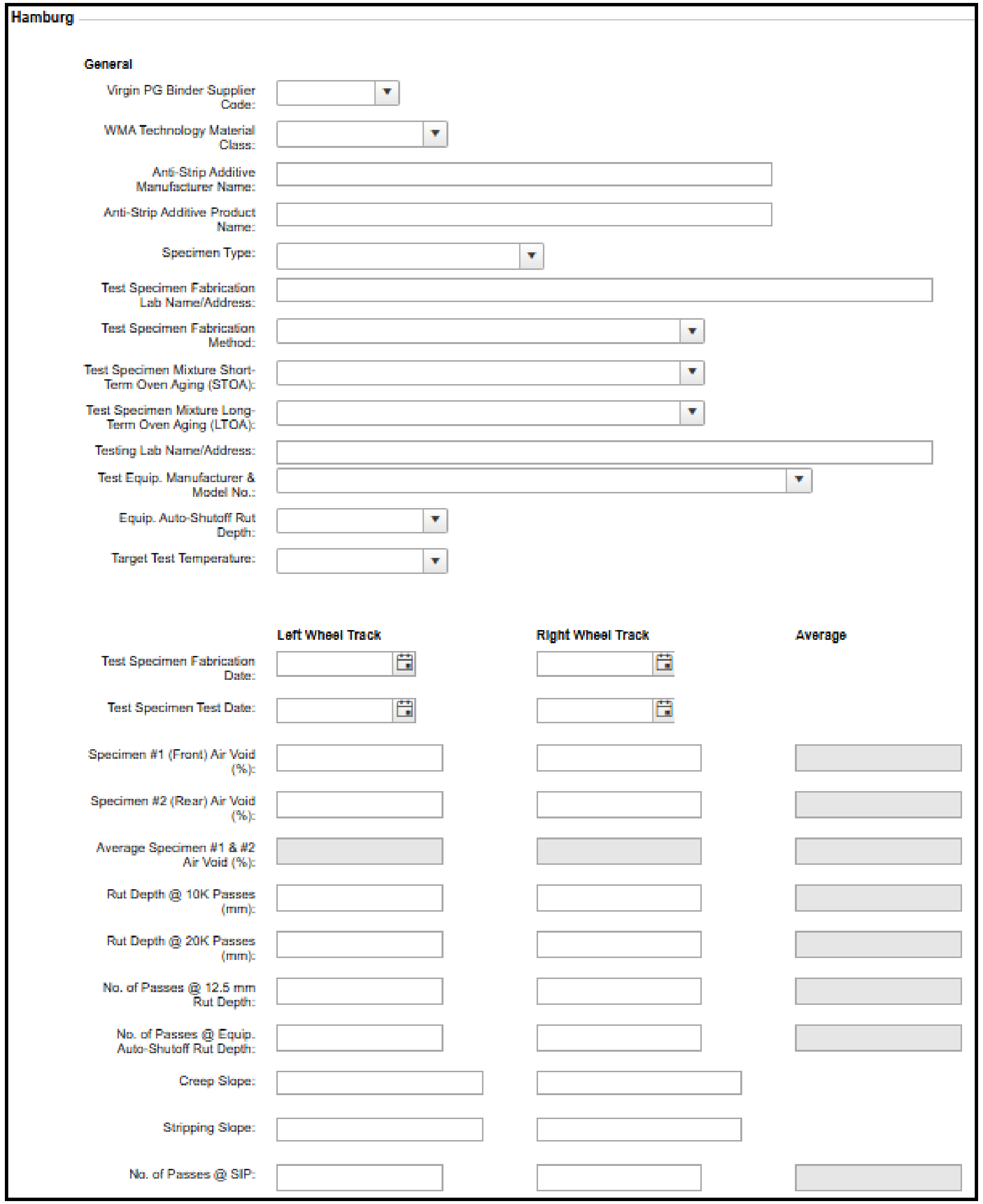


ECAMMS RELEASE 45 ENHANCEMENTS

- JMF Maintenance: Hamburg Design Subpage.
- JMF Maintenance: IDEAL CT Design Subpage.
- Both subpages will be required to be completed to submit JMFs that require submission of Hamburg Wheel Track Testing and IDEAL-CT testing data according to SOL# 481-24-01.
  - In 2025, all Wearing Courses except:
    - 4.75 mm Wearing Courses
    - 9.5 mm Pervious Wearing Courses
    - Ultra Thin Bonded Wearing Courses, Type A, B, & C.

ECAMMS JMF HAMBURG DESIGN

- Permanent Data Fields
- Dropdown Fields
- Fields formatted to specific required data formats.
  - See Hamburg Design Subpage Guidelines Document.
- Some fields have upper and lower limits to prevent incorrect data entry.
- Much easier data entry.
- Data cannot be copied from a previous year's JMF with HWT Data.


Hamburg

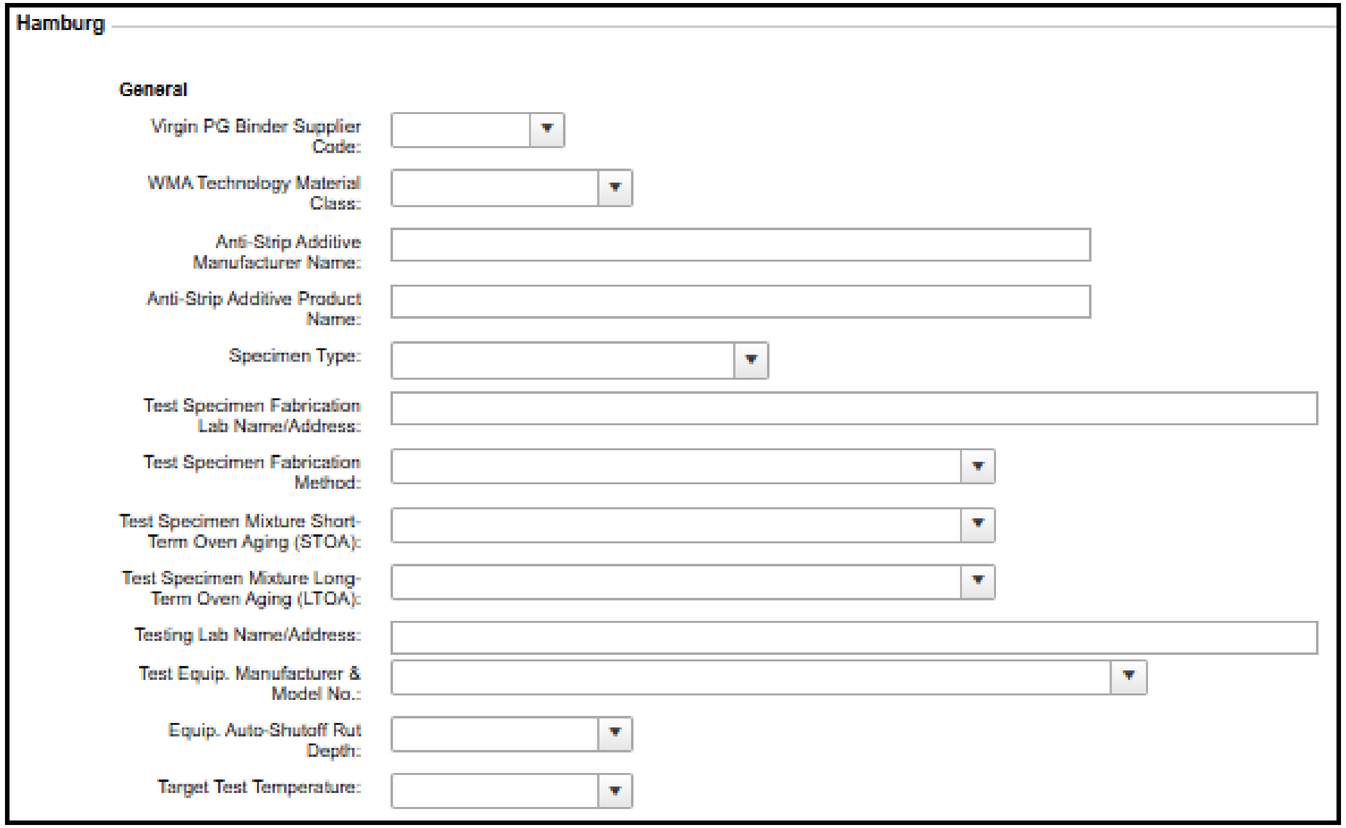
General

Virgin PG Binder Supplier Code:
WMA Technology Material Class:
Anti-Strip Additive Manufacturer Name:
Anti-Strip Additive Product Name:
Specimen Type:
Test Specimen Fabrication Lab Name/Address:
Test Specimen Fabrication Method:
Test Specimen Mixture Short-Term Oven Aging (STOA):
Test Specimen Mixture Long-Term Oven Aging (LTOA):
Testing Lab Name/Address:
Test Equip. Manufacturer & Model No.:
Equip. Auto-Shutoff Rut Depth:
Target Test Temperature:

	Left Wheel Track	Right Wheel Track	Average
Test Specimen Fabrication Date:			
Test Specimen Test Date:			
Specimen #1 (Front) Air Void (%):			
Specimen #2 (Rear) Air Void (%):			
Average Specimen #1 & #2 Air Void (%):			
Rut Depth @ 10K Passes (mm):			
Rut Depth @ 20K Passes (mm):			
No. of Passes @ 12.5 mm Rut Depth:			
No. of Passes @ Equip. Auto-Shutoff Rut Depth:			
Creep Slope:			
Stripping Slope:			
No. of Passes @ SIP:			

ECAMMS JMF HAMBURG DESIGN

- WMA Technology Material Class field is <u>not</u> required and can be left blank on JMF Material Classes starting with SP, SR, SMA, HR, HV, & UTBWC.
- Anti-Strip Additive Product Name should not be same as Anti-Strip Additive Manufacturer Name.
- Test Specimen Long-Term Oven Aging (LTOA) field is <u>not</u> required and can be left blank.
- Testing Lab Name/Address field can be copied from Online Bulletin 41 Physical Address field.



ECAMMS JMF HAMBURG DESIGN

- Creep Slope field is always required and may require manual calculation of the creep slope using the Hamburg test report rut depth vs. # of passes plot and data table.
- Two Hamburg Test Scenarios:
    1) Hamburg Testing goes full 20,000 Passes and then shuts off.
    2) Hamburg Testing reaches the auto-shutoff rut depth before reaching a full test of 20,000 passes and shuts off with < 20,000 Passes.

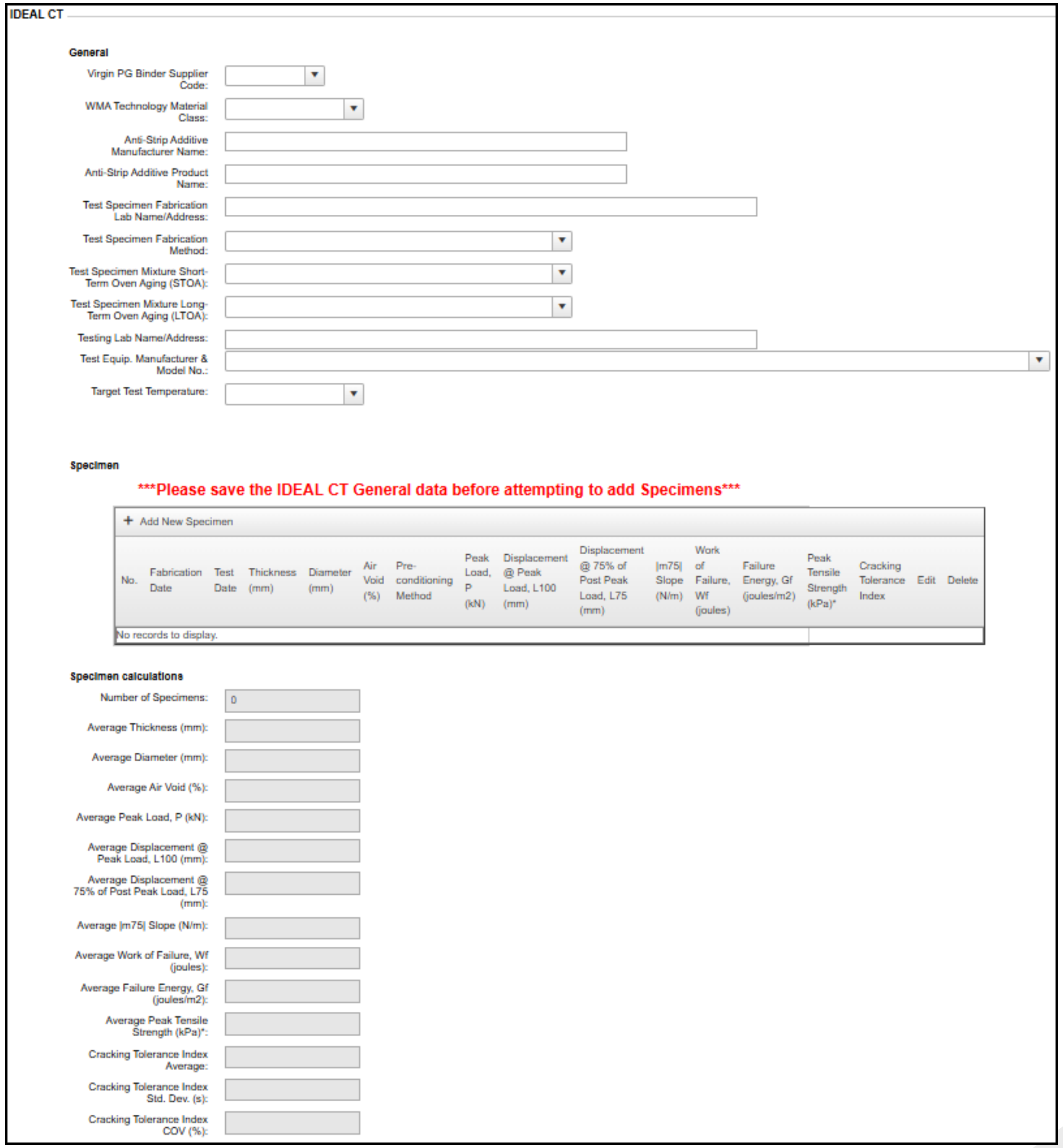
	Left Wheel Track	Right Wheel Track	Average
Test Specimen Fabrication Date:			
Test Specimen Test Date:			
Specimen #1 (Front) Air Void (%):			
Specimen #2 (Rear) Air Void (%):			
Average Specimen #1 & #2 Air Void (%):			
Rut Depth @ 10K Passes (mm):			
Rut Depth @ 20K Passes (mm):			
No. of Passes @ 12.5 mm Rut Depth:			
No. of Passes @ Equip. Auto-Shutoff Rut Depth:			
Creep Slope:			
Stripping Slope:			
No. of Passes @ SIP:			

ECAMMS JMF HAMBURG DESIGN

Hamburg Data Field	Scenario 1) Example: A Hamburg Wheel Track completes a full test to 20,000 Passes and Rut Depth @ 20,000 Passes is 6.85 mm	Scenario 1) Example: A Hamburg Wheel Track completes a full test to 20,000 Passes and Rut Depth @ 20,000 Passes is 13.44 mm	Scenario 2) Example: A Hamburg Wheel Track does not complete a full test to 20,000 Passes and shuts off at the Auto-Shutoff Rut Depth @ 8,600 Passes	Scenario 2) Example: A Hamburg Wheel Track does not complete a full test to 20,000 Passes and shuts off at the Auto-Shutoff Rut Depth @ 18,450 Passes
Equip. Auto-Shutoff Rut Depth:	20 mm	20 mm	20 mm	20 mm
Rut Depth @ 10K Passes (mm):	3.54	6.61		11.80
Rut Depth @ 20K Passes (mm):	6.85	13.44		
No. of Passes @ 12.5 mm Rut Depth:		18,544	6,545	10,125
No. of Passes @ Equip. Auto-Shutoff Rut Depth:			8,600	18,450

ECAMMS JMF IDEAL CT DESIGN

- Permanent Data Fields
- Dropdown Fields
- Fields formatted to specific required data formats.
  - See IDEAL CT Design Subpage Guidelines Document.
- Some fields have upper and lower limits to prevent incorrect data entry.
- Much easier data entry.
- Data cannot be copied from a previous year’s JMF with IDEAL-CT Data.



IDEAL CT

General

Virgin PG Binder Supplier Code:
WMA Technology Material Class:
Anti-Strip Additive Manufacturer Name:
Anti-Strip Additive Product Name:
Test Specimen Fabrication Lab Name/Address:
Test Specimen Fabrication Method:
Test Specimen Mixture Short-Term Oven Aging (STOA):
Test Specimen Mixture Long-Term Oven Aging (LTOA):
Testing Lab Name/Address:
Test Equip. Manufacturer & Model No.:
Target Test Temperature:

Specimen

Please save the IDEAL CT General data before attempting to add Specimens

+ Add New Specimen

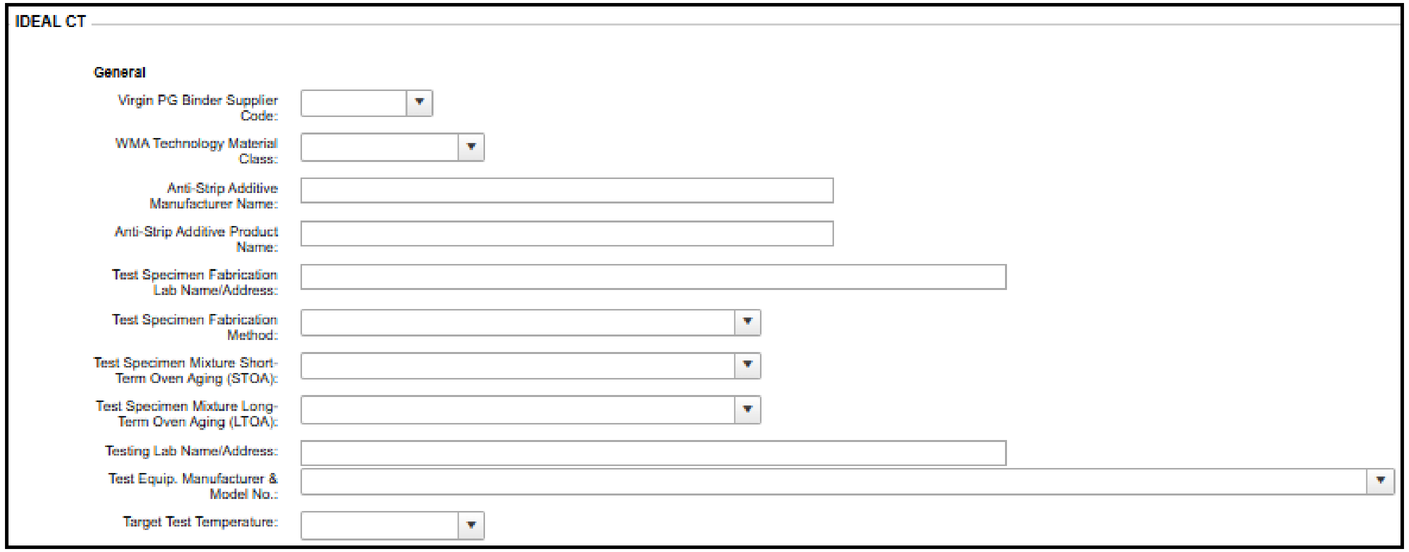
No.	Fabrication Date	Test Date	Thickness (mm)	Diameter (mm)	Air Void (%)	Pre-conditioning Method	Peak Load, P (kN)	Displacement @ Peak Load, L100 (mm)	Displacement @ 75% of Post Peak Load, L75 (mm)	|m75| Slope (N/m)	Work of Failure, Wf (joules)	Failure Energy, Gf (joules/m2)	Peak Tensile Strength (kPa)*	Cracking Tolerance Index	Edit	Delete
No records to display.																

Specimen calculations

Number of Specimens: 0
Average Thickness (mm):
Average Diameter (mm):
Average Air Void (%):
Average Peak Load, P (kN):
Average Displacement @ Peak Load, L100 (mm):
Average Displacement @ 75% of Post Peak Load, L75 (mm):
Average |m75| Slope (N/m):
Average Work of Failure, Wf (joules):
Average Failure Energy, Gf (joules/m2):
Average Peak Tensile Strength (kPa)*:
Cracking Tolerance Index Average:
Cracking Tolerance Index Std. Dev. (s):
Cracking Tolerance Index COV (%):

ECAMMS JMF IDEAL CT DESIGN

- WMA Technology Material Class field is not required and can be left blank on JMF Material Classes starting with SP, SR, SMA, HR, HV, & UTBWC.
- Anti-Strip Additive Product Name should not be same as Anti-Strip Additive Manufacturer Name, e.g.,:
  - Manuf. Name = Arkema
  - Product Name = AD-here LOF 62-40
- Test Specimen Long-Term Oven Aging (LTOA) field is not required and can be left blank.
- Testing Lab Name/Address field can be copied from Online Bulletin 41 Physical Address field.
- General section data must be completed to be able to enter the Specimen section data.


IDEAL CT

General

Virgin PG Binder Supplier Code:

WMA Technology Material Class:

Anti-Strip Additive Manufacturer Name:

Anti-Strip Additive Product Name:

Test Specimen Fabrication Lab Name/Address:

Test Specimen Fabrication Method:

Test Specimen Mixture Short-Term Oven Aging (STOA):

Test Specimen Mixture Long-Term Oven Aging (LTOA):

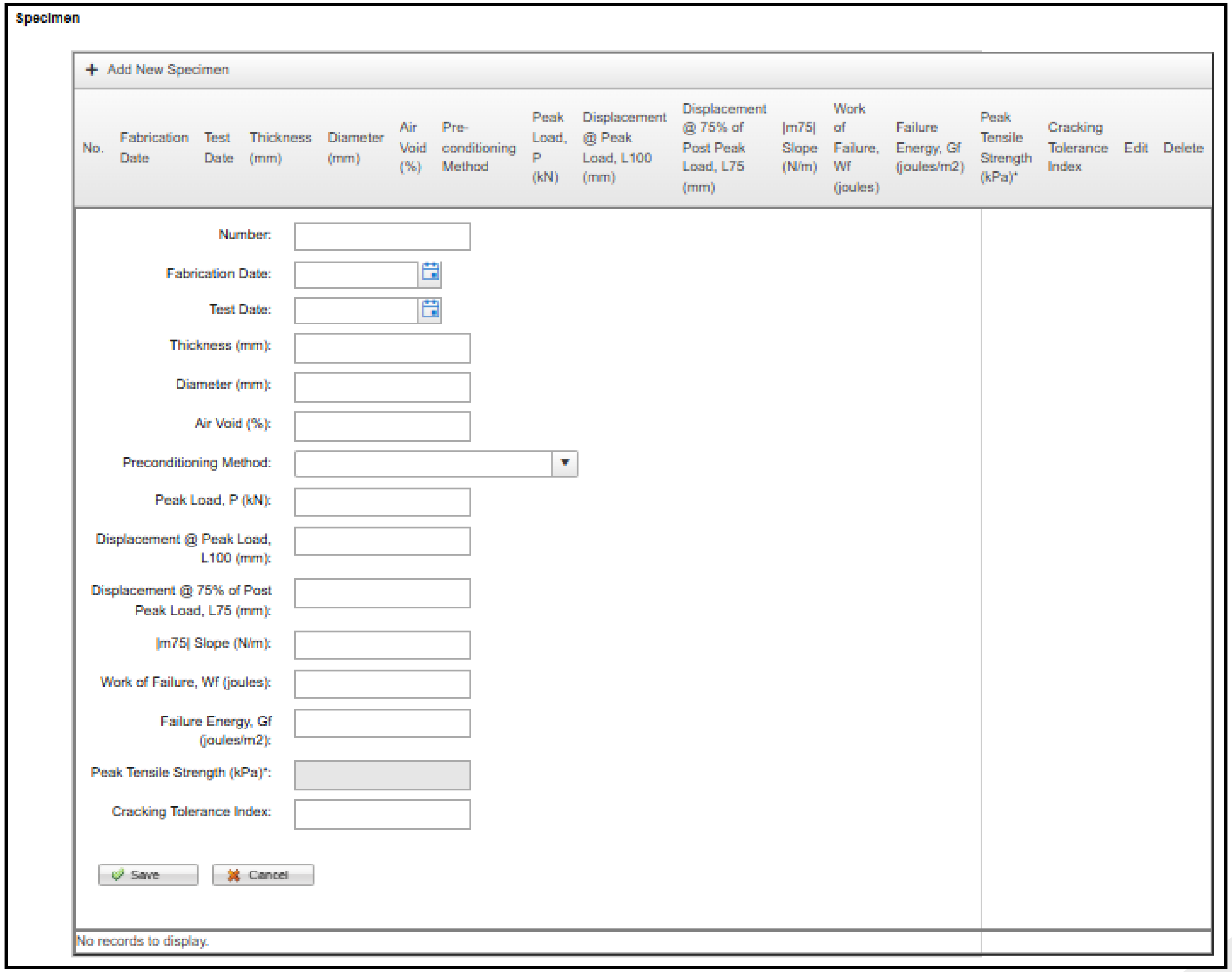
Testing Lab Name/Address:

Test Equip. Manufacturer & Model No.:

Target Test Temperature:

ECAMMS JMF IDEAL CT DESIGN

- Number: 1, 2, 3, 4, or 5.
- Field units of measure are <u>important</u>, and they follow the reporting requirements in ASTM D8225-19.
- Peak Load (kN) - 0.001 to 50.000)
- Displacement related fields in mm.
- Post Peak Slope (|m75|), in N/m (not in kN/mm or kN/m).
- Cracking Tolerance Index format is NNN.N. Round to nearest one decimal place for entry if more than one decimal place reported from test equipment software.
- A minimum of 3 specimens are required for Specimen calculation section to calculate field averages and standard deviation and COV of the Cracking Tolerance Index.



ECAMMS JMF IDEAL CT DESIGN

- Completed Asphalt JMF IDEAL CT Design Subpage
- Note:
  - WMA Technology Material Class Field shows "187 – EVO-M1"
  - Anti-Strip Additive Manufacturer Name shows "Ingevity" – Consistent with WMA Technology Material Class field.
  - Anti-Strip Additive Product Name shows "Evotherm M1" – Consistent with WMA Technology Material Class field.

IDEAL CT

General

Virgin PG Binder Supplier Code:	ASSA1 15
WMA Technology Material Class:	187 - EVO-M1
Anti-Strip Additive Manufacturer Name:	Ingevity
Anti-Strip Additive Product Name:	Evotherm M1
Test Specimen Fabrication Lab Name/Address:	Quality Asphalt Producer, Inc., 123 Test Lane, Anywhere, PA 17000
Test Specimen Fabrication Method:	LMLC (Lab Mixed Lab Compacted)
Test Specimen Mixture Short-Term Oven Aging (STOA):	2 HRS @ 145 C (PG64S-22)
Test Specimen Mixture Long-Term Oven Aging (LTOA):	
Testing Lab Name/Address:	Quality Asphalt Producer, Inc., 123 Test Lane, Anywhere, PA 17000
Test Equip. Manufacturer & Model No.:	Pine Test Equipment, Marshall 850 Test Press, Model AF850T/AF850TD, w/ Original 1.0667 Ratio Sprockets + InstroTek, Smart-Jig
Target Test Temperature:	25 C

Specimen

+ Add New Specimen

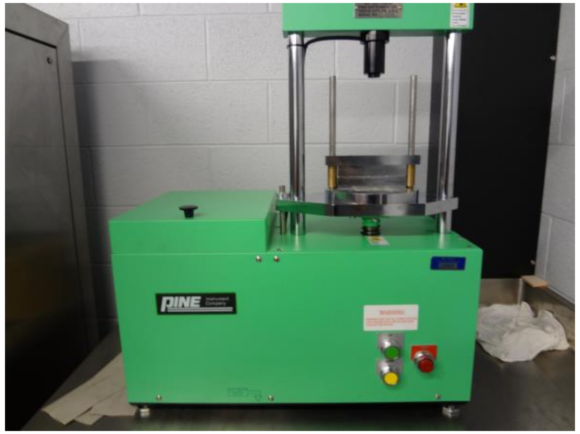
No.	Fabrication Date	Test Date	Thickness (mm)	Diameter (mm)	Air Void (%)	Pre-conditioning Method	Peak Load, P (kN)	Displacement @ Peak Load, L100 (mm)	Displacement @ 75% of Post Peak Load, L75 (mm)	|m75| Slope (N/m)	Work of Failure, Wf (joules)	Failure Energy, Gf (joules/m2)	Peak Tensile Strength (kPa)*	Cracking Tolerance Index	Edit	Delete
1	12/02/24	12/04/24	62.0	150.0	6.9	2	6.740	3.35	6.05	892228.5	53.57	5760.70	461.4	260.3		
2	12/02/24	12/04/24	62.1	150.0	6.9	2	7.180	3.49	6.32	937069.3	58.29	6268.20	490.7	281.7		
3	12/02/24	12/04/24	62.2	150.0	7.0	2	6.660	3.18	5.92	970825.1	54.17	5825.10	454.4	236.8		

Specimen calculations

Number of Specimens:	3
Average Thickness (mm):	62.1
Average Diameter (mm):	150.0
Average Air Void (%):	6.9
Average Peak Load, P (kN):	6.860
Average Displacement @ Peak Load, L100 (mm):	3.34
Average Displacement @ 75% of Post Peak Load, L75 (mm):	6.10
Average |m75| Slope (N/m):	933,374.3
Average Work of Failure, Wf (joules):	55.34
Average Failure Energy, Gf (joules/m2):	5,951.33
Average Peak Tensile Strength (kPa)*:	468.8
Cracking Tolerance Index Average:	259.6
Cracking Tolerance Index Std. Dev. (s):	22.5
Cracking Tolerance Index COV (%):	8.7

OUTLINE

1. Bulletin 27, 2003 Edition, Changes
2. eCAMMS Release 45 Enhancements for Asphalt JMFs
3. **AASHTO Standards, Changes (If time allows)**

- R 67-20, Sampling Asphalt Mixtures after Compaction (Obtaining Cores):
  - PennDOT does not reference this standard. PennDOT references PTM No. 729.
  - Added language to brush off loose particles adhering to core and to remove any granular subbase material from bottom of core.
  - For Packaging and Transporting Samples, added text at end “to prevent breaking or deforming”
  - Appendix X2 (Non-Mandatory). Revised completely to make it a procedure for removing cut aggregates from a core before further testing of the core.

2020 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 209-20, Theoretical Maximum Specific Gravity (Gmm) and Density of Asphalt Mixtures:
  - Added reference to R 67, Sampling Asphalt Mixtures after Compaction (Obtaining Cores).
  - Include an equation and example for calculating the weighted average maximum theoretical specific gravity of large-size samples tested in portions.
  - In Sections 12.2 and 12.2.1, removed references to "(*Gmm)*" as these subsections are for Theoretical Maximum Density.

2020 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- TP 124-20, Determining the Fracture Potential of Asphalt Mixtures Using the Illinois Flexibility Index Test (I-FIT):
  - Changed title of standard to include "Illinois" and revised from "FIT" to "I-FIT" throughout standard.
  - Added reference to R 30 if testing to determine effects of long-term aging.
  - Revised notch width & tolerance requirements from 1.5 ± 0.5 mm to ≤ 2.25 mm.
  - Revised to allow SGC specimens compacted to 115 ± 1 mm height if laboratory does not have capability to compact SGC specimens to the recommended 160 ± 1 mm height.
  - Added precision estimates.

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS

- M 332-21, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test:
  - Revised “H” from “High” to “Heavy” throughout standard.
  - Revised PAV DSR G*sinδ from max 5000 kPa to 6000 kPa for “S” grade
    - If intermediate temperature stiffness, G*sinδ, is from 5000 to 6000 kPa, an intermediate phase angle minimum limit of min 42° is required.

- PP 113-21, Characterizing the Relaxation Behavior of Asphalt Binders Using the Delta Tc (ΔTc) Parameter:
  - New Standard.

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 28-21, Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV):
  - Corrected pressure gauge readings for SI and US Customary units for lab elevation.

- T 240-21, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test):
  - Added reference to NCHRP Project 20-07 / Task 400
    - Effect of Elevation on RTFO Aging of Asphalt Binders.
  - New Table 1, conditioning time with lab elevation.
    - Conditioning time increases 1 min. with each 1000 ft of elevation.
  - New equation for calculating mass change (mass change correction factor).
  - New Table 2, mass change correction factor vs. conditioning time.
    - Correction factor increases with increase in conditioning time.

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 85-21, Specific Gravity and Absorption of Coarse Aggregate:
  - Added reference to T 255 (Total evaporable moisture content) for drying sample to constant mass.

- T 30-21, Mechanical Analysis of Extracted Aggregate:
  - In Table A1, removed sieves with opening sizes larger than 2 in.
    - Eliminates the sieving efficiency issue for larger sieves.
  - In Table A1, removed 350 by 350 mm and 372 by 580 mm sieve frame sizes.
  - In Table A1, added US customary units of measure equivalencies for sieve diameters and sieving area.

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- <u>T 331-21, Bulk Specific Gravity (Gmb) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method</u>:
  - Revised and clarified Procedure section regarding wet specimens and drying, bag mass, and check conditions.
  - Revised Equation *(1)* and definition of B (bag mass) to eliminate unnecessary steps.

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 283-21, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage:
  - Added reference to R 30 (Mixture Conditioning of HMA).
    - Prepare mixture according to R 30, Section 7.1 & determine Gmm according to T 209.
    - Determine compaction temperature according to R 30.
  - Added reference to R 67 (Sampling Asphalt Mixtures after Compaction).
    - Related to preparation of Field-Mixed, Field-Compacted specimens.
  - Deleted reference to T 269 (Percent Air Voids)
    - Added equation for calculating percentage of air voids.

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- <u>T 283-21 (Continued):</u>
  - Deleted ASTM D3459 (Thickness/Height of Compacted Specimens).
    - Added “tape, rule or calipers for measuring specimen thickness”.
    - Added language to determine specimen thickness by measuring in four locations around the specimen and averaging, or if the specimen is compacted by T 312, use the final height from the SGC.
  - Revised pan depth from “approximately 25 mm (1 in.)” to “at least a depth of 25 mm (1 in.)”.
  - Added how to adjust compacted specimens to 7.0 ± 0.5 percent air voids.
    - Adjust by mass change or by level of compaction.
  - Added language for blotting each specimen with a damp towel and determining SSD as quickly as possible (not to exceed 15 s).

2021 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 393-21, Determining the Fracture Potential of Asphalt Mixtures Using the Illinois Flexibility Index Test (I-FIT):
  - Formerly TP 124.
  - Adopted as a full standard.

- T 394-21, Determining the Fracture Energy of Asphalt Mixtures Using the Semicircular Bend Geometry (SCB):
  - Formerly TP 105.
  - Adopted as a full standard.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS

- In 2022, many AASHTO standards were revised to address proper selection of Temperature Measuring Devices (TMD) as a result of NCHRP Report 20-07, Task 427:
  - Added non-liquid in glass thermometer types, thermometer temperature ranges, and thermometer tolerance ranges based on temperature usage ranges and usage tolerance ranges specified in each standard.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- M 323-22, Superpave Volumetric Mix Design:
  - Various revisions from work done by the M 323/R 35 Task Force housed in the now defunct Mixture ETG that were never officially endorsed or forwarded to the AASHTO SOM/COMP including:
  - Added reference to M 332.
  - Added "binder content (P_b)" and "binder content RAP (P_{bRAP})" to terminology.
  - Added new Note 5 informing that a mixture performance test for cracking implemented by an agency is acceptable in lieu of the RAPBR binder selection criteria in Section 5.3.1.
  - Added PCS Control Point for 4.75 mm NMAS to Table 5 (1.18 mm sieve, 40%).
  - Removed VFA requirements and footnotes from Table 7 and added new Table 8 specifically for VFA requirements by NMAS.
  - Added references to Superpave5 and Annex A1 (mandatory) when agencies specify Superpave5 (agency discretion).

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- M 332-22, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test:
  - Revisions from TFASH effort.
  - Added Note 3 to inform choice of which LTPPBind program version to use is up to the specifier.
  - Deleted references to M 323 regarding selection of asphalt binder grade.
  - Added new Section 4.2.5 explaining evaluation of J_{nrdiff} with max 75% limit except for when $J_{nr3.2}$ is less than 0.5 (“E” grades).
  - Deleted some Table 1 informational footnotes.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- M 350-22, Reclaimed Asphalt Shingles (RAS) for Use in Asphalt Mixtures:
  - Formerly MP 23.
  - Adopted as a full standard.

- MP 46-22, Balanced Mix Design:
  - Editorial updates to sequencing of notes and tables as well as updated State practices.

- R 114-22, Design Considerations When Using Reclaimed Asphalt Shingles (RAS) in Asphalt Mixtures:
  - Formerly PP 78.
  - Adopted as a full standard.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 30-22, Laboratory Conditioning of Asphalt Mixtures (title change – formerly "Mixture Conditioning of HMA"):
  - Revisions based on work completed in NCHRP 9-52, 9-52A, and 20-44 (19) relative to short-term aging.
  - Revised Section 1, Scope, to indicate long-term conditioning simulates 1-3 years of pavement service life.
  - Deleted Sections related to short-term conditioning for mixture mechanical property testing.
  - Added short-term conditioning for WMA, 2 h ± 5 min at 116 ± 3°C, and HMA, 2 h ± 5 min at 135 ± 3°C, in lieu of conditioning at compaction temperature.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 35-22, Superpave Volumetric Design for Asphalt Mixtures:
  - In Terminology Section, added *design air void content*, *reclaimed asphalt pavement binder ratio*, *VFA*, *VMA*, and *WMA* and removed *materials selection*, *design aggregate structure*, *design binder content selection*, and *evaluating moisture susceptibility* and associated Notes (Notes 3 and 4).
  - In Preparing Aggregate Trial Blends Section, added new subsection to oven dry RAP to constant mass and to avoid exposing RAP to extended oven conditioning to minimize further aging of RAP binder.
  - Added references to Superpave5 for use by agency discretion and added new Annex for Preparing Superpave5 Replicate Aggregate Specimens and alternate Table for Superpave5 Gyratory Compaction Effort.

- T 176-22, Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test:
  - Corrected and clarified dimensional discrepancies with the Sand Equivalency Apparatus described in Section 4.1 (Table and Figure 1).
  - Revised Section 6, Sampling, regarding reducing and splitting the sample.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 209-22, Theoretical Maximum Specific Gravity (Gmm) and Density of Asphalt Mixtures:
  - In Sections 5.4.5 and 5.5, revised 4.0 kPa (30 mmHg) to 3.3 kPa (25 mmHg) – bottom of range at which the test is performed instead of the middle of range.
  - In Section 7.2.1, revised to "Plant-produced samples may be short-term conditioned according to R 30 as specified by the agency. See Note 5."
  - In Section 7.2.1, deleted requirement to dry the samples to constant mass.
  - In Sections 9.1 and 10.1, revised to require residual pressure for 15 ± 1 min. instead of 15 ± 2 min. to reduce variability.
  - In Section A1.1.1 (Standardization of Bowl for Mass Determination in Water), revised 2nd sentence to read "If the range of the three masses is less than or equal to 0.3 g, use the average as B in Equation 1." and revised 3rd sentence from "variation" to "range".
  - In Section A1.1.2 (Check of Bowl for Mass Determination in Water), added alternate check procedure for labs that standardize bowls frequently
  - In Sections A1.2.1 and A1.2.2 (Standardization of Flask and Pycnometer for Mass Determination in Air), revised similarly to revisions in A1.1.1 and A1.1.2, respectively.

2022 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 401-22, Cantabro Abrasion Loss of Asphalt Mixture Specimens (title change – added "Cantabro"):
  - Formerly TP 108.
  - Adopted as a full standard.
  - In Section 5 (Significance and Use), revised to include.
  - In Section 6.5, Chamber ambient temperature tolerance widened from ± 1°C to ± 2°C.
  - In Section 8.1 (Procedure), adjusted drying language not to exceed 52 ± 3°C.
  - Added Appendix A for conditioning protocols to simulate field aging.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS

- In 2023, a number of AASHTO standards will again be revised to address proper selection of Temperature Measuring Devices (TMD) as a result of NCHRP Report 20-07, Task 427 and further technical and practical review:
  - Includes revisions to thermometer types, thermometer temperature ranges, and thermometer tolerance ranges based on temperature usage ranges and usage tolerance ranges specified in each standard.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- M 332-23, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test:
  - Revisions from Task Force for Asphalt Standards Harmonization (TFASH).
  - In Table 1, revised PAV conditioning temperatures to simplify as shown in table below.
  -

Performance Grade	PG 46	PG 52	PG 58	PG 64	PG 70	PG 76	PG 82
PAV conditioning temperature, °C	90	90	100	100	100 ~~(110)~~	100 ~~(110)~~	100 ~~(110)~~

f ~~For climates with a LTPPBind high pavement temperature of 76 or above, the PAV conditioning temperature shall be 110 °C.~~

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 209-23, Theoretical Maximum Specific Gravity (Gmm) and Density of Asphalt Mixtures:
  - Section 5. Apparatus:
    - In Section 5.5. (Vacuum Measurement Device), revised from “be accurate to 0.1 kPa (1mmHg)” to “be readable to at least 0.2 kPa (2 mmHg)”.
  - Section 9. Test Method A – Mechanical Agitation Procedure:
    - In Section 9.1., revised from “manometer reads 3.7 ± 0.3 kPa (27.5 ± 2.5 mmHg)” to “manometer reads 4.0 ± 0.6 kPa (30 ± 5 mmHg)”.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 240-23, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test):
  - New Section 6., Determination of Oven Preheat Time, added to include two preheat time options:
  - Section 6.1.1., determine time for fully loaded oven to thermally equilibrate at 163 ± 1.0°C (325 ± 1.8°F) as determined by two consecutive 15-min temperature recordings that do not vary by more than 0.5°C (1°F). Oven preheat time is the time oven takes to reach thermal equilibrium plus an additional 30 min.
  - Section 6.1.2., in lieu of using Section 6.1.1., a minimum oven preheat time of 4 h may be used.
  - In Section 7 (Preparation of Oven) and Section 7.5., revised from preheat oven from 2 h to the preheat time determined in Section 6.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 324-23, Hamburg Wheel-Track Testing of Compacted Mixtures:
  - Section 1. Scope:
    - New Section 1.5., indicating test method is standard; however, agencies may require deviations for test temperature, maximum rut depth calculation, equipment, or other.
  - Section 5. Apparatus:
    - In Section 5.3., (Impression Measurement System), added root-mean square error (RMSE) equation for determining the deviation from the 11 pre-set measurement locations.
    - In Section 5.7., (Balance), deleted this Section.
  - Section 6. Specimen Preparation:
    - In Section 6.3.1., (Field-Produced Asphalt Mixture), revised from T 168 to R 97 for obtaining sample of asphalt mixture.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- <u>T 324-23, Hamburg Wheel-Track Testing of Compacted Mixtures (Continued):</u>
  - Section 9. Calculations:
    - In Section 9.1., moved text from Note 10 to this Section. Note 10 text indicated that agency may define a test as a single slab specimen, a single 250-mm (10-in.) or 300-mm (12-in.) core specimen, or as two 150-mm (6-in.) diameter cylindrical or core specimens.
  - Annex A – Revised to “Evaluating Hamburg Wheel Tracking Device”.
    - Sections A1. to A7., now address inspection of the steel wheels and verification of water bath temperature, LDT calibration, wheel loading assembly, wheel travel and rut measurement.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 331-23, Bulk Specific Gravity (Gmb) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method:
  - Section 5. Apparatus:
    - In Section 5.4., revised to include updates involving plastic bag size and thickness.

- T 340-23, Determining Rutting Susceptibility of Asphalt Mixtures Using the Asphalt Pavement Analyzer (APA):
  - Throughout standard, revised from hot mix asphalt (HMA) to asphalt mixtures.
  - Throughout standard as appropriate, revised to add testing details for testing four or six cylindrical specimens using a two-wheel or three-wheel APA, respectively.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 47-23, Reducing Samples of Asphalt Mixtures to Testing Size:
  - In Section 7.1., Mechanical Splitter Type A, revise for clarity.
  - In Section 8., Procedure for Mechanical Splitter Method:
    - In Section 8.1., deleted last sentence indicating the release agent shall not contain any solvents or petroleum based products. Previous sentence requires an approved asphalt release agent.
    - In Section 8.3.2., revise text to active voice.
  - In Section 9., Quartering Method Apparatus:
    - In Section 9.1., clarified text for the quartering template to require template to be formed in the shape of a 90-degree cross with equal length sides that exceed the diameter of the flattened cone of material to be quartered.
    - In Section 9.1., replaced Figure 5 and relabeled to Quartering Template.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 47-23, Reducing Samples of Asphalt Mixtures to Testing Size (Continued):
  - In Section 10. Procedure of Quartering Method:
    - In Section 10.3., clarified text requiring flattening of conical pile to a diameter of four to eight times the thickness.
    - In Section 10.5., clarified text by adding new subsections for Quartering and Sectoring.
  - In Section 11., Incremental Method Apparatus:
    - In Section 11.1., deleted text about sampling as sampling is covered in Section 6.1.
  - In Section 12., Procedure for Incremental Method:
    - In Section 12.1., revised text to active voice and revised text to only include the requirements for a hard, non-stick, level surface to perform the incremental method.
    - Section 12.2 (new), added text from Section 12.1. regarding placing the sample on the level surface and requiring not to lose any material or introduce any foreign material.

2023 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 118-23, Characterizing the Relaxation Behavior of Asphalt Binders Using the Delta Tc (ΔTc) Parameter:
  - Formerly PP 113.
  - Adopted as a full standard.

2024 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- MP 46-24, Balanced Mix Design:
  - Section 5.5., add this new Section for High Temperature Indirect Tensile Test (HT-IDT) – ALDOT 458.
  - Appendix X1., Summary of Mixture Performance Test Criteria Used by State Highway Agencies, editorially and informationally revised and updated state specific requirements.

- PP 105-24, Balanced Design of Asphalt Mixtures:
  - Throughout, revised from “performance-based/related” to “mechanical” test results.
  - Section 4., Summary of the Practice, updated/clarified the four Approaches.
  - Section 10., Report, clarified the reporting requirements.

2024 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- R 30-24, Short-Term Laboratory Conditioning of Asphalt Mixtures:
  - Throughout, removed all procedures for Long-Term Laboratory Conditioning.
- R 121-24, Long-Term Laboratory Conditioning of Asphalt Mixtures:
  - Proposed New Standard for Long-Term Laboratory Conditioning.
  - Section 7., Long-Term Mixture Conditioning Procedures, kept the existing LTOA conditioning from R 30 as Method A plus added four new LTOA conditioning options (Methods B to E) for specification by agencies:
    - Method A - Conditioning of Compacted Mixture Specimens at 85°C.
    - Method B - Conditioning of Uncompacted Loose Mixture at 85°C.
    - Method C - Conditioning of Uncompacted Loose Mixture at 95°C (NCHRP 09-54 – NCHRP Reports 870 and 973).
    - Method D - Conditioning of Uncompacted Loose Mixture at 100 to 125°C.
    - Method E - Conditioning of Uncompacted Loose Mixture at 135°C.

2024 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 11-24, Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing:
  - Section 2., Referenced Documents, and Section 8., Procedure A – Washing with Plain Water, added reference to AASHTO M 255, Total Evaporable Moisture Content of Aggregate by Drying, for procedure for drying the aggregate to constant mass.
  - Section 8., Procedure A – Washing with Plain Water, clarified language for agitating and washing the sample.

- T 27-24, Sieve Analysis of Fine and Coarse Aggregates:
  - Section 2., Referenced Documents, and Section 7., Procedure, added reference to AASHTO M 255, Total Evaporable Moisture Content of Aggregate by Drying, for procedure for drying the aggregate to constant mass.

2024 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 30-24, Mechanical Analysis of Extracted Aggregate:
  - Section 2., Referenced Documents, added new references to AASHTO R 76, Reducing Sample of Aggregate to Testing Size, to AASHTO T 255, Total Evaporable Moisture Content of Aggregate by Drying, and to AASHTO T 319, Quantitative Extraction and Recovery of Asphalt Binder from Asphalt Mixtures.
  - Section 3., Summary of Method, added this new section.
  - Section 5., Apparatus, clarified requirements for balance, sieves, mechanical sieve shaker, oven, wetting agent, and mechanical washing apparatus (optional).
  - Section 8., Procedure, referenced AASHTO T 255 for procedure for drying sample to constant mass and clarified language for agitating and washing the sample for both manual washing and mechanical washing.
  - Annex A1., Time Evaluation, added new Note regarding recommendations when excessive time (more than 10 min.) is required to achieve adequate sieving.
  - Annex A2., Overload Determination, added alternate procedure for splitting the portion finer than the 4.75 mm (No. 4) sieve and equation for determining the mass of size increment on total sample basis.

2024 SIGNIFICANT UPDATES TO PUBLISHED AASHTO STANDARDS (CONTINUED)

- T 269-24, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures:
  - Section 7., Calculations, added new informational Note that air voids may be reported to nearest 0.01%; however, test results should not be reported to a greater number of decimal places than the specified air void limits.

- T 315-24, Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR):
  - Revisions throughout the standard from the Task Force for Asphalt Standards Harmonization (TFASH).
    - Harmonization of ASTM and AASHTO asphalt binder standards.
  - Throughout standard, significant updates/revisions, including additional photographs, to clarify and update requirements and procedures of this test method.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- M XXX-25, Balanced Mix Design:
  - Adopted as a full standard.
  - Formerly Provisional Standard MP 46.

- PP XXX-25, Development of Balanced and Durable Asphalt Mixtures with High Recycled Asphalt Materials Contents:
  - Adopted as new Provisional Standard Practice.
  - Developed as part of NCHRP Project 9-65, Capturing Durability of High Recycled Binder Ratio (RBR) Asphalt Mixtures.

- R XXX-25, Balanced Design of Asphalt Mixtures:
  - Adopted as a full standard.
  - Formerly Provisional Standard PP 105.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 11-25, Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing:
  - Section 5.7., Mechanical Washing Apparatus, added new Note 3 providing information that some mechanical washing equipment may degrade some aggregate types and to determine if mechanical washing apparatus causes significant deterioration perform procedure as described in Annex A.
  - Added new mandatory Annex A, Mechanical Washer Comparison. The difference in percent passing the No. 200 sieve between manual washing and mechanical washing split samples is not to exceed 0.82%; otherwise, mechanical washing apparatus should not be used.

- T 30-25, Mechanical Analysis of Extracted Aggregate:
  - To add a reference, description of apparatus, and instructions for using ASTM D8159, Standard Test Method for Automated Extraction of Asphalt Binder from Asphalt Mixtures.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 84-25, Specific Gravity and Absorption of Fine Aggregate:
  - Revisions based on an ASTM C128-22 equivalency review and include clarifications of bulk specific gravity (dry), bulk specific gravity (saturated surface dry (SSD)), and apparent specific gravity.
  - Other clarifications.

- T 85-25, Specific Gravity and Absorption of Coarse Aggregate:
  - Revisions based on an ASTM C127-15 equivalency review and include clarifications.
  - Section 5 Significance and Use, new Section 5.1., to clarify specific gravity and the distinction between density of aggregate particles and bulk density of aggregates.
  - Section 9.2., Note 6 deleted regarding conversion of specific gravity to density.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 166-25, Bulk Specific Gravity (Gmb) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens:
  - To explain that the precision estimates also pertain to Method B (volumeter).
  - Added commentary about a water bath heater/chiller.
  - Clarified that the thermometer resolution provided is a minimum value.

- T 209-25, Theoretical Maximum Specific Gravity (Gmm) and Density of Asphalt Mixtures:
  - Modified the requirements for the thermometer used to measure the water temperature.
  - Modified the requirements for the thermometer used for the drying oven.
  - Added commentary about a water bath heater/chiller.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 255-25, Total Evaporable Moisture Content of Aggregate by Drying:
  - Section 5 Apparatus:
    - Section 5.2., Source of Heat, separated ovens and clarified oven requirements from other sources of heat (Section 5.2.1.).
    - New Section 5.3., Thermometers. Formerly with Source of Heat
  - Section 7.2 (Procedure) was separated into Section 7.2. for drying and Section 7.2.1. for rapid heating and issues with particles exploding.
  - Added separate Section 8.3. for calculating % change including adding equation where statements.

- T 308-25, Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method:
  - Added instructions, formulas, and example calculations for determining correction factor batch weights in an annex. The examples include mixtures with and without reclaimed asphalt pavement.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 313-25, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR):
  - Section 2 (Referenced Documents) added reference to R 118, Characterizing the Relaxation Behavior of Asphalt Binders Using the Delta Tc (ΔTc) Parameter.
  - Section 15 (Precision and Bias) revised precision statements and replaced Table 1 Precision Estimates with with tables including Table 1, Precision Estimates of Creep Stiffness and Slope (m-value) at PG+10°C, Table 2, Precision Estimates of Creep Stiffness and Slope (m-value) at PG+4°C, and Table 3, Precision Estimates of Continuous Low-Temperature PG and ΔTc.

- T 313-25, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR) (Continued):
  - Revisions throughout the standard from the Task Force for Asphalt Standards Harmonization (TFASH). Harmonization of ASTM and AASHTO asphalt binder standards.
    - The use of many terms has been harmonized throughout such as replacing “beam” with “specimen”, “sample” with “test specimen”, “gage” with “gauge”, “midpoint with “midspan , “thermometric device” with “thermometer”, etc.
    - Extensive editorial changes to enhance conciseness and clarity.
    - Some of the sections have been moved to be consistent with workflow in the laboratory.
    - Non-mandatory information has been moved from sections to Notes and vice-versa. Notes are used extensively to provide guidance or rationale.
    - Use and specification of the silicone rubber molds has been added to the AASHTO standard as an Annex because it is not in common use.
    - Beam theory and associated extraneous equations have been condensed to a short Annex.
    - Checking, verification, standardization are now used as per their ASTM definitions. Standardization steps are no longer referred to as calibration steps.
    - Checking and verification done daily by the operator are now within the main body and steps that are done semi-annually or less frequently have been moved to a separate Annex.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 331-25, Bulk Specific Gravity (Gmb) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method:
  - To incorporate updates involving plastic bag size, thickness, and selection to maintain equivalency with ASTM D6752/D6752M-23.
  - To modify the thermometer requirements in Section 5 and modify the water bath temperature range in Sections 5.10 and 6.3 to match the values in other asphalt mixture test methods.

SIGNIFICANT UPDATES TO AASHTO STANDARDS TO BE PUBLISHED IN 2025

- T 350-25, Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR):
  - Revisions to incorporate emulsified asphalt residue resulting from T 59 (distillation or oven evaporation) or R 78 (low temperature evaporation).
  - Added that the emulsified asphalt residue from T 59 or R 78 simulate the field condition of the emulsified asphalt residue immediately after the pavement was constructed.
  - Section 2 (Referenced Documents) added references to R 78, Recovering Residue from Emulsified Asphalt Using Low-Temperature Evaporative Techniques and T 59, Emulsified Asphalts.

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Balanced Mix Design (BMD)
Task Force Update
FHWA Expert Task Group on Asphalt Mixtures

Dave Newcomb

Performance-Related Mixes and Balanced Mix Design

Thomas Bennert, Ph.D.
Rutgers University, NJ

North Eastern States' Materials Engineers Association (NESMEA)
October 18th – 19th, 2016
Newark, DE

NY MATERIALS

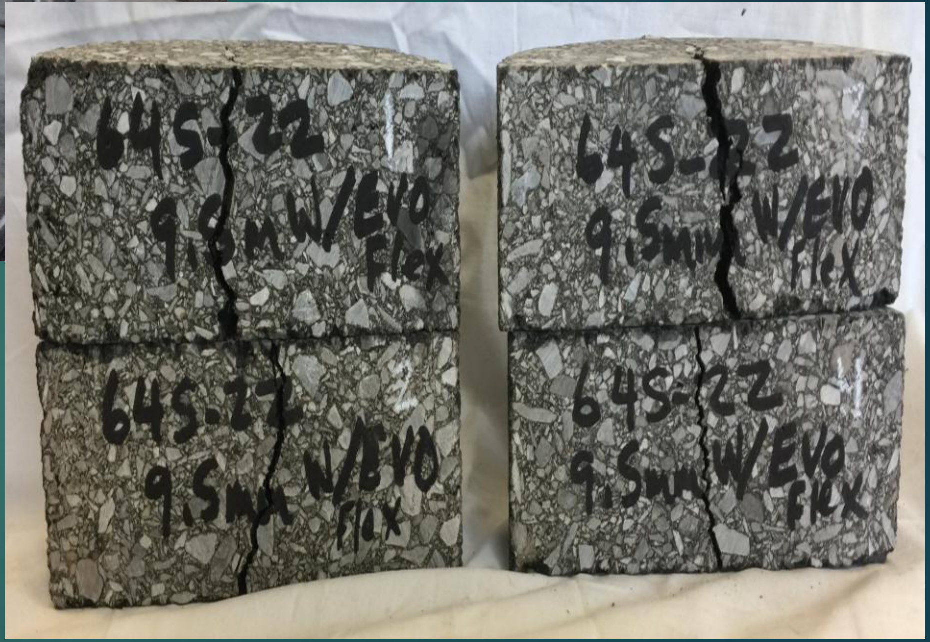
NAPA MEMBER

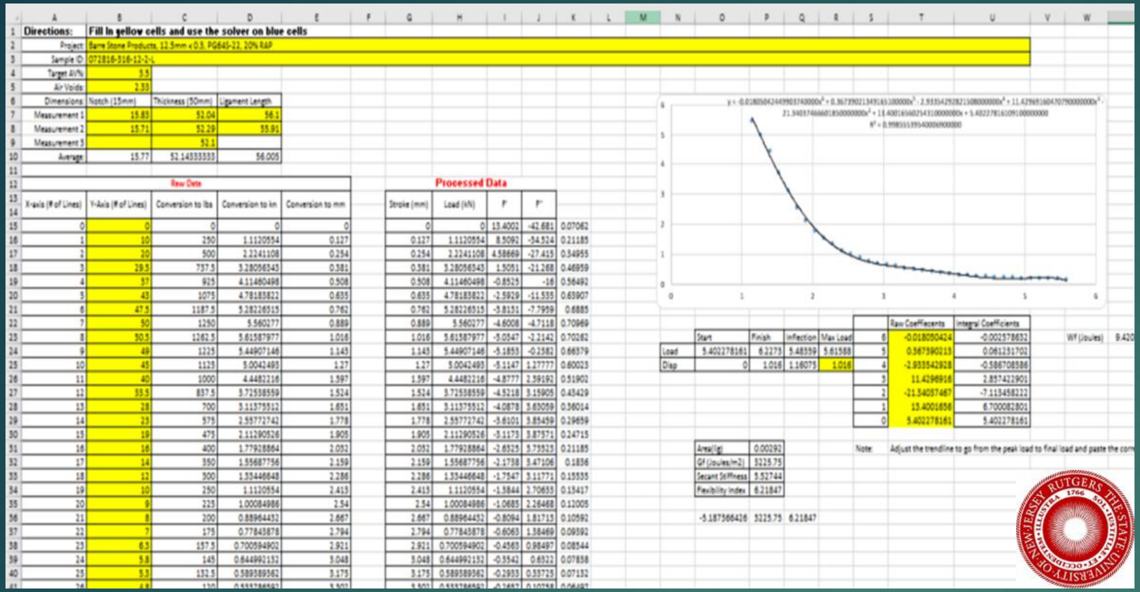
Cantabro Testing

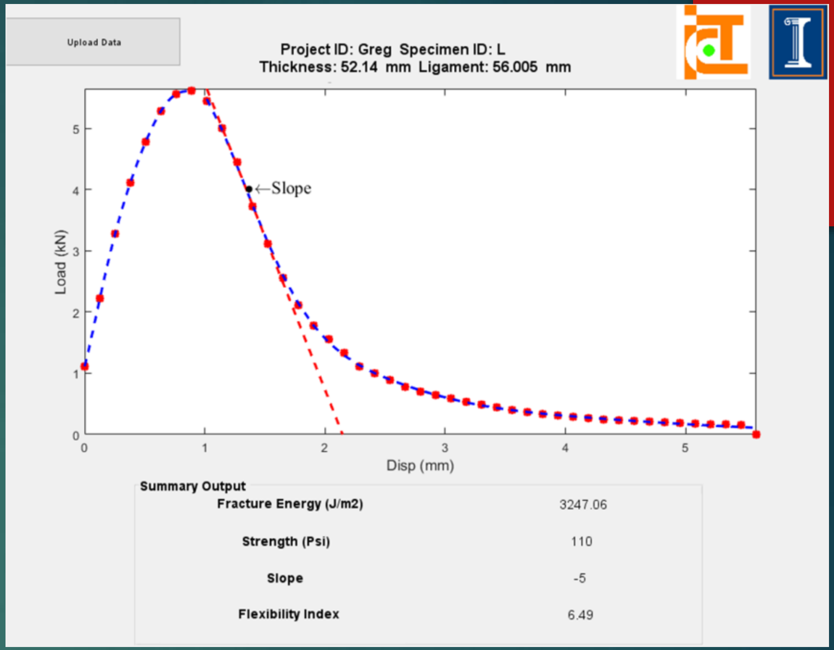
SCB Testing


BOART LONGYEAR


LONGYEAR

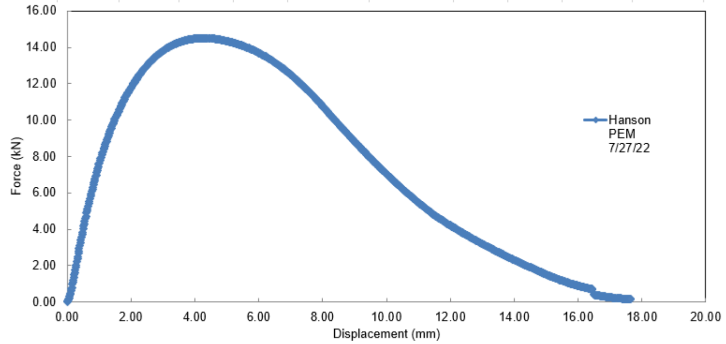

64S-22
9.5mm W/EVO
Flex





Load drop from (%) 85 To (%) 65

Mixture Description: Mix	Specimen ID	Thickness (mm)	Air Voids (%)	Tensile Strength (kPa)	Displacement (L), mm	Fracture Energy (Gf): Energy (LLD) (Gf) (J/m2)	Fracture Energy (Gf): Average	Slope (S): S	Slope (S): Average	Slope (S): Standard Deviation	Slope (S): COV	Gf/S: Gf/S	Gf/S: Average	Gf/S: Standard Deviation	Gf/S: COV
Hanson PEM 7/27/22	16A	62.1	7.07	969	8.2	14,267	14,314	2.01	1.91	0.16	8.65	7,102	7,589	894.63	11.79
	17	62.0	7.07	991	8.0	14,794		1.67				8,843			
	18	61.9	6.29	1020	7.7	13,879		2.03				6,821			
Average		62.0	6.81	993	8.0										

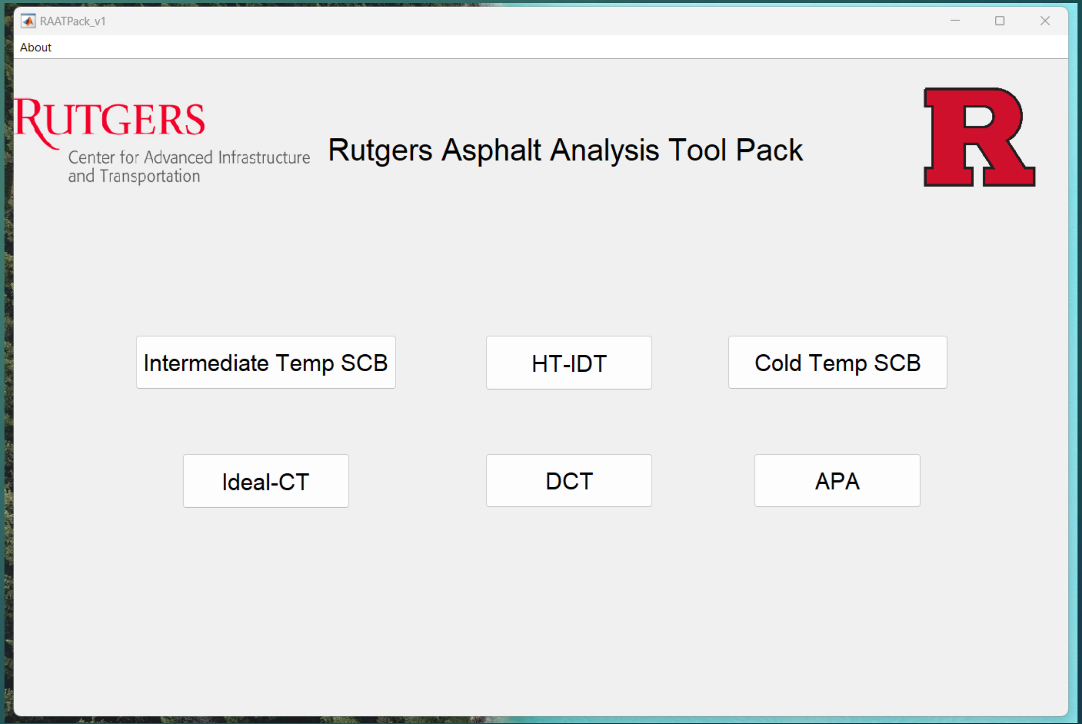


CT Index

(Gf/S)*(L/D)*(t/62): (Gf/S)*(L/D)	Average	Standard Deviation	COV
387.8	402.9	49.99	12.41
470.2			
350.5			

(Gf/S)*(L/D)^2: (Gf/S)*(L/D)^2	Average	Standard Deviation	COV
21.11	21.40	2.83	13.25
25.00			
18.07			

FST_{Index}: Gf/Tensile Strength	Average	Standard Deviation	COV
14.72	14.42	0.58	4.02
14.93			
13.61			



NY MATERIALS

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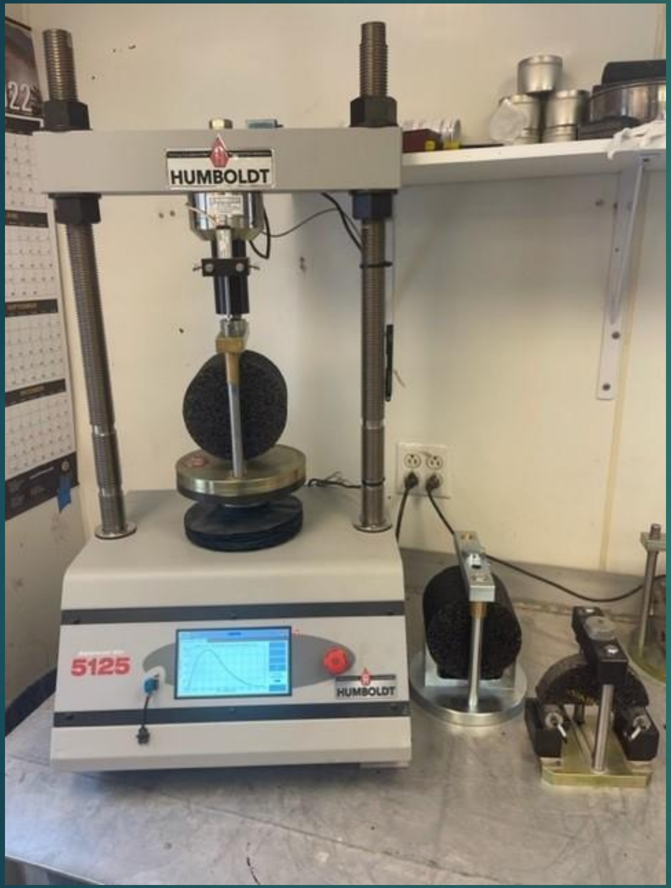
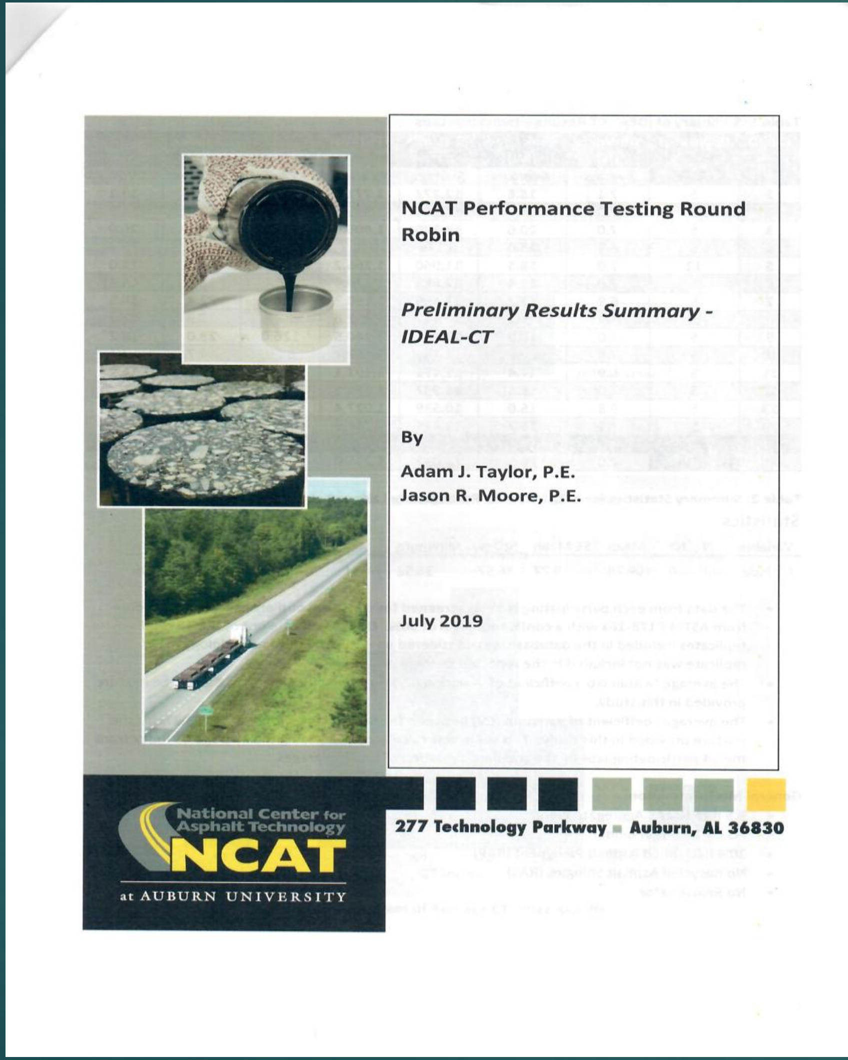
Upgrade my Equipment



Verify Methods & Practices



NCAT Performance Testing Round Robin

Preliminary Results Summary - IDEAL-CT

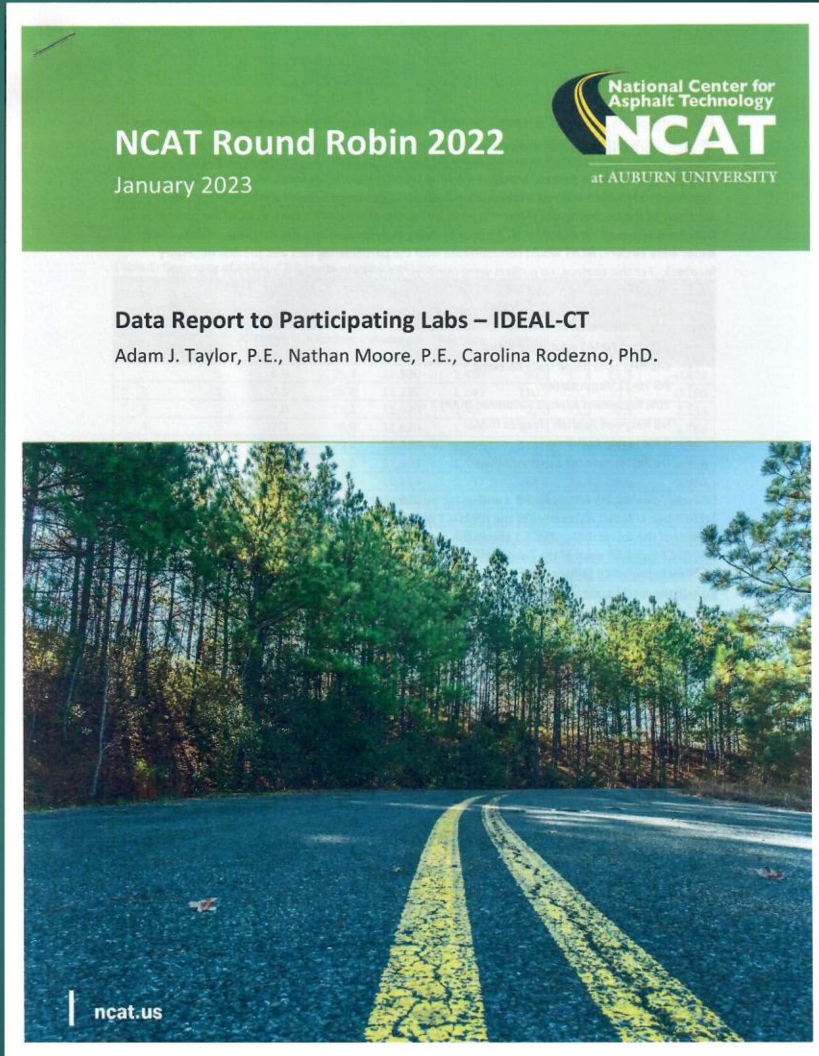
By

Adam J. Taylor, P.E.
Jason R. Moore, P.E.

July 2019

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

277 Technology Parkway ▪ Auburn, AL 36830



NCAT Round Robin 2022

January 2023

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Data Report to Participating Labs – IDEAL-CT

Adam J. Taylor, P.E., Nathan Moore, P.E., Carolina Rodezno, PhD.

ncat.us

2019 Special Note

Task 2. Number of Specimens (Testing Lab).

The testing laboratory will make the following number of specimens for performance testing:

a. Overlay Tester – 5 specimens
b. Asphalt Pavement Analyzer (APA) or Hamburg Wheel Tracker – 6 specimens
c. Semi-circular Bend (SCB) – 4 specimens
d. Ideal-CT – 3 specimens
e. High Temperature Indirect Tension – 3 specimens
f. Gradation
g. Asphalt content using chemical extraction.

Task 3. Number of Specimens (Producer Lab).

The producer will make the following number of specimens for performance testing:

a. Semi-circular Bend (SCB) – 4 specimens
b. Ideal-CT – 3 specimens
c. High Temperature Indirect Tension – 3 specimens

Task 4.

Test Results. The Producer will submit both the testing lab and Produce lab results to the Materials Bureau once the tests are completed. In addition, the Producer shall submit the volumetric results of the mixture during the production for the day selected. The QAF will be 1.00

Plant Production	Units	Target	Range	Lot 4A	Rutgers *	Lot 4B
Voids	%	3.16	2.5 - 4.5	4.53		3.69
AC Content	%	6.3	6.1 - 6.5	6.5	6.3	6.3

APA Rutting @ 8,000 Cycles @ 64°C	Units	Target	Range	Lot 4A	Rutgers	Lot 4B
Rut Depth	mm		4 - 7	-	4.38	-

Hamburg Rutting at 20,000 Cycles @ 50°C	Units	Target	Range	Lot 4A	Rutgers	Lot 4B
Rut Depth	mm	< 12.5	n/a	-	10.45	-

High Temperature Indirect Tensile Stregth (HT-IDT) @ 42°C	Units	Target	Range	Lot 4A	Rutgers	Lot 4B
Voids	%	7.0	6.5 - 7.5	7.0	7.0	6.9
Thickness	mm	95.0	94.0 - 96.0	94.8	95.5	95.0
HT-IDT	PSI		23 - 47	36.0	33.2	36.1

Overlay Test for Crack Resistance @ 25°C	Units	Target	Range	Lot 4A	Rutgers	Lot 4B
# of Cycles to Failure	Cycles		100 - 700	-	1171	-

Semicircular Bend (SCB)	Units	Target	Range	Lot 4A	Rutgers	Lot 4B
Voids	%	7.0	6.0 - 8.0	7.1	7.1	7.0
Thickness	mm	50.0	49.0 - 51.0	48.6	49.9	48.8
Ligament	mm			57.6	58.1	57.9
Flexibility Index	FI	> 8.0		8.6	18.8	11.4

Proposed Ideal-CT	Units	Target	Range	Lot 4A	Rutgers	Lot 4B
Voids	%	7.0	6.5 - 7.5	7.1	7.0	7.0
Thickness	mm	62.0	61.0 - 63.0	62.1	62.2	62.0
(Gf/S)*(L/D)			70 - 250	176.0	217.5	178.8

Asphalt Design and Production Task Force (ADP – TF)

- Tom Kane – NYSDOT
- Karl Vogel – NYSDOT
- Chris Heller – NYSDOT
- Bruce Barkevich – NYCMA
- Greg Rose – Barre Stone
- Massimo Colombai – Dolomite
- Aaron Markham – Gernatt
- Rocco Perretta – Heidelberg
- Jared Borelli – Callanan
- Kai Qualben – Tilcon NY
- Connor Campbell – Suit-Kote
- Mike Moore Jr. – Cobleskill Stone

Benchmarking NYS Mixes

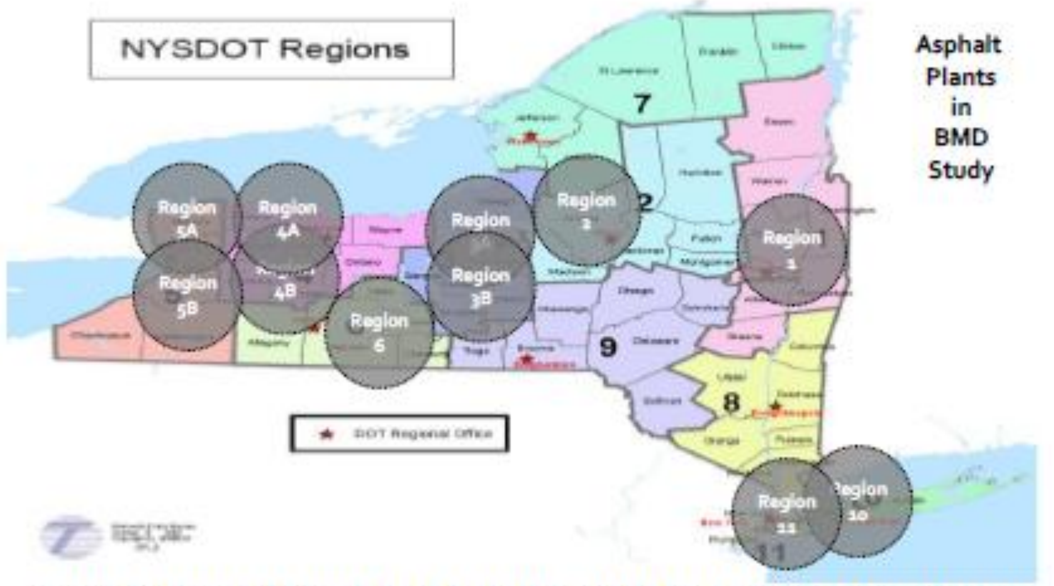
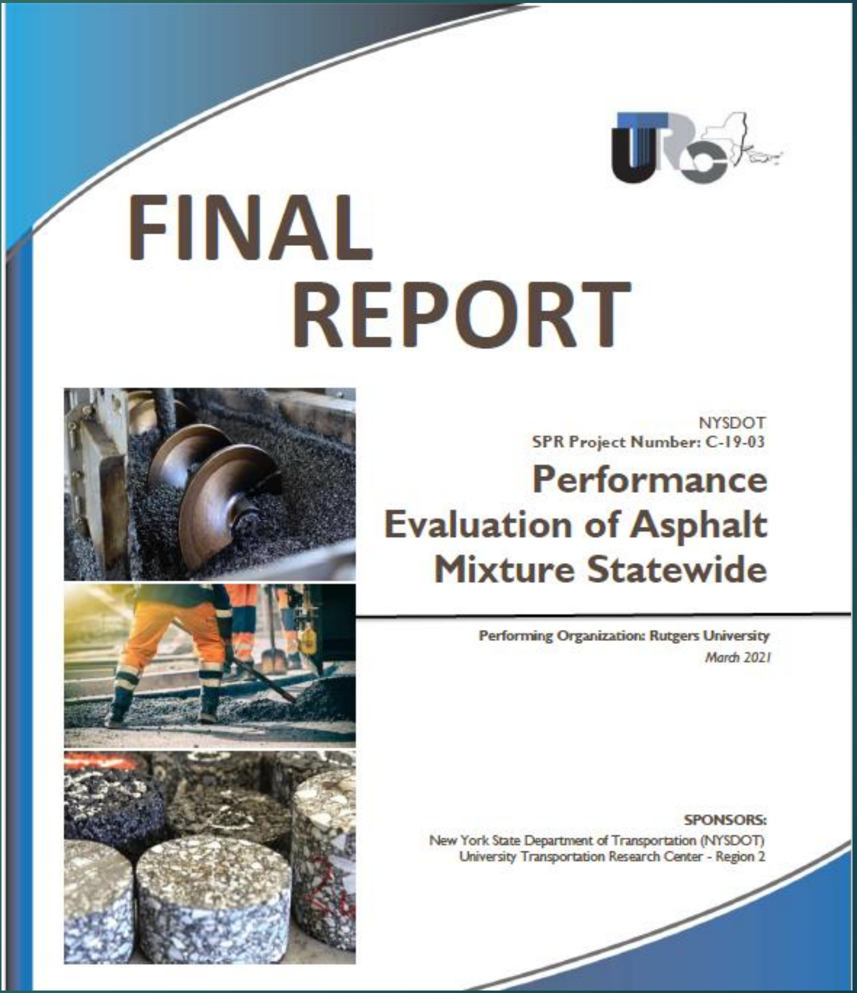


Figure 6 – Regional Locations of Asphalt Mixtures Evaluated in NYSDOT BMD Study



FINAL REPORT

NYSDOT
SPR Project Number: C-19-03

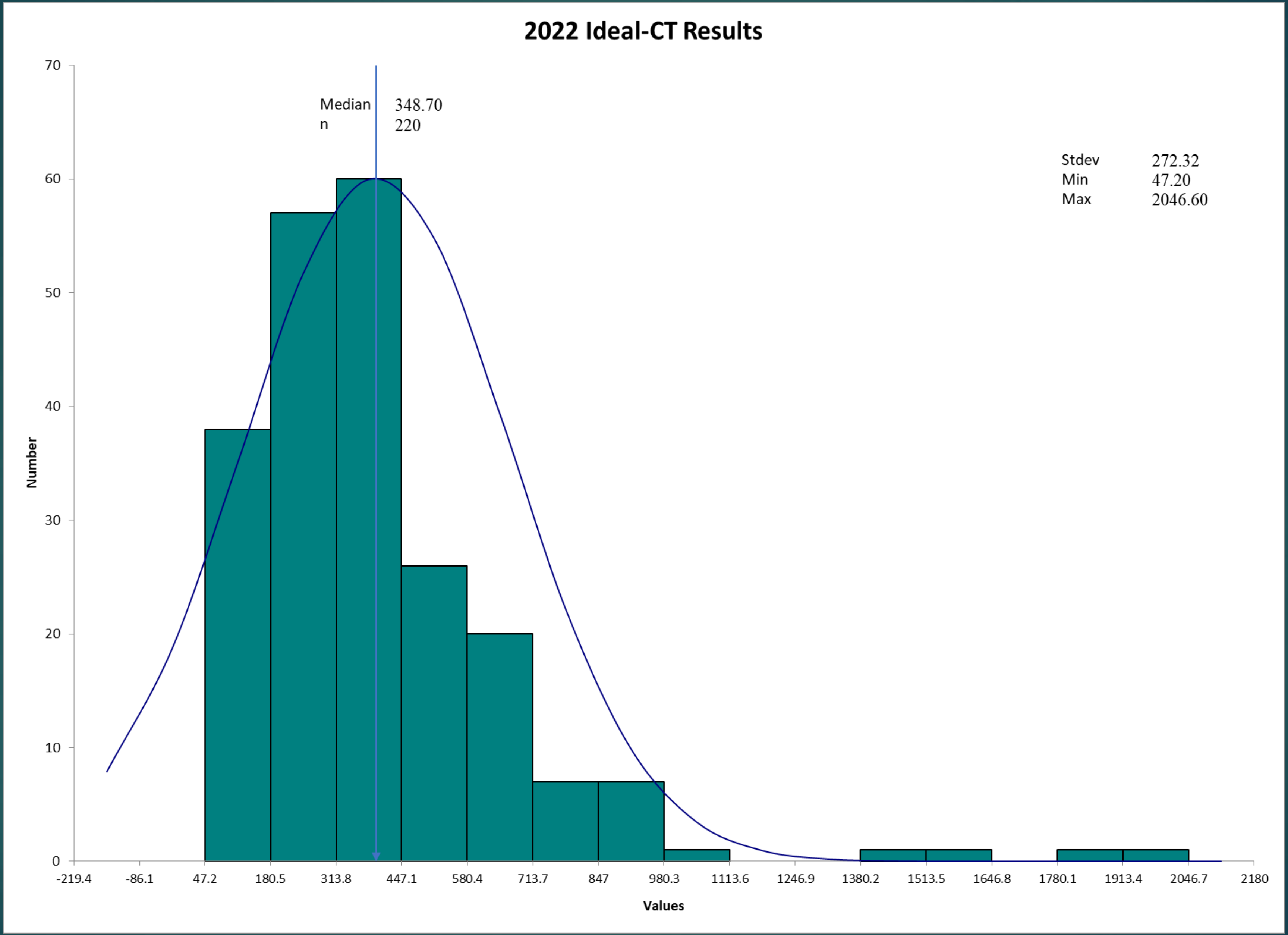
Performance Evaluation of Asphalt Mixture Statewide

Performing Organization: Rutgers University
March 2021

SPONSORS:
New York State Department of Transportation (NYSDOT)
University Transportation Research Center - Region 2

	A	B	E	F	G	H	I	J	K	L	M	N
1	IDEAL-CT	Date Sampled	Air Voids	CT Index	QCQA	Mix Size	RAP %	AC %	QA/QC Results		JMF Averages	
2		7/5/2022	6.64	283.6	QA	9.5mm		6.2	Average	376.9333333		
3		7/5/2022	7	478.9	QA	9.5mm		6.2	Std Dev	79.9642559		
4		7/5/2022	7.2	368.3	QA	9.5mm		6.2	COV	21.2%	QA	
5		7/5/2022	6.1	408.8	QC	9.5mm		6.2	Average	320.1666667	Average	419.55
6		7/5/2022	6.8	300.8	QC	9.5mm		6.2	Std Dev	65.90095261	Std Dev	83.30275606
7		7/5/2022	6.4	250.9	QC	9.5mm		6.2	COV	20.6%	COV	19.9%
8		7/8/2022	6.77	539.0	QA	9.5mm		6.2	Average	462.1666667	QC	
9		7/8/2022	6.85	460.5	QA	9.5mm		6.2	Std Dev	62.06493016	Average	300.95
10		7/8/2022	7.06	387.0	QA	9.5mm		6.2	COV	13.4%	Std Dev	63.81396791
11		7/8/2022	7	246.1	QC	9.5mm		6.2	Average	281.7333333	COV	21.2%
12		7/8/2022	7.1	239.2	QC	9.5mm		6.2	Std Dev	55.34391465		
13		7/8/2022	7.1	359.9	QC	9.5mm		6.2	COV	19.6%		
14		5/12/2022	7.20	303.8	QA	9.5mm	0	6.4	Average	240.5		
15		5/12/2022	7.08	291.2	QA	9.5mm	0	6.4	Std Dev	80.77412952		
16		5/12/2022	7.16	126.5	QA	9.5mm	0	6.4	COV	33.6%		
17		5/12/2022	7.30	417.1	QC	9.5mm	0	6.4	Average	378.6666667		
18		5/12/2022	6.60	384.7	QC	9.5mm	0	6.4	Std Dev	34.1161418		
19		5/12/2022	7.00	334.2	QC	9.5mm	0	6.4	COV	9.0%		
20		5/17/2022	7.00	382.6	QA	9.5mm	0	6.4	Average	266.0333333		
21		5/17/2022	6.6	238.0	QA	9.5mm	0	6.4	Std Dev	86.04612458		
22		5/17/2022	7.4	177.5	QA	9.5mm	0	6.4	COV	32.3%		
23		5/17/2022	7	479.7	QC	9.5mm	0	6.4	Average	421.1	QA	
24		5/17/2022	7.5	381.0	QC	9.5mm	0	6.4	Std Dev	42.36437182	Average	335.7916667
25		5/17/2022	7.3	402.6	QC	9.5mm	0	6.4	COV	10.1%	Std Dev	148.3177869
26		5/23/2022	7.2	435.8	QA	9.5mm	0	6.4	Average	364.5333333	COV	44.2%
27		5/23/2022	7.14	332.2	QA	9.5mm	0	6.4	Std Dev	50.46512547	QC	
28		5/23/2022	6.9	325.6	QA	9.5mm	0	6.4	COV	13.8%	Average	365.8666667
29		5/23/2022	7.4	261.2	QC	9.5mm	0	6.4	Average	255.7333333	Std Dev	65.19762436
30		5/23/2022	7.4	234.3	QC	9.5mm	0	6.4	Std Dev	15.75020282	COV	17.8%
31		5/23/2022	7.2	271.7	QC	9.5mm	0	6.4	COV	6.2%		
32		5/26/2022	6.5	210.1	QA	9.5mm	0	6.4	Average	498.0666667		
33		5/26/2022	7.46	623.8	QA	9.5mm	0	6.4	Std Dev	204.1676816		
34		5/26/2022	7.1	660.3	QA	9.5mm	0	6.4	COV	41.0%		
35		5/26/2022	6.8	394.4	QC	9.5mm	0	6.4	Average	380.3666667		
36		5/26/2022	6.8	409.9	QC	9.5mm	0	6.4	Std Dev	31.44946564		
37		5/26/2022	6.6	336.8	QC	9.5mm	0	6.4	COV	8.3%		
38		6/3/2022	7.19	255.7	QA	9.5mm	0	6.4	Average	309.825		
39		6/3/2022	7.15	434.2	QA	9.5mm	0	6.4	Std Dev	113.4890606		
40		6/3/2022	6.75	398.5	QA	9.5mm	0	6.4	COV	37%		
41		6/3/2022	6.5	150.9	QA	9.5mm	0	6.4				

	P	Q	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	HT-IDT	Date Sampled	Air Voids	IDT Strength	QCQA	Mix Size	RAP %	AC %	QA/QC Results		Per Day Results		JMF Averages	
2		7/5/2022	6.70	43.2	QA	9.5mm		6.2	Average	51.5				
3		7/5/2022	7.00	52.0	QA	9.5mm		6.2	Std Dev	6.582299497				
4		7/5/2022	7.00	59.3	QA	9.5mm		6.2	COV	12.8%	Average	42.08333333	QA	
5		7/5/2022	7.00	34.1	QC	9.5mm		6.2	Average	32.66666667	Std Dev	4.03985233	Average	49.16666667
6		7/5/2022	7.40	33.3	QC	9.5mm		6.2	Std Dev	1.497405163	COV	9%	Std Dev	5.405141585
7		7/5/2022	7.20	30.6	QC	9.5mm		6.2	COV	4.6%			COV	11.0%
8		7/8/2022	6.90	44.0	QA	9.5mm		6.2	Average	46.83333333			QC	
9		7/8/2022	7.10	48.8	QA	9.5mm		6.2	Std Dev	2.053181813			Average	34.61666667
10		7/8/2022	7.30	47.7	QA	9.5mm		6.2	COV	4.4%	Average	41.7	Std Dev	2.476164148
11		7/8/2022	6.60	36.7	QC	9.5mm		6.2	Average	36.56666667	Std Dev	1.803693788	COV	7.2%
12		7/8/2022	6.50	34.6	QC	9.5mm		6.2	Std Dev	1.554205764	COV	4%		
13		7/8/2022	6.70	38.4	QC	9.5mm		6.2	COV	4.3%				
14		5/12/2022	6.96	45.2	QA	9.5mm	0	6.4	Average	46.06666667				
15		5/12/2022	7.36	44.5	QA	9.5mm	0	6.4	Std Dev	1.744196727				
16		5/12/2022	7.60	48.5	QA	9.5mm	0	6.4	COV	3.8%	Average	47.03949622		
17		5/12/2022	7.60	42.4	QC	9.5mm	0	6.4	Average	48.01232578	Std Dev	2.898602511		
18		5/12/2022	7.30	49.9	QC	9.5mm	0	6.4	Std Dev	4.053008295	COV	6%		
19		5/12/2022	7.30	51.7	QC	9.5mm	0	6.4	COV	8.4%				
20		5/17/2022	7.05	32.5	QA	9.5mm	0	6.4	Average	38.63333333				
21		5/17/2022	6.49	40.7	QA	9.5mm	0	6.4	Std Dev	4.413111777				
22		5/17/2022	6.53	42.7	QA	9.5mm	0	6.4	COV	11.4%	Average	39.64128831		
23		5/17/2022	7.20	35.3	QC	9.5mm	0	6.4	Average	40.64924329	Std Dev	5.511350006		
24		5/17/2022	7.20	36.7	QC	9.5mm	0	6.4	Std Dev	6.609588236	COV	14%		
25		5/17/2022	7.20	50.0	QC	9.5mm	0	6.4	COV	16.3%				
26		5/23/2022	7.40	29.7	QC	9.5mm	0	6.4	Average	32.99125074				
27		5/23/2022	7.40	33.2	QC	9.5mm	0	6.4	Std Dev	2.604772605				
28		5/23/2022	7.20	36.1	QC	9.5mm	0	6.4	COV	7.9%	Average	35.8289587		
29		5/23/2022	7.43	34.8	QA	9.5mm	0	6.4	Average	38.66666667	Std Dev	2.691230746	QA	
30		5/23/2022	7.35	40.0	QA	9.5mm	0	6.4	Std Dev	2.777688887	COV	8%	Average	39.3952381
31		5/23/2022	7.39	41.2	QA	9.5mm	0	6.4	COV	7.2%			Std Dev	5.764710061
32		5/26/2022	6.70	45.2	QA	9.5mm	0	6.4	Average	34.83333333			COV	14.6%
33		5/26/2022	7.06	27.8	QA	9.5mm	0	6.4	Std Dev	7.484354051			QC	
34		5/26/2022	7.02	31.5	QA	9.5mm	0	6.4	COV	21.5%	Average	34.2676345	Average	37.67306892
35		5/26/2022	7.80	30.7	QC	9.5mm	0	6.4	Average	33.70193566	Std Dev	4.840932954	Std Dev	7.060465013
36		5/26/2022	7.60	35.9	QC	9.5mm	0	6.4	Std Dev	2.197511858	COV	14%	COV	18.7%
37		5/26/2022	7.80	34.5	QC	9.5mm	0	6.4	COV	6.5%				
38		6/3/2022	6.95	44.0	QA	9.5mm	0	6.4	Average	40.66666667				
39		6/3/2022	7.03	39.1	QA	9.5mm	0	6.4	Std Dev	2.358436394				
40		6/3/2022	6.87	38.9	QA	9.5mm	0	6.4	COV	6%	Average	36.83862789		
41		6/3/2022	7.50	31.2	QC	9.5mm	0	6.4	Average	33.01058911	Std Dev	1.943664769		



2022 Ideal-CT Results
Median 348.70
n 220
Stdev 272.32
Min 47.20
Max 2046.60
Number
70
60
50
40
30
20
10
0
-219.4
-86.1
47.2
180.5
313.8
447.1
580.4
713.7
847
980.3
1113.6
1246.9
1380.2
1513.5
1646.8
1780.1
1913.4
2046.7
2180
Values

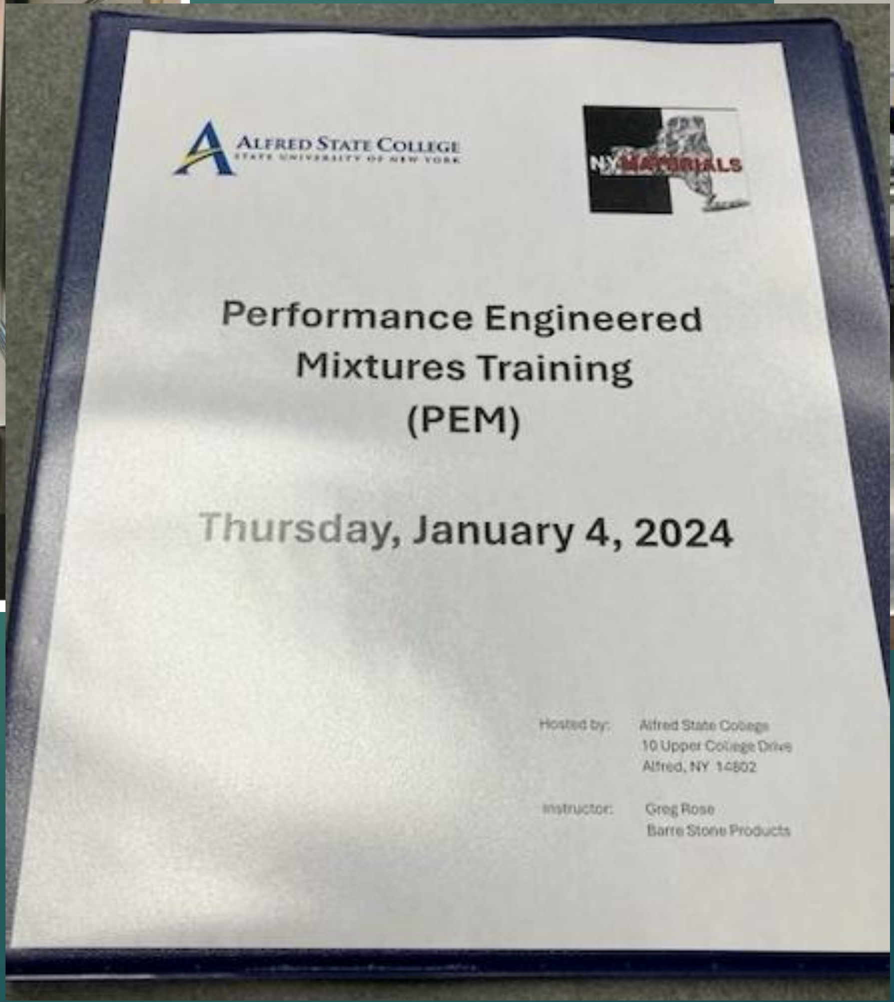
2024 VPP NYSDOT Specific Projects

2.7 Asphalt Mixture Evaluation Using Performance Testing

This note shall apply to the sites listed below:

Project 4V2311 – Route 33, Genesee County
Project 4V2331 – Route 33A, Monroe County
Project 4V2332 – Route 250, Monroe County
Project 4V2341 – Route 21, Wayne and Ontario Counties
Project 4V2351 – Route 31A, Orleans County
Project 4V2361 – Route 14, Wayne County
Project 4V2371 – Route 39, Wyoming County
Project 5V2432 – Route 277, Erie County
Project 5V2443 – Route 62, Erie County
Project 5V2444 – Route 187, Erie County
Project 5V2452 – Route 324, Erie County
Project 7V2411 – Route 9, Clinton County
Project 7V2412 – Route 9B, Clinton County
Project 7V2413 – Route 22, Clinton County
Project 7V2432 – Route 37, Jefferson County
Project 7V2441 – Route 812, Lewis County
Project 7V2452 – Route 37, St. Lawrence County
Project 7V2456 – Route 420, St. Lawrence County
Project 7V2462 – Route 126, Jefferson County
Project 7V2664 – Route 37, Jefferson County
Project 9HW411 – Route 26, Broome County
Project 9HW421 – Route 206, Chenango County
Project 9HW441 – Route 268, Delaware County
Project 9HW451 – Route 166, Otsego County
Project 9HW461 – Route 28, Delaware County
Project 9HW471 – Route 52, Sullivan County
Project 9V2461 – Route 10, Schoharie County

NYCMA PEM Training Class



NY MATERIALS

NAPA MEMBER

<u>**PERFORMANCE ENGINEERED MIXTURES (PEM) EVALUATION USING PERFORMANCE TESTING**</u>

Description

This note covers the requirements of Performance Engineered mixes (PEM) for Asphalt Top Course mixtures. The requirements are mixture design, verification, and production under a performance testing process. All provisions of Section 401 Asphalt Production of the NYS Standard Specifications apply except as modified below.

Mixture Design Process

Asphalt Mixtures shall be designed to meet the requirements of New York State Materials Method 5.16, *Asphalt Mixture Design and Mixture Verification Procedures*, except as modified. Mixture should meet or exceed the performance testing requirements specified in Table 1, unless waived by the Regional Materials Engineer.

Table 1 – Performance Testing Criteria

Test Methods	Criteria	Min. Design Value	Max. COV

2. **Regional Materials Lab –** The RML will do the following:
   a. Test the Producer fabricated second set samples to determine if they meet the performance criteria referenced in Table 1.
   b. **Additional Cross-Lab Testing:** The RME may elect to fabricate additional samples for cross-lab testing by the Producer, if necessary.

Mixture Design Process

Asphalt mixtures shall be designed to meet the requirements of New York State Materials Method 5.16, *Asphalt Mixture Design and Mixture Verification Procedures* except as modified. Mixture should meet or exceed the performance testing requirements specified in Table 1, unless waived by the Regional Materials Engineer (RME).

Table 1 – Performance Testing Criteria

Test Methods	Criteria	Min. Design Value	Max. COV
AASHTO T 393-21 Flexibility Index Test	Flexibility Index	8	≤40
ASTM D6931-17 Indirect Tensile Strength Test	IDT Strength	30 psi	≤25
ASTM D8225-19 Determination of CT Index	CT Index	135	≤25

Designs may use an air void content between 2% and 5%.

In no case shall the job mix tolerance fall outside the Control Points of the control sieves.

Table 2 - Summary of Testing Criteria for Performance Engineered Mixtures (PEM)				
At the Plant		**High Temperature IDT**	**IDEAL CT index**	**SCB Flexibility Index**
Test Method		ASTM D6931-17 NCHRP 9-33 Report	ASTM D8225-19	AASHTO T 393-21
No. of Samples		3	3	3
Load Rate (mm/min)		50±5	50±2	50±2
Height (mm)		62±1[1]	<= 19 mm NAS = 62±1 >=25 mm NAS = 95±1	50±1
Notch Width (mm)		NA	NA	<2.25
Aging	Lab mixed	2 hours loose mix volumetric Conditioning at Compaction Temperature	4 hours loose mix conditioning at Compaction Temperature	4 hours loose mix conditioning at Compaction Temperature.
	Plant mixed	Reheat loose mix to Compaction Temperature and Compact Specimens or Reheat loose mix to Compaction Temperature	Reheat loose mix to Compaction Temperature and Compact Specimens or Reheat loose mix to Compaction Temperature	Reheat loose mix to Compaction Temperature and Compact Specimens or Reheat loose mix to Compaction Temperature
Compaction Temperature, °C		V Grade = 132°C ± 3°C E Grade = 146°C ± 3°C	V Grade = 132°C ± 3°C E Grade = 146°C ± 3°C	V Grade = 132°C ± 3°C E Grade = 146°C ± 3°C
Air Voids, %		7 ± 1	7 ± 0.5	7 ± 1
Test Temperature, °C		44°C ± 1.0	25°C ± 1.0	25°C ± 1.0
Water Bath Conditioning		44°C for 2 hrs ± 10 min.	25°C for 2 hrs ± 10 min.	25°C for 2 hrs ± 10 min

[1] **Modified height from ASTM D6931-17**

Table 3 - Production Testing and Sampling Table			
Plant Test Property	**Test Method**	**Producer Testing Frequency[1]**	**Department Testing Frequency[2]**
PG Binder Content	Automation, Ignition Oven (NY 400-13C), or AASHTO T 164 Method A or B	Every Sublot	Every Lot
Aggregate Gradation	AASHTO T27	Every Sublot	Every 3 Lots
Air Voids	MM 5.16, AASHTO T269	Every 2 Lots	Every 3 Lots
Indirect Tensile Strength	ASTM D6931-17	Every 2 Lots	Every 3 Lots
Determination of CT Index	ASTM D8225-19	Every 2 Lots	Every 3 Lots

1. All sampling at the plant
2. All sampling at the paver

Mixture Production

Asphalt Mixture requirements are as follows:

Table 4 - Mixture Gradation, Absolute Difference Value			
Limits (Test Value – JMF Value)	Sieve Sizes		
	#50 and Larger (300 µm and Larger)	#100 (150 µm)	#200 (75 µm)
Production	0.0 – 5.0	0.0 – 4.0	0.0 – 2.0
Evaluation	5.0 – 8.0	4.0 – 6.0	2.0 – 4.0
Action	>8.0	>6.0	>4.0

Table 5 - Mixture Performance Limits		
PEM Limits	IDEAL CT	HT-IDT (psi)
Production	≥ 135.0	≥ 30.0
Evaluation	108.0 - 134.9	24.0 - 29.9
Action	< 108.0	< 24.0

Table 6 – Air Void Limits	
Limits	Air Voids
Production	2%-5%
Evaluation	<2% or >5%

Project 4V2351
Rt. 31A VPP Project

- 2.0 Miles from the BSP Asphalt Plant
- 7.7 mile overlay project
  - 4,600 tons of Shim (Scratch), PG64S-22, Warm-Mix
  - 18,650 tons of 12.5 F2 Top, PG64V-22, Warm-Mix
- Performance Engineered Mixture Evaluation using Performance Testing
- 70 Series Compaction (peak the gauge)

Mix Design Verification

DESIGN	Spec	23 Project	Trial #1	Trial #2	Trial #6	DOT Verification #1	DOT Verification #2
Mixed		Plant	Plant	Plant	Lab	Lab	Lab
Ideal-CT	≥ 135.0	171.3	134.8	164.0	165.6	190.1	213.0
COV	≤ 25.0	6.4	4.8	35.2	16.0	47.5	21.0
HT-IDT	≥ 30.0	-	35.3	27.0	44.1	47.7	-
COV	≤ 25.0	-	6.0	18.3	7.3	4.9	-
I-Fit	≥ 8.0	6.1	5.8	-	7.2	4.4	-
COV	≤ 40.0	25.8	13.6	-	15.8	18.4	-


2


1
2

NCAT Trial Weight Estimating Spreadsheet

National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Mix Gmm:	2.489
Specimen Height (mm):	62
Target Air Voids (%)	7
Passing #8 Sieve (%)	37
	CF
Estimated CF	1.037
User Input CF	1.036
Estimated Weight (g):	2,448
Rounded Weight (g):	2,450

Input

Result

Typical Values		
Test	*Specimen Height (mm)*	*Target Air Voids (%)*
HB/IDEAL	62	7.0
APA	75	7.0
TSR	95	7.0
OT/IDT	125	7.5 - 8.0
I-FIT/DCT	160	7.5 - 8.0

Average Starting CF Values	
Height (mm)	*Average CF*
62	1.036
75	
95	
125	
160	

Questions? Please contact:

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Adam Taylor - tayloa3@auburn.edu

National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Calculate Volume CF from G_{mb} Data

From T166 (Bulk) Test

Dry Specimen Mass (g):	2461.5
Underwater Mass (g):	1409.5
SSD Mass (g):	2467.9
Specimen Diameter (mm):	150
Specimen Height (mm):	62
True G_{mb}:	2.326
Cylinder G_{mb}:	2.247
Mix Specific CF:	1.035

Disclaimer:

The Correction Factor (CF) is specific to each unique mix type, sample height, and target air void content

NY MATERIALS

NAPA MEMBER


1
2
3
4
5
6


HUMBOLDT
5125
HUMBOLDT

Gradation Results

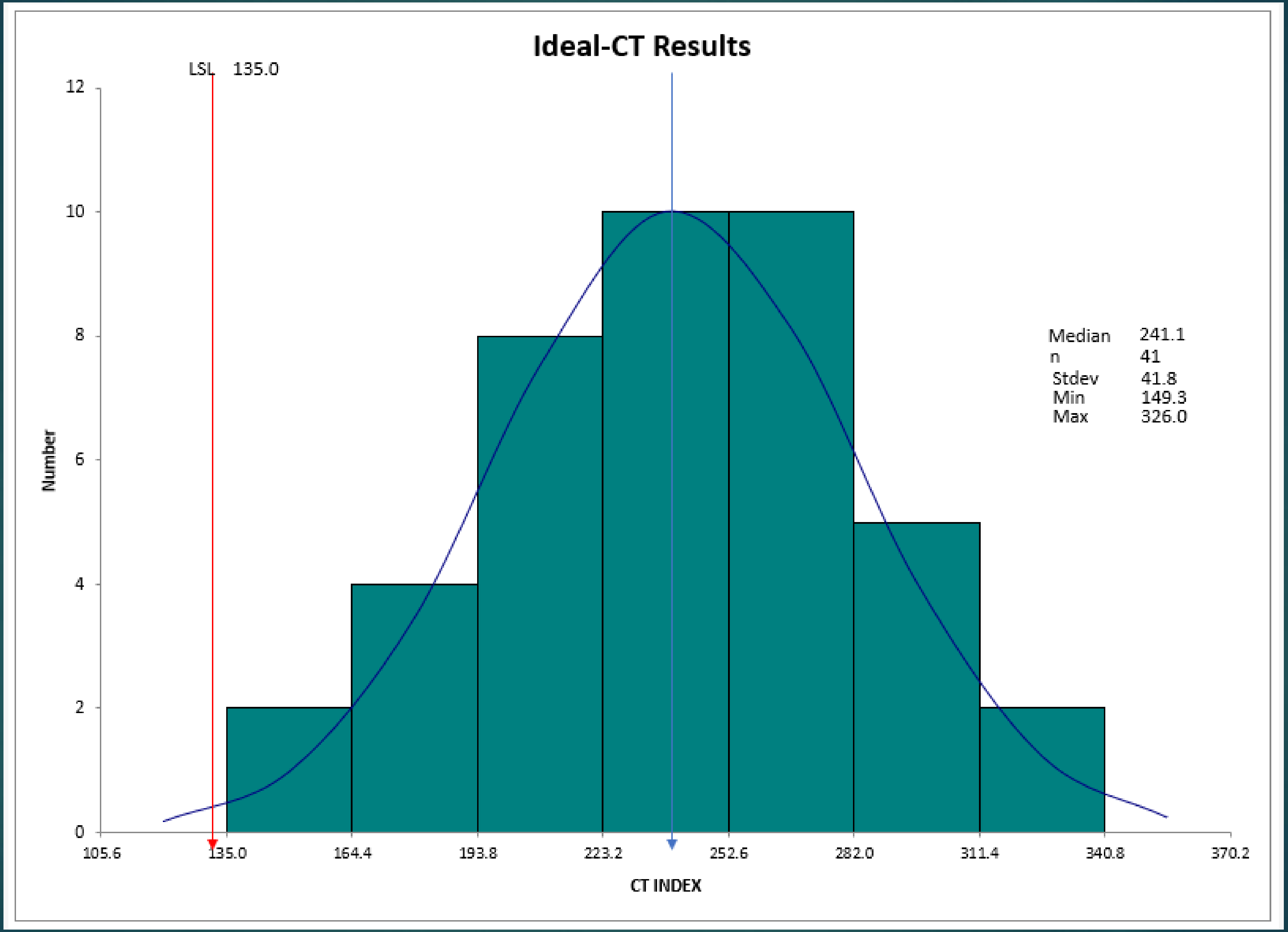
Sieve	Target	Production	BSP Average	DOT Average
#4	57	± 5.0	56.3	57.4
#8	39	± 5.0	39.5	38.1
#50	9	± 5.0	9.4	9.5
#100	6	± 4.0	5.9	5.9
#200	3	± 2.0	3.1	3.0

Volumetric Results

	Minimum	Target Air Voids	Maximum
Production	2.0	**3.5**	5.0
BSP	2.00	**2.52**	3.98
DOT	1.99	**3.28**	4.76

Ideal-CT Results

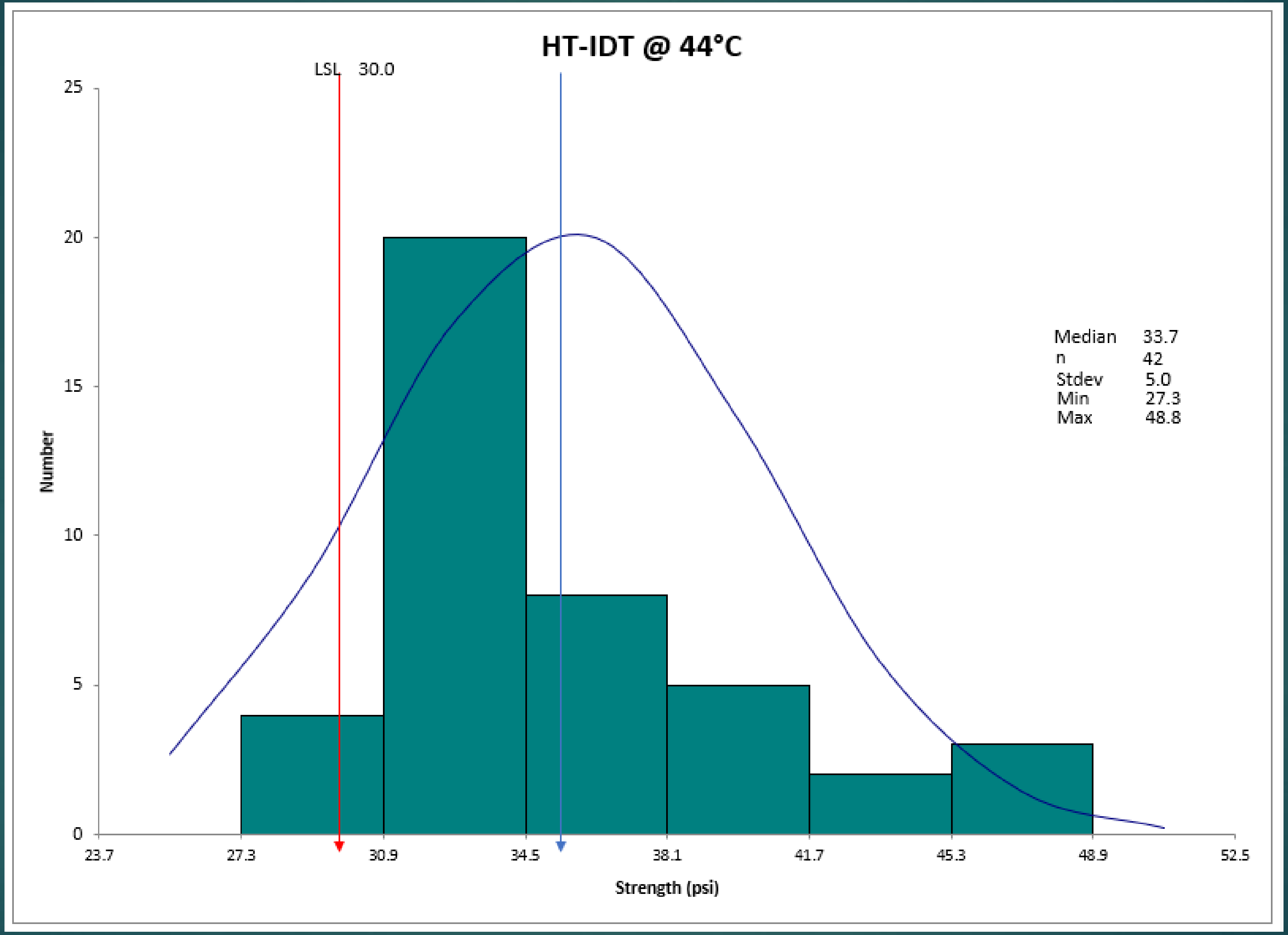
Ideal-CT	Minimum	Average	Maximum
Production		≥ 135.0	
BSP	177.3	253.3	326.0
DOT	149.3	207.9	291.5

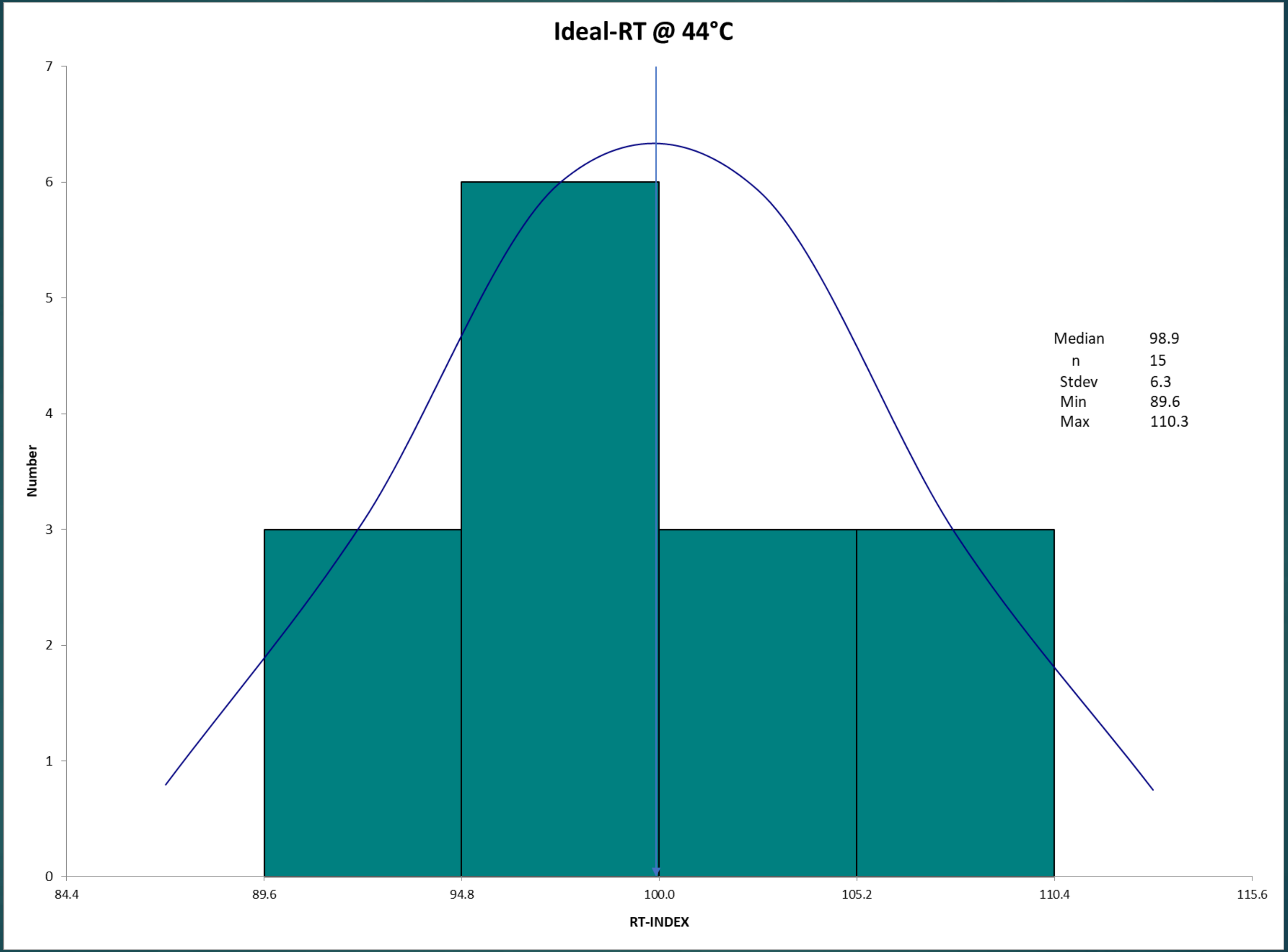


Ideal-CT Results
LSL 135.0
12
10
8
6
4
2
0
Number
105.6
135.0
164.4
193.8
223.2
252.6
282.0
311.4
340.8
370.2
CT INDEX
Median 241.1
n 41
Stdev 41.8
Min 149.3
Max 326.0

HT-IDT Results

HT-IDT	Minimum	Average	Maximum
Production		≥ 30.0	
BSP	27.3	**33.0**	38.5
DOT	32.0	**41.0**	48.8


HT-IDT @ 44°C
LSL 30.0
Median 33.7
n 42
Stdev 5.0
Min 27.3
Max 48.8
Number
25
20
15
10
5
0
23.7
27.3
30.9
34.5
38.1
41.7
45.3
48.9
52.5
Strength (psi)


Ideal-RT @ 44°C
Number
RT-INDEX
0
1
2
3
4
5
6
7
84.4
89.6
94.8
100.0
105.2
110.4
115.6
Median 98.9
n 15
Stdev 6.3
Min 89.6
Max 110.3

THANK YOU!

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