



**Department of
Transportation**

Performance Engineered Mixtures for PCC Pavements

Specification Update and Requirements

October 28, 2025

Objectives

At the end of this presentation, participants will be able to identify:

- New PEM Requirements
- Where PEM requirements can be found in Materials Procedures and Standard Specifications
- Changes to pavement standard specifications



Why PEM, why now?

- ➔ Existing Concrete Specifications (ie: Section 501) “outdated”
 - ❑ Improved Long Term Concrete Performance
 - ❑ Taking better advantage of Contractor/Producer experience/innovation
 - ❑ Required Compliance with State Legislation:
 - Executive Order # 22 Required Embodied Carbon Guidance (June 2023)
 - Buy Clean Concrete Guidelines (Sept. 2023)
 - *Establishment of emissions limits on concrete used in state-funded public building and transportation projects*
 - *Portland cement accounts for approximately 80-90 percent of the embodied carbon in concrete, a reduction in cement use leads to reduced greenhouse gas emissions*

What is PEM?

Department specifies properties, Producer designs the mix to meet.

Improved Durability

- Air Content – (Total Air)

- Freeze/Thaw & Scaling Resistance – (Entrained Air/ Air Void Distribution)

Shrinkage Crack Reduction

- Limits on Paste Content

- Cement Reduction (Typically 10-15%)

Lowered Permeability through Surface Resistivity

Workability – Contractor/ Producer can optimize mix for specific placement conditions

Old Mixes (Class Mixes)

- Old prescriptive mixes left no room for innovation.
- Prescriptive class mixes have gone away.

Concrete Class	Design Mix Guidelines (where sand fineness modulus = 2.80) ¹						Primary Use
	T.C.M. ⁵ Content (kg/m ³)	Sand % Total Agg. (solid volume)	Water/cementitious mat'ls (by mass)	Air Content % desired (Range)	Slump Range (mm)	Type of Coarse Aggregate Gradation	
A	360	36.2	0.46	6.5 (5.0 - 8.0)	65 - 90	CA 2	general purpose structural
C	359	35.8	0.44	6.5 (5.0 - 8.0)	40 - 65	CA 2	pavement: slipform paving, form paving
D	430	45.8	0.44	7.5 (6.0 - 9.0)	65 - 90	CA 1	thin structural applications
DP ²	430	45.8	0.40	7.5 (6.0 - 9.0)	50-125	CA 1	thin structural applications, overlays
E	384	35.8	0.44	6.5 (5.0 - 8.0)	75 - 100	CA 2	structural slabs and structural approach slabs
F	425	34.6	0.38	6.5 (5.0 - 8.0)	50 - 75	CA 2	high early strength for pavement or structural applications
G ³	431	45.0	0.45	6.0 (4.0 - 8.0)	150 - 180	CA 2	underwater
GG ³	475	45.0	0.45	6.0 (4.0 - 8.0)	150- 180	CA 1	underwater (special)
H	400	40.0	0.44	6.5 (5.0 - 8.0)	75 - 100	CA 2	pumping applications
HP ²	405	40.0	0.40	6.5 (5.0 - 8.0)	75 - 125	CA 2	pumping, structural slabs, approach slabs, substructures exposed to chlorides
I ⁴	380	41.0	0.44	6.0 (4.0 - 8.0)	15 - 40	CA 2	slip forming highway median barriers
J ⁴	403	45.8	0.44	6.0 (4.0 - 8.0)	15 - 40	CA 1	slip forming structural median barriers, parapet walls and curbs

New Mixes (PEM)

New mixes focus on performance criteria:

- Strength
- Air Content
- Shrinkage/ Paste Factor
- Permeability
- Optimized Gradation
- Freeze Thaw Durability

Slump and W/C ratio no longer specified design criteria

Table 1 Concrete Mixtures Design Mix Performance Criteria								
Application	Minimum Compressive Strength (psi) ¹	Flexural Strength (psi)	Air Content % (range)	56 Day Resistivity (kΩ-cm)	Freeze-Thaw Durability (ASTM C666 or AASHTO T395 or ASTM C457) ²	Edge Slump ³ (AASHTO T396)	Surface Voids ³ (AASHTO T396)	Paste Volume (AASHTO R101)
502- PCC Pavements	3000	600	5.0-10.0	≥16.5	DF ≥ 90% or SAM ≤ 0.20 or Spacing Factor ≤ 0.008"	<.25"	<30%	25%
503- PCC Pavement Foundations	3000	600	5.0-10.0	N/A	N/A	<.375"	<30%	27%

1. Compressive strength will be evaluated at 28 days. The mixture shall meet the requirements of §502-3.16, *Opening to Traffic*, within the time specified in the contract for opening prior to opening to traffic.
2. Freeze-Thaw test selected is at the discretion of the producer.
3. The requirements of AASHTO T396 shall apply for slipform applications.

Freeze Thaw Testing - SAM

- **AASHTO T395 –Standard Method of Characterization of the Air-Void System of Freshly Mixed Concrete by the Sequential Pressure Method**
- Air void structure assessment of plastic concrete
 - Allows issues with mix to be detected and addressed sooner as QC tool. Only required to be run at mix trial
- In lieu of SAM, the following can be used for mix development/ approval
 - **ASTM C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing**
 - **ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of Air-Void System in Hardened Concrete**



Permeability Testing- Surface Resistivity (SR)

AASHTO T358 – Standard Method of Test for Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration

Assesses permeability of concrete- Higher density reduces chloride ingress

Used as a QA measure

Paste content and pozzolans in mix help to control SR.

Performance targets are set at 56 days.



Workability- Box Test

AASHTO T396- Evaluating the Workability of Slip Form Concrete Paving with the Box Test

Test is only required at the trial batch if the mix is proposed for slipforming.

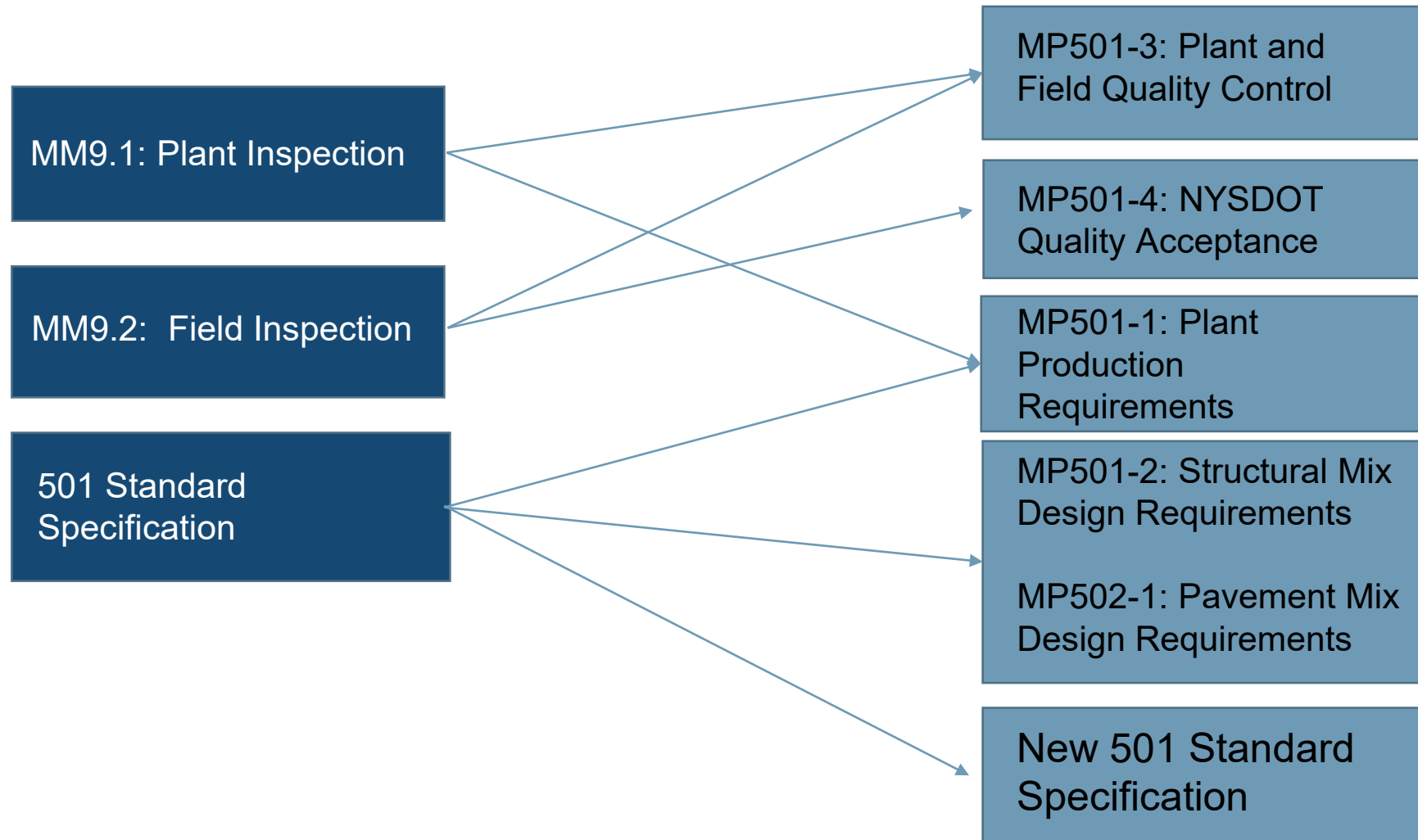
Mixes proposed for fixed form paving projects **DO NOT** require a box test be performed.

- 8'x8'x8" test panel was formerly required for all PCC pavement mixes. This has been eliminated from PEM, still required for HES mixtures.



New 501 Program Specification Documents

Document Updates



Pavement Design Documents

Materials Procedure 502-1: Mix Design Requirements for Pavements

Standard Specification 502- PCC Pavements

- $SR \geq 16.5$
- $SAM \leq .20$
- Paste Content: 25%
- Max Edge Slump: .25"

Standard Specification 503- PCC Pavement Foundations

- No SR Requirement
- No SAM Requirement
- Paste Content: 27%
- Max Edge Slump: 3/8"
- **No QA's**

Repair Mixes- 510 Special Specification

Two options are available for PEM mixes for repairs.
No QAs are applied on 510 Repairs.

502- PCC Pavement Mix

- $SR \geq 16.5$
- $SAM \leq .20$
- Paste Content: 25%
- 3000 PSI Compressive
- 600 PSI Flexural Strength

579, 582 – Repair, Misc. General Purpose Mix

- $SR \geq 18$
- $SAM \leq .20$
- Paste Content: 27%
- 4000 PSI Compressive
- No Flexural Strength Requirement

MP501-3 Plant and Field QC

- QC Requirements Document
- Replacing MM9.1 and MM9.2
- Plant and Field QC become the contractors' responsibility
- Quality Control Plan



III. QUALITY CONTROL PLAN (QCP):

The Contractor shall submit a QCP including (but not limited to) the following information:

- Contractor – Company and Contact Information
- Concrete Producer– Company and Contact Information
- Project – Number and Location
- QC Plan Administrator – Company and Contact Information
- QC Plant – Company and Contact Information
- QC Plant Technician(s) – Contact Information
- QC Field – Company and Contact Information
- QC Field Technician(s) – Contact Information & ACI Certification Number
- NYSDOT Regional Materials – Contact Information
- Approved PCC Mix Designs – Mix ID# and Application/Element Type

The Plan Administrator is the representative of the Contractor and is responsible to ensure all requirements are in conformance with the specification and this procedure.

The Plan Administrator, or their representative, shall be available to communicate with Contractor and Department personnel at all times.

Materials Procedure 501-3

TABLE 1. MINIMUM PLANT QC TESTING FREQUENCY

Procedure ³	Frequency	Reference
Coarse Aggregate Gradation	1 test per 500 cy – Structural ¹ 1 test per 2000 cy – Pavement ¹	Appendix B
Coarse Aggregate Cleanness	Weekly	Appendix C
Fine Aggregate Gradation	1 test per 500 cy – Structural ¹ 1 test per 2000 cy – Pavement ¹	Appendix D
Combined Aggregate Gradation	1 test per 500 cy – Structural ¹ 1 test per 2000 cy – Pavement ¹	Appendix E
Fine Aggregate Fineness Modulus ²	1 test per 500 cy – Structural ¹ 1 test per 2000 cy – Pavement ¹	Appendix F
Aggregate Visual Identification	Daily	MM 28, Appendix G
Aggregate Free Moisture	Fine: Daily Coarse: Daily	Appendix H

Note 1. At this rate, but no less than once per day

Note 2. If the average of the three most recent test results has changed by more than 0.20 from the value used in the mix design, contact the RME.

Note 3. When testing is required for the Moisture Content of Lightweight Fine or Lightweight Coarse Aggregates, refer to Test Method No. NY 703-19E and NY 703-20F respectively.

Materials Procedure 501-3

TABLE 2. MINIMUM FIELD QC TESTING FREQUENCY

PCC Type	Procedure(s)	Frequency
Structural	Temperature, Slump, Unit Weight, Air Content	Minimum of 1 series of tests from each structural component and thereafter at a rate of 1 series per $\pm 50 \text{ yd}^3$ for the duration of that placement.
Structural & Pavement	Cylinders (1 set = Three 4x8's)	1 set of cylinders for each age/day break requested by the Contractor for early loading/opening. All sets must be taken from the same truck. Follow §501-3.07A for compression strength determination.
Pavement	Unit Weight, Temperature and Air Content	1 set of tests from the first placement of each day and thereafter at a rate of 1 set per 150 to 200 yd^3 (150 yd^3 is equivalent to 450 feet long by 12 feet wide by 9-inch-thick pavement).

501 Specification Update

TABLE 501-3 QUALITY ASSURANCE FREQUENCY

Application	Procedures	Minimum Rate
Structural Concrete	Air, Temperature, and Cylinders	1 set from each structural element. An additional set will be required for placements at a rate of 1 set per $\pm 200 \text{ yd}^3$ for the duration of that placement. ¹
Concrete Pavements	Air, Temperature, and Cylinders	1 set per $\pm 1000 \text{ yds}^3$ and a minimum of 2 sets per each day's placement

Note 1. The structural component/placement will be defined by the Engineer.

502 Specification Update

- Class C and associated process times were removed in May 2024 Spec Update.
- Other changes include:
 - Updated payment to be based on actual Cubic Yards of concrete placed
 - New tolerances for PCC thickness were developed, mirroring requirements for asphalt paving
 - Modification of payment items to allow undoweled pavements to be specified

Plastic Thickness Determination

PCC Pavement Tolerances

- Must be equal to specified thickness (-1/4 inch)
- No additional payment is made for concrete placed:
 - 1/4 inch over designed thickness for overlays
 - 1/2 inch over designed thickness when placed on subbase

Asphalt Pavement Tolerances

- +/- 1/4 inch for all pavement courses
- An additional + 1/4 inch will be allowed when placed directly on newly constructed subbase

Curing

Old Method

- Specified curing for 4 days when placed between June 1st and September 15th
- Increased curing to 6 days when placed outside of that window

New Method

- Maintain curing on pavement until the pavement can be opened to traffic

Opening to Traffic

Old Method

- Wait 7 days to open to Construction Traffic
- Wait 10 days between June 1 and September 15, or 15 days outside this window for conventional traffic.

New Method

- Open to Construction traffic when mix reaches 2500 PSI.
- Open to general traffic at 3000 PSI.

Opening to Traffic

Methods to determine strength to open to traffic

- 1) Cylinders
- 2) Maturity – Using ASTM C1074 or a modification thereof.
 - AASHTO T413 will be considered as an acceptable modification to ASTM C1074

Approved Plants

- Currently Over 100 Approved Plants
- Plant trials are ongoing
- Expect the list to continue growing
- Approved plants also have trials with additional mixes ongoing
- PDF Download is updated as list grows
- <https://www.dot.ny.gov/divisions/engineering/technical-services/technical-services-repository/alme/ApprovedPlants.pdf>

Approved Concrete & Asphalt Plants and Liquid Bituminous Material Facilities

Region 01 Materials

518-782-7293

Approved Asphalt Plants

H0001	Callanan Industries Inc.	101 Dunham Drive	Albany	NY
H0007	Callanan Industries Inc.	100 Crabapple Lane	Watervliet	NY
H0014	Peckham Industries, Inc.	438 Vaughn Road	Hudson Falls	NY
H0016	Palette Stone Corp.	Rt 29	Saratoga Springs	NY
H0017	King Road Materials Inc.	145 Cordell Rd	Schenectady	NY
H0018	King Road Materials Inc.	145 Cordell Rd	Colonie	NY
H0019	Palette Stone Corp	Route 29	Saratoga Springs	NY
H0020	Palette Stone Corp	5 Petrified Gardens Road	Saratoga Springs	NY
H0028	Wm. E. Dailey	1298 Rt. 7A	Shaftsbury	VT
H0248	Saranac Lake Quarries	909 NYS Route 3	Saranac Lake	NY
H0280	Palette Stone Corp.	Rt 29	Saratoga Springs	NY
H0285	Peckham Industries, Inc.	Route 9W	Catskill	NY
H0298	Peckham Industries, Inc.	5983 Rt 9	Chestertown	NY
H0346	Heidelberg Materials Northeast LLC	816 Commerce Road	Altamont	NY
H0376	Callanan Industries Inc.	Route 396	So. Bethlehem	NY
H0377	New Castle Asphalt LLC	230 Riverside Avenue	Rensselaer	NY
H0390	Peckham Industries, Inc.	7065 RTE. 9W	Catskill	NY
H0391	Dolomite Industries	831 State Route 67	Ballston Spa	NY
H0402	Troy Sand and Gravel	3600 Route 43	West Sand Lake	NY

Approved Concrete Plants

C0003	Bonded Concrete, Inc.	Route 155	Watervliet	NY
C0004	Bonded Concrete Inc.	Route 155	Watervliet	NY
C0005	Bonded Concrete Inc.	Route 43	West Sand Lake	NY
C0008	Clemente Latham North	Reed Street Pruyn Island	Glens Falls	NY
C0011	Electric City Concrete	1741 Vley Road	Scotia	NY
C0012	Glens Falls Ready Mix Inc.	112 Big Boom Road	Queensbury	NY
C0013	Palette Stone Corp.	Brook Road	Saratoga Springs	NY
C0014	J. P. Carrara & Sons Inc.	3081 Route 9N	Crown Point	NY
C0016	Saranac Lake Quarries	909 NYS Route 3	Saranac Lake	NY
C0304	Cranesville Block	5 Commerce Avenue	Albany	NY
C0410	Jointa Galusha Llc	1 Shermantown Road	Glens Falls	NY

Concrete Plants Allowed to Only Supply Contracts Let Before 5/1/24

C0276	Clemente Latham Concrete	9 Fonda Road	Cohoes	NY
C0305	The Fort Miller Co. Inc.	688 Wilbur Avenue	Greenwich	NY
C0439	Clemente Latham Concrete	South Pearl Street	Albany	NY
C0548	Bonded Concrete Inc.	61 Lupine Road	Gansevoort	NY

Liquid Bituminous Facilities

L0101	Callanan Industries Inc.	101 Dunham Drive	Albany	NY
L0104	All States Asphalt, LLC	6 Freemans Bridge Road	Scotia	NY
L0105	Peckham Materials Corp. (Parco)	Union Street	Athens	NY

Questions?

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Department of Transportation