HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

555 Hulet Drive
Bloomfield Hills, MI 48302-0360

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www.hrcengr.com

ADDENDUM NO. 1
TO SPECIFICATIONS AND PLANS FOR THE
2025 SAFETY PATH PROGRAM (W. MAPLE ROAD)
BLOOMFIELD TOWNSHIP
OAKLAND COUNTY, MICHIGAN

Date: April 10, 2025, HRC Job No. 20240038

This Addendum is issued prior to receipt of bids to provide for certain changes and clarifications to the Specifications and/or the Plans, as herein specified, and is hereby made a part of the Contract Documents and shall be taken into consideration in preparing the Proposal. The General Conditions and Specifications for the original work and the Contract Drawings are to govern this work unless otherwise revised herein. All other conditions remain the same.

The Bidder shall acknowledge the receipt of this Addendum by signing this Addendum and enclosing it in the submission of his bids. **This must also be acknowledged on Page 4 of the Proposal. The proposal included in this Addendum must be submitted for the bid to be considered responsive.** Failure to enclose Addendum No. 1 in the submission of bids may be justification for the bid proposal being rejected as non-responsive.

The following lists the extent of this Addendum. Description of the changes or clarifications are given within each heading:

CONTRACT DOCUMENTS:

1. SECTION 00300 – PROPOSAL (Revised and Reissued)
   - Revise to add missing line numbers in DIVISION A and renumber subsequent line items, and to remove line item 58.
2. SECTION 02511 – HOT MIXED ASPHALT PAVEMENT (Revised and Reissued).
   - Revised to change the requirements for binder used in leveling course.
3. SECTION 02520 – CONCRETE PAVING MATERIALS
   - Revised to increase the minimum required cement quantity.

SUMMARY:

This Addendum No. 1 has been issued to revise the numbering on the proposal form, the requirements for HMA pavement, and the requirements for concrete paving materials. A copy of the amended pages of the Contract Documents noted in this Addendum No. 1 have been posted online at http://www.hrcengr.com/bid-info, www.bidnetdirect.com/mitn and should be utilized during the preparation of bids and incorporated into the Bid Documents.

The Bidder shall acknowledge receipt of this Addendum No. 1 by signing in the location provided below and incorporating this Addendum No. 1 with the submission of his bid. Failure to include Addendum No. 1 and its attachments may result in rejection of the bid.

Respectfully submitted,

HUBBELL, ROTH & CLARK, INC.

Karyn M. Stickel, P.E.
Senior Associate

Melissa Fickel
Project Engineer

pc: All plan holders
Bloomfield Township; R.C. Almas, C. Markus
HRC; File

Received and Acknowledged By:

Company:_____

Signature: _____

Printed Name:_____

Title:_____

Date: _____

PROPOSAL
FOR
2025 SAFETY PATH PROGRAM
TOWNSHIP OF BLOOMFIELD
OAKLAND COUNTY, MICHIGAN

TOWNSHIP OF BLOOMFIELD
DAVE PAYNE PUBLIC SERVICES BUILDING
4200 TELEGRAPH ROAD
BLOOMFIELD HILLS, MI 48302

Bids Due: Thursday, April 17, 2025
On or Before 2:00 Pm, Local Time
HRC Job No. 20240038

To Prospective Bidders:

Name of Bidder: _____

Address: _____

Date: _____ Telephone: _____ Fax: _____

The above, as Bidder, hereby declares this bid is made in good faith without fraud or collusion with any persons bidding, and that the Drawings, Specifications, and all other information referenced in the Instructions to Bidders have been examined. Further, the Bidder is familiar with the location of the work described herein and is fully informed as to the nature of the work and the conditions relating to the performance of the Contract.

The Bidder acknowledges that no representations or warranties of any nature whatsoever have been received, or are relied upon from the TOWNSHIP OF BLOOMFIELD, its agents or employees, as to any conditions to be encountered in accomplishing the work and that the bid is based solely upon the Bidder's own independent judgment.

The above, as Bidder, hereby certifies that the Drawings, Specifications, and other data provided by the Owner for bidding purposes have been examined. Further, the undersigned certifies that the proposed construction methods have been reviewed and found acceptable for the conditions which can be anticipated from the information provided for bidding.

The Bidder hereby affirms that the site of work has been inspected and further declares that no charges in addition to the Individual Unit Prices shall be made on account of any job circumstances or field conditions which were present and/or ascertainable prior to the bidding. In addition, The Contractor, as such and as Bidder, shall make the determination as to existing soil conditions and shall also complete the work under whatever conditions created by the Contractor/Bidder's sequence of construction, construction methods, or other conditions the Contractor/Bidder may create, at no additional cost to the Owner.

The above, as Bidder, confirms knowledge of the location of the proposed 2025 SAFETY PATH PROGRAM and appurtenant construction in the TOWNSHIP OF BLOOMFIELD, OAKLAND County, Michigan, and the conditions under which it must be constructed; and also declares to have carefully examined the Drawings, Specifications, and Contract Documents which the Bidder understands and accepts as sufficient for the purpose of constructing said 2025 SAFETY PATH PROGRAM and appurtenant work, and agrees to contract with the TOWNSHIP OF BLOOMFIELD to furnish all labor, materials, tools, equipment, facilities and supervision

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necessary to do all the work specified and prescribed for the TOWNSHIP OF BLOOMFIELD in strict accordance with the Owner's General Conditions, and with the full intent of the Drawings and Specifications, prepared by Hubbell, Roth & Clark, Consulting Engineers, and will accept in full payment therefore the sum of:

W MAPLE ROAD – Grading and installation of approximately 3,323 linear feet of 5' wide concrete safety path along the north side of W Maple Road, between Franklin Road and Surrey Cross Road, including safety path, traffic control, tree/vegetation removals, landscaping and restoration.

Item	Quantity			Unit Price		Total Cost
DIVISION A - CIVIL						
1. Mobilization - Max 5%	1	LS	@	$LUMP SUM	=	$_____
2. Color Audio-Video Route Survey	1	LS	@	$LUMP SUM	=	$_____
3. Traffic Maintenance and Minor Traffic Devices (Incl. Flag Control)	1	LS	@	$LUMP SUM	=	$_____
4. Erosion Control, Silt Fence	505	LFT	@	$_____	=	$_____
5. Erosion Control, Inlet Protection Fabric Bag	29	EA	@	$_____	=	$_____
6. 4' Tree & Property Protection Fence	500	LFT	@	$_____	=	$_____
7. Tree Removal, 6" – 18" dbh	24	EA	@	$_____	=	$_____
8. Tree Removal, 19" – 36" dbh	1	EA	@	$_____	=	$_____
9. Tree Removal, 36" dbh or Greater	3	EA	@	$_____	=	$_____
10. Saw Cutting, Pvmt-Full Depth	884	LFT	@	$_____	=	$_____
11. Pavement, Rem, Full Depth	385	SYD	@	$_____	=	$_____
12. Safety Path, Rem, Full Depth	28	SYD	@	$_____	=	$_____
13. Curb and Gutter, Rem	415	LFT	@	$_____	=	$_____
14. Road Sign Remove/Relocate	17	EA	@	$_____	=	$_____
15. Culvert, 12-inch, Rem	5	LF	@	$_____	=	$_____
16. Dr Structure, Rem	1	EA	@	$_____	=	$_____
17. Boulder Remove/Relocate	1	EA	@	$_____	=	$_____
18. Station Grading, Special	33.5	STA	@	$_____	=	$_____
19. Structure Adjustment (+/- 6")	24	EA	@	$_____	=	$_____
20. Modular Retaining Wall, Conc. Installed	1043	SFFT	@	$_____	=	$_____
21. Dr Structure, 60 Inch Dia	1	EA	@	$_____	=	$_____
22. Dr Structure Cover Type B	1	EA	@	$_____	=	$_____
23. Culv, RCP, 12 Inch	9	LFT	@	$_____	=	$_____
24. Aggregate Base, 4 Inch, MDOT 21AA	1981	SYD	@	$_____	=	$_____
25. Aggregate Base, 6 Inch, MDOT 21AA	505	SYD	@	$_____	=	$_____
26. HRC Base Repair, Curb Detail	87	LFT	@	$_____	=	$_____
27. Concrete Curb Opening, Safety Path	89	LFT	@	$_____	=	$_____
28. Concrete Curb and Gutter, MDOT Varies	373	LFT	@	$_____	=	$_____
29. Concrete Side Street Approach, 8 Inch	264	SYD	@	$_____	=	$_____
30. Concrete Drive, Nonreinforced, 6 Inch	70	SYD	@	$_____	=	$_____
31. Concrete, Safety Path, 4 Inch	13784	SFT	@	$_____	=	$_____
32. Concrete Safety Path, 6 Inch	1225	SFT	@	$_____	=	$_____
33. Slope Paving, Conc	20	SYD	@	$_____	=	$_____
34. HMA 5EML Course, RCOC	3	TON	@	$_____	=	$_____
35. Cold Milling HMA Surface, 1.5 Inch	348	SFT	@	$_____	=	$_____
36. Detectable Warning Surface, 2 ft. Wide	70	LFT	@	$_____	=	$_____
37. Evergreen Tree, 8'-10'	8	EA	@	$_____	=	$_____
38. Deciduous Shrub, 30"-36", B&B	13	EA	@	$_____	=	$_____
39. Upright Evergreen Shrub, 4'-6' B&B	18	EA	@	$_____	=	$_____

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40. Turf Restoration, Seed and Straw Mulch, Inc. 2-inch Topsoil	2841	SYD	@	$_____	=	$_____
41. Hardwood Bark Mulch, 4 Inch	350	SYD	@	$_____	=	$_____
42. RCOC Permit Allowance	1	LS	@	$ 6,000.00	=	$_____
43. Observation Crew Days	___	days	@	$ 800.00	=	$_____

DIVISION A – SUBTOTAL **= $_____**

AS-NEED CONTRACT UNITS (Not specified on drawing)

44. Mailbox Relocate	1	EA	@	$_____	=	$_____
45. Remove Stump, Greater than 8 Inch Dia.	1	EA	@	$_____	=	$_____
46. Structure Adjustment (>6", up to 24")	1	EA	@	$_____	=	$_____
47. Structure, Cover, Repl.	1	EA	@	$_____	=	$_____
48. Aggregate Base, 10 Inch, MDOT 21AA	150	SYD	@	$_____	=	$_____
49. Concrete Spillway	1	EA	@	$_____	=	$_____
50. Culv, RCP End Sect, 12 Inch	1	EA	@	$_____	=	$_____
51. Culv, CMP, 12 Inch	50	LFT	@	$_____	=	$_____
52. Culv, CMP End Sect, 12 Inch	2	EA	@	$_____	=	$_____
53. HMA 4EML Course, RCOC	5	TON	@	$_____	=	$_____
54. HMA 3EML Course, RCOC	5	TON	@	$_____	=	$_____
55. Deciduous Tree, 3" cal.	10	EA	@	$_____	=	$_____
56. Decorative Stone Mulch, w. Fabric	250	SYD	@	$_____	=	$_____
57. Groundcover Restoration, Match Ex. Plant Mat.	250	SYD	@	$_____	=	$_____

AS-NEEDED CONTRACT UNITS – SUBTOTAL **= $_____**

TOTAL AMOUNT OF BID (Division A & As-needed Contract Units) **$_____**

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ALTERNATES

Voluntary Alternates proposed by the Bidder will not be considered. The Bidder shall submit a bid based on the information shown on the Drawings and Specifications.

The Owner, at its sole discretion, reserves the right to award to the Bidder who, in the sole determination of the Owner, will best serve the interest of the Owner. The Owner reserves the right to accept any bid, to reject any or all bids, to waive any and all informalities involving price, time, or changes in the work, and to negotiate contract terms with the successful Bidder, and the right to disregard all nonconforming, nonresponsive, unbalanced or conditional bids. However, it is the intention of the Owner to award to the low total bid to one bidder. Also, the Owner reserves the right to reject the bid of any Bidder if the Owner believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the bid is not responsive or the Bidder is unqualified, of doubtful financial ability, or fails to meet any other pertinent standard or criteria established by the Owner.

Each bidder agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid.

Each Proposal must be accompanied by a bid deposit in the form of a certified check, cashier's check or bid bond, executed by the bidder and Surety Company, payable to the CHARTER TOWNSHIP OF BLOOMFIELD in the amount of FIVE Percent (5%) of the amount of the Proposal. See Instructions to Bidders – Bid Deposit for more information.

TAXES

The Bidder affirms that all applicable Federal, State and Local taxes of whatever character and description are included in all prices stated in this Form of Proposal.

ADDENDA

The Bidder acknowledges the following Addenda, covering revisions to the drawings or specifications and the cost, if any, of such revision has been included in the quoted proposal:

Addendum No._____ Dated_____

Addendum No._____ Dated_____

Addendum No._____ Dated_____

FEES

The Bidder shall refer to the General Conditions for allowable Fees for additional work performed, upon Owner's written authorization, by Bidder's own forces and/or for additional work, upon Owner's written authorization, by Bidder's subcontractors.

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TIME OF COMPLETION

If awarded the Contract for the 2024 SAFETY PATH PROGRAM, we agree to have all work substantially completed by the following dates:

	Substantial Completion	Final Completion
W Maple Road	September 26, 2025	October 31, 2025

Substantial Completion is defined that the facility is ready to use for its intended purpose with all utility systems fully functional. For the safety path and sidewalk repair work, substantial completion includes having the safety path open to traffic, forms removed, backfill placed, and topsoil, seed and mulch installed. Final Completion is completing all restoration, clean-up and punch-list.

The Bidder hereby agrees to furnish the required Bonds, Insurance Certificates, and Policies within ten (10) days after acceptance of this Proposal. **The execution of all work and specific constraints as described in the contract drawings and specifications, with particular reference to Section 01010 Special Project Requirements, must be strictly adhered to.**

LIQUIDATED DAMAGES

Time is of the essence for completion of this project in order to have the Project ready for the Township of Bloomfield. The Bidder guarantees that the work will be completed within the time limit stated herein before or within the time as extended as provided elsewhere in the Specifications. Inasmuch as the damage and loss to the Owner which will result from the failure of the Bidder to complete the work within the stipulated time, will be most difficult or impossible to accurately determine, it is mutually agreed that the damages to the Owner for such delay and failure on the part of the Bidder shall be liquidated in the amount of FIVE HUNDRED Dollars ($500.00), for each and every calendar day by which the Bidder shall fail to complete the work or any part thereof within the provisions hereof, and such liquidated damages shall not be considered as a penalty.

The Owner will deduct and retain out of any money due or to become due hereunder the amount of the liquidated damages, and in case those amounts are less than the amount of actual liquidated damages, the Bidder shall pay the difference upon demand of the Owner.

We understand that liquidated damages may be assessed should we fail to meet the stipulated completion dates. Specifically, liquidated damages will be assessed daily beginning September 26, 2025, until such a time that Substantial Completion is achieved and further if all work is not completed by the Final Completion Date.

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BIDS TO REMAIN FIRM

The price stated in this Proposal shall be guaranteed for a period of not less than sixty (60) days from the bid due date and if authorized to proceed within that period, the bidder agrees to complete the work covered by the Proposal at said price.

If this Proposal is accepted by the Owner and the undersigned shall fail to contract as aforesaid and to furnish the required surety bonds within fifteen (15) days after being notified of the acceptance of their bid, then the undersigned shall be considered to have abandoned the contract, and the Certified Check, Cashier's Check or Bid Bond accompanying this Proposal shall be forfeited to the Township of Bloomfield.

If the undersigned enters into the contract in accordance with their proposal, or if their proposal is not accepted, then the accompanying bid guarantee shall be returned to the undersigned.

Company Name: _____

Signature:_____ Title: _____

Address: _____

County:_____ State: _____

Telephone No.:_____ Fax No.: _____

Email Address: _____

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LEGAL STATUS OF BIDDER

This Bid is submittal in the name of:

(Print)_____

The undersigned hereby designates below the business address to which all notices, directions or other communications may be served or mailed:

Street_____

City_____

State_____ Zip Code_____

The undersigned hereby declares the legal status checked below:

( ) INDIVIDUAL

( ) INDIVIDUAL DOING BUSINESS UNDER AN ASSUMED NAME

( ) CO-PARTNERSHIP
The Assumed Name of the Co-Partnership is registered in the County of _____, Michigan

( ) CORPORATION INCORPORATED UNDER THE LAWS OF THE STATE OF _____

_____. The Corporation is

( ) LICENSED TO DO BUSINESS IN MICHIGAN

( ) NOT NOW LICENSED TO DO BUSINESS IN MICHIGAN

The name, titles, and home addresses of all persons who are officers or partners in the organization are as follows:

A corporation duly organized and doing business under the laws of the State of _____

NAME AND TITLE	HOME ADDRESS
_____	_____
_____	_____
_____	_____

Signed and Sealed this_____ day of _____, 20__.

_____
By (Signature)

_____
Printed Name of Signer

_____
Title

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BID BOND

We, the undersigned, _____

_____

As Principal, hereinafter called the Principal, and _____

_____

A corporation duly organized under the laws of the State of _____

As surety, hereinafter called the SURETY, are held and firmly bound unto:

The Owner: _____

in the sum of_____ Dollars ($_____),

For the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for _____

_____

_____

NOW, THEREFORE, if the OWNER shall accept the bid of the Principal and the Principal shall enter into a contract with the OWNER in accordance with the terms of such bid, and give such bond or bonds as may be specified in the CONTRACT DOCUMENTS with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the OWNER the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the OWNER may in good faith contract with another party to perform the work covered by said bid, then the obligation of the Principal shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this_____ day of _____, 20_____

_____ _____

(Witness) (Principal) (Seal)

(Title)

_____

(Witness) (Surety)

_____

(Title)

END OF SECTION

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SECTION 02511

HOT MIXED ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section shall include all work, materials, labor, and equipment necessary to furnish and install Hot Mix Asphalt (HMA) on a prepared base to the line, grade, thickness, and cross-section in accordance with these specifications and drawings.

B. Related Requirements:
1. Section 02223 – Safety Path Grading
2. Section 02530 – Concrete Curb and Gutter
3. Section 02539 – Special Provisions Cold Milling HMA Surfaces
4. Section 02540 – Sidewalk, Safety Path Paving

1.2 MEASUREMENT AND PAYMENT

A. **Saw Cutting Pvmt, Full Depth (LFT)**
The Owner will pay for the amount of Saw Cutting as specified in the drawings, according to MDOT 501.03, as measured in linear feet. The quantity of Saw Cutting will be measured in place by the Owner after saw cutting is complete.

B. **Pavement Removal, Full Depth (SYD)**
The Owner will pay for the amount of Pavement Removal as specified in the drawings.. The quantity of Pavement Removals will be measured in place by the Owner after removals are complete.

C. **HMA 5EML Course (TON)**
The Owner will pay for the amount of HMA specified based on the weight placed, as supported by the weigh tickets supplied by the Contractor, and by the quality assurance yield calculations and mat thickness depth checks conducted by the Owner**. HMA, (5EML)** will be paid for at the contract unit price per ton bid as called for in the Contract Documents.

D. **HMA 4EML (TON)**
The Owner will pay for the amount of HMA specified based on the weight placed, as supported by the weigh tickets supplied by the Contractor, and by the quality assurance yield calculations and mat thickness depth checks conducted by the Owner**. HMA, (4EML)** will be paid for at the contract unit price per ton bid as called for in the Contract Documents.

E. **HMA 3EML (TON)**
The Owner will pay for the amount of HMA specified based on the weight placed, as supported by the weigh tickets supplied by the Contractor, and by the quality assurance yield calculations and mat thickness depth checks conducted by the Owner**. HMA,**

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(3EML) will be paid for at the contract unit price per ton bid as called for in the Contract Documents.

F. **Aggregate Base, 4 inch, MDOT 21AA (SYD)**
The Owner will pay for the amount of aggregate base specified based on the area placed, as measured in square yards. The quantity of aggregate base will be measured in place by the Owner after placement, compaction, and depth have been verified by the Owner.

G. **Aggregate Base, 6 inch, MDOT 21AA (SYD)**
The Owner will pay for the amount of aggregate base specified based on the area placed, as measured in square yards. The quantity of aggregate base will be measured in place by the Owner after placement, compaction, and depth have been verified by the Owner.

H. **Aggregate Base, 10 inch, MDOT 21AA (SYD)**
The Owner will pay for the amount of aggregate base specified based on the area placed, as measured in square yards. The quantity of aggregate base will be measured in place by the Owner after placement, compaction, and depth have been verified by the Owner.

I. Bond coat payment shall be included in the payment of HMA, Ton or HMA, Square Yard.

J. Reductions to final pay amounts can be made for non-conforming work and HMA installation outside acceptable tolerances, as provided for in Section 3.6.

1.3 REFERENCES

A. Abbreviations and Acronyms
1. ASTM - American Society for Testing Materials
2. HMA – Hot Mix Asphalt
3. MDOT - Michigan Department of Transportation.
4. MIOSHA – Michigan Occupational Safety and Health Act
5. MMUTCD – Michigan Manual of Uniform Traffic Control Devices
6. JMF – Job Mix Formula
7. RAP – Reclaimed Asphalt Pavement

B. Definitions
1. Aggregate Correction Factor-The value applied to the test results of an Ignition Furnace to correct for the aggregate and the oven being used.
2. Final Binder Grade – the resultant performance grade of the HMA binder from the combination of virgin binder and RAP binder.
3. Subgrade – Portion of the earth grade upon which the pavement structure is placed.
4. Subbase – Layer of granular material placed on the subgrade as a part of the pavement structure.
5. Open Graded Drainage Course – Layer of specified open-graded aggregate material placed on the subgrade as part of the pavement structure.
6. Aggregate Base – Layer of dense graded aggregate material placed on a subgrade, subbase or open graded drainage course as part of the pavement structure.
7. HMA base course – Layer below the leveling course for pavements in which there are three specified layers.
8. HMA leveling course - Layer below the top course for pavements in which there are two or three specified layers.

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9. HMA top course – Layer that forms the pavement surface.
10. HMA patch – an HMA repair of a small, localized defect in the pavement surface either as planned or as created by defective material that needs to be removed or replaced.

C. Where referenced, "MDOT Specifications" is a general term that shall include the current version of the MDOT Standard Specifications for Construction and all Supplemental Specifications, Special Provisions, and Errata existing at the time of the award of the Contract.

D. MDOT manuals that are referenced specifically by name shall be the current versions of said manuals existing at the time of the award of the Contract.

1.4 PREPRODUCTION MEETING

A. The Owner reserves the right to schedule a pre-production meeting. The pre-production meeting will be held a minimum of 7 calendar days prior to the start of HMA production and placement. The Owner will provide written notification to all parties a minimum of 14 calendar days prior to the meeting. Items of discussion shall include, but not be limited to:
1. Project safety.
2. Project mixture and testing Special Provisions.
3. Job Mix Formula.
4. HMA sampling and testing requirements and procedures.
5. Provision of Aggregates for Aggregate Correction Factor
6. Sequence of operations.
7. HMA placement methods.
8. The Contractor's HMA-QC Plan.
9. The roles and responsibilities of all parties involved in the work.
10. HMA acceptance criteria.
11. Project documentation.

1.5 SUBMITTALS

A. Bond Coat supplier and manufacturer data that includes test results for the properties indicated in the Tables titled "Anionic (Cationic) Emulsified Asphalts" in the MDOT Specifications.

B. Job Mix Formulas
1. Shall include all the information listed in Table 1-1 for each JMF.
2. Shall be submitted for review:
   a. At least fourteen (14) calendar days prior to a Pre-Production Meeting if one is conducted.
   b. At least fourteen (14) calendar days prior to the first placement of the asphalt if a Pre-Production Meeting is not conducted.
3. New and /or updated Job Mix Formula(s) are required if the asphalt work extends beyond the calendar year in which the work began.

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1.6 QUALITY CONTROL

A. Quality control of all materials used on the project and methods of installation shall be the responsibility of the Contractor. The Owner retains the right to perform random independent testing for the Owner's assurance the project is compliant at his tested locations however contract compliance remains the responsibility of the Contractor.

B. It shall be the responsibility of the Contractor to correct or suspend operations, if necessary, when the work is not in compliance with these specifications.

1.7 QUALITY ASSURANCE

A. The Owner will inspect, sample, test and evaluate the HMA for compliance to these specifications for the following:
   1. Delivery and Placement Temperature
      a. The Owner will make periodic checks for temperature using a calibrated thermometer or temperature gun at locations within the truck, paver hopper or within the mat at the discretion of the Owner.
      b. Refer to Section 3.5.A and Table 3-1 for allowable temperature ranges.
   2. Layer Thickness and Yield
      a. The Owner will conduct periodic mat thickness depth checks and yield calculations during placement of the HMA material.
      b. Lower layers of HMA base course are to be constructed to a tolerance of ± ¾ inch and final layers of base course constructed to a tolerance of ± 3/8 inch.
      c. HMA leveling course is to be constructed to a tolerance of ±¼ inch.
      d. HMA top course is to be constructed to a tolerance of ±1/8 inch.
      e. The cumulative pavement thickness shall be at least the planned thickness and not be more than ¼ inch greater than the planned thickness.
      f. The pavement thickness of a single course pavement shall be at least the planned thickness and not be more than ¼ inch greater than the planned thickness.
   3. Joint Quality: The Owner shall visually inspect the joint configuration and placement for tightness, smoothness and alignment to evaluate conformance to the requirements stated in PART 3, Sections 3.5 B.5 and 3.5 C.3.
   4. Surface Texture (segregation)
      a. The Owner shall visually inspect the surface texture to evaluate conformance to the requirements of PART 3, Section 3.5 B.6.
      b. Areas that visually appear to be segregated shall be evaluated by the Owner by taking a set of 6 to 15 tests with a nuclear density gauge in both the visually segregated area and in an adjacent non-segregated area with the mean value of density of the two areas compared using the MDOT BITSEG2 computer program.
      c. HMA that generates an output from the MDOT BITSEG2 program of "Remove and Replace, take corrective action" or "take corrective action" shall be conserved to be segregated.
   5. Surface Texture (foreign material)
      a. The Owner shall visually inspect the surface for the occurrence of foreign material or deformities in the HMA.
   6. Surface Smoothness:

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a. The Owner shall visually inspect and make measurements to evaluate conformance to the requirements of Article 3.5 B.6 and Article 3.5.C.5.

7. Density
   a. HMA base, leveling and top course placed for both main line and hand patching shall be compacted to a minimum of 92.0% and a maximum of 96.0% of the density calculated from the theoretical maximum specific gravity (G_{mm}) indicated on the Owner-reviewed JMF for the mixture.
   b. The compaction percentage shall be determined by a calibrated nuclear density gauge.
   c. The compaction percentage may be determined by 6 inch diameter cores (using dried back weights) at the discretion of the Owner.
8. Longitudinal Joint Density
   a. Longitudinal Joints in HMA base, leveling and top course shall be constructed so that the density of the joint is a minimum of 85.0% of the density calculated from the theoretical maximum specific gravity (G_{mm}) indicated on the Owner-reviewed JMF for the mixture.
   b. The compaction percentage shall be determined by a calibrated nuclear density gauge centered on the line where the joint between the two adjacent lifts abut at the surface.
   c. Cores will not be permitted to establish the density and compaction % of longitudinal joints in HMA base, leveling or top course.
9. Unsupported Edges
   a. The Owner shall inspect the Unsupported Edges of the HMA for compliance to these specifications within the planned pavement surface width.
10. Mixture Properties
   a. The Owner shall obtain samples of the hot mixture from the plant and test the mixture to evaluate compliance to the Owner-reviewed JMF.
      1) A single sample shall be obtained from each day's placement for each mixture type being placed that is under 100 tons.
      2) Two samples shall be obtained from each day's placement for each mixture type being placed that exceeds 100 tons.
   b. For testing that requires the extraction of the asphalt binder from the sample(s):
      1) The Owner may perform the extraction using either Vacuum or Ignition Furnace methods.
      2) Should the Ignition Furnace method be selected, the Contractor shall provide the Owner with the appropriate aggregate samples needed to determine the Aggregate Correction Factor for each mixture tested.
   c. The tested mixture properties during production shall be within the Acceptance Limits from the target values on the Owner-reviewed JMF are indicated in Table 3-4.

B. Testing Agencies: The Owner may employ an independent testing agency for as-directed testing for in place density and mixture properties.

C. Destructive Testing: Destructive testing may be necessary during the term of the Contract to confirm that the acceptance test results are out of specification. The contractor shall be solely responsible for all costs incurred to perform destructive testing, including but not

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limited to the costs related to the testing of the areas suspected of failing to meet the contract requirements in a means acceptable to the Owner, to retain experts to direct the method of testing, oversee the testing, and assist in the resolution of the deficient areas solely at the contractor's expense. Should the destructive testing results provide supplemental information that the areas being tested were in compliance with the Contract requirements; the Contractor shall be compensated for the costs incurred in a method mutually selected by the Owner and the Contractor from Section 00700 – General Conditions.

PART 2 PRODUCTS

2.1 BOND COAT

A. Shall meet the requirements of type SS-1h as specified in the table Titled "Anionic Emulsified Asphalts" or type CSS-1h as specified in the table Titled "Cationic Emulsified Asphalts" in the current version of the MDOT Specifications.

2.2 HMA MIXTURES

A. Mixing Plants
   1. Shall meet the current requirements by MDOT or appropriate state agency.

B. Composition of Mixture
   1. Provide the HMA mix type and the performance grade of asphalt binder as shown on the project plans and as described on the Owner-reviewed JMF.
   2. Aggregates
      a. Shall be natural aggregates, iron blast furnace slag, reverberatory blast furnace slag or steel furnace slag.
      b. Gradation shall be within the range for each sieve size as indicated Table 2-1.
      c. Physical Requirements shall be as indicated in Table 2-2.
      d. The minimum Aggregate Wear Index (AWI) for aggregates used in HMA Top Course mixtures shall be 250, unless otherwise specified.
      e. The Owner reserves the right to request test results for and/or sample and test aggregates used in HMA Mixtures to establish compliance to these requirements prior to or during the production of HMA mixtures.
   3. Binder
      a. Shall comply with the requirements indicated in Table 2-3.
      b. Shall be from a supplier listed on the MDOT "Asphalt Binder Suppliers List" existing at the time of the contract award:
      c. The Owner reserves the right to request test results for and/or sample and test binders used in HMA Mixtures to establish compliance to these requirements prior to or during production of HMA mixtures.
   4. Mineral Filler
      a. Shall be 3MF mineral filler consisting of limestone dust, dolomite dust, fly ash collected by an electrostatic precipitation method, slag, or hydrated lime.
      b. Shall have a gradation with 100 percent passing the No. 30 sieve and 75 to 100 percent passing the No. 200 sieve.

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c. Free carbon content of the fly ash sample shall not exceed 12 percent by weight as measured by the loss on ignition tests in accordance with ASTM C311.

C. Mix Design Criteria and Volumetric Properties shall meet the requirements indicated in Table 2-4.

D. Substitution of Reclaimed Asphalt Pavement (RAP) Substitution for virgin binder is permitted as follows, unless otherwise indicated on the project plans:
1. 0% to 17% RAP binder, by weight of the total binder for HMA topping.
2. 18% to 27% of RAP binder, by weight of the total binder for HMA leveling and base course.
3. A binder blending chart shall be provided to show that the combination of virgin binder and RAP binder meets the specified Final Binder Grade.

2.3 PAVING EQUIPMENT

A. Paving equipment shall be in good working order and capable of constructing HMA pavement in accordance with the specifications. Should the HMA paving indicate that an equipment problem is causing the construction to be out of specification, the Owner has the right to request the equipment be repaired or replaced.

B. If maintaining traffic in the work area during construction, all self-propelled equipment within the construction influence area shall be with all safety devices as required by MIOSHA, MMUTCD, MDOT, or the local any governmental agencies within the construction influence area.

PART 3 EXECUTION

3.1 EXAMINATIONS

A. Each layer of HMA shall not be placed until the surface upon which it is to be placed has been inspected by the Contractor immediately prior to continuing construction.

B. The Owner provides independent testing at random locations to assist in determining the conditions at the point the test is performed, but the Contractor shall remain solely responsible for compliance to the contract provisions throughout the entire project area.

3.2 PREPARATION OF SURFACES

A. Subgrade
1. Prepare subgrade in accordance with Section 2200 and Section 2214 of the Specifications.
2. Grade subgrade to within one-half inch in ten feet of the design grade.
3. Compact the subgrade, to a depth of not less than nine inches, to not less than 95% of the maximum unit weight as determined by the method described in the MDOT Density Testing and Inspection Manual appropriate for the subgrade material.

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4. Proof roll all subgrade using rubber-tired equipment of sufficient size and weight, as determined by the Engineer, to identify any soft or yielding soils that require improvement.
5. Complete any improvements needed to the subgrade using the specified materials and to the limits as directed by the Owner.

B. Subbase
1. Grade the subbase to within three-eighths of an inch in ten feet of the design grade.
2. Compact the subbase to not less than 97% of the maximum unit weight as determined by the method in the MDOT Density Testing and Inspection Manual appropriate for the subbase material.

C. Open Graded Drainage Course: Grade and compact the open graded drainage course to the design grade so that the finish surface is smooth and uniform in appearance without, depressions, ruts or ridges.

D. Aggregate Base
1. Place the aggregate base to the line and grade as shown on the contact documents to within a tolerance of +/- 3/8 inch, unless otherwise specified.
2. Compact the aggregate base to not less than 98% of the maximum unit weight as determined by the method in the MDOT Density Testing and Inspection Manual appropriate for the aggregate base material.

E. Existing Pavement Surfaces
1. An existing pavement surface may include a newly placed layer of pavement, the surface of an existing pavement without modification, or the existing pavement that has been removed in part with the use of a cold milling machine or by other means acceptable to the Owner.
2. Adjust all structures to finished grade prior to placement of HMA top course, matching both the design longitudinal and transverse cross slopes.
3. Remove existing cold patch.
4. Remove existing joint sealants to a depth of up to one inch, vegetation, or such dirt and debris from transverse and longitudinal joints and from cracks by mechanical or hand methods.
5. Thoroughly clean the surface of the pavement and paved shoulders of all dirt and debris. All cracks and joints shall be blown with compressed air to remove any loose material. A self-contained vacuum sweeper shall be used to pick up all loose material.
6. Full Depth Patch Removal: Remove full depth existing patches, when directed by the Owner, by providing a full depth saw cut around the area to be removed and remove existing materials and dispose of off-site.
7. Hand Patching
   a. Fill in holes and depression and replace full depth existing patches and joint repairs when directed by the Owner using the HMA mixture specified in the contract documents. Compact the full depth hand patching material in layers no greater than 3 inches to the adjacent pavement grade by the use of a roller or by vibratory plate compactors or other means acceptable to the Owner for areas not accessible to a roller.

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b. The Contractor shall use an HMA top course material acceptable to the Owner. HMA mixtures 2C, 11A, and 700B shall not be permitted for hand patching.

F. Other Surfaces: Where included in the design pavement cross-section on the Contract Drawings, HMA pavement may be placed on other surfaces for certain road rehabilitation projects, which may include cold milling, and pulverized or rubblized HMA or concrete pavement. For these projects, special provisions or specifications are included in the Contract Documents detailing the requirements for preparation of those surfaces.

3.3 BOND COAT

A. Uniformly apply bond coat to the surfaces against which new HMA is to be placed with a pressure distributor.

B. The surfaces against which new HMA is to be placed shall be clean and dry. Contact surfaces that have become coated with dust, sand, or other objectionable material shall be cleaned by brushing, blowing with compressed air, or cut back with a power saw or other mechanical means to achieve a smooth clean edge, as directed by the Owner.

C. The bond coat shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Reapplication of the bond coat may be required at the direction of the Engineer if it becomes contaminated prior to placement of the HMA mixture.

D. At no time shall bond coat be applied to the vertical face of concrete curb and gutter or monolithically poured face curb.

3.4 TRANSPORTATION OF MIXTURES

A. Each load of HMA mixture delivered to the project shall be weighed to the nearest 20 pounds on a certified scale having an automatic print out system.

B. Trucks used for hauling HMA mixtures shall have tight, clean, smooth beds and shall be adequately covered to protect from the weather and foreign objects.

C. Trucks used to haul HMA mixtures when the air temperature is below 50 degrees F. shall be insulated. The insulation shall be continuous along the bottom and four sidewalls.

D. A release agent, as permitted by the Owner shall be applied to the hauling units with atomizing spray equipment. Excessive use of release agent will be cause for rejection of the load.

3.5 INSTALLATION

A. Weather Limitations
1. Do not place HMA when the temperature of the surface being paved is less than 35 Degrees F.
2. For temperatures of the surface being overlaid between 35 Degrees F and 49 Degrees F, follow the restrictions on lift sizes indicated in Table 3-1.

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B. Placing HMA Mixtures

1. Pavers
   a. HMA shall be placed by a self-propelled mechanical paver to such a depth that when compacted it will have the thickness specified or as directed by the Owner. The mixture shall be dumped into the center of the hopper and care shall be exercised to avoid overloading the paver and spilling the mixture.
   b. Pavers will be required to have an automatically controlled and activated screed and strike off assembly except when placing HMA mixtures for:
      1) Variable width sections.
      2) The first course of an HMA base course mixture on a subgrade, subbase or aggregate base.
      3) HMA base course mixtures for shoulders and widening less than 10.5 feet in width or as directed by the Owner.
2. HMA Shoulders: Shoulder widths within the tolerance of the equipment shall be placed with the main line HMA Top Course mixture. Shoulder widths exceeding the capabilities of the equipment shall be placed with an acceptable paver as directed by the Owner.
3. HMA Wedging
   a. When necessary to take out irregularities in the existing road surface, wedging with HMA mixture shall be done by placing several layers with the paver.
   b. The nominal maximum aggregate size for the material used shall not exceed ¾ inch and the maximum lift thickness shall be 2 inches. HMA Mixtures 2C, 11A and 700B will not be permitted for wedging.
   c. Any corrections made by wedging with HMA mixture shall be placed, compacted, and allowed to cool prior to placing leveling, or top course mixtures. If the surface temperature of the wedging material falls below 150° F then a bond coat shall be applied prior to placement of the next layer of pavement.
4. HMA Lift Thickness
   a. Place HMA in lift thickness that are within the application rates in Table 3-2.
   b. When the planned lift thickness exceeds 2 inches for HMA top course mixtures and 2 ½ inches for HMA leveling course mixtures, the pavement shall be constructed in two or more courses, unless otherwise specified in the contract documents.
5. HMA Joints
   a. When placing the HMA top course, or the top 2 courses of multi-level pavement on the traveled portion of the roadway, the paving operation shall be conducted in a combination of widths which will cause the final course longitudinal joint lines to coincide with the proposed painted lane lines.
   b. In placing HMA mixture adjacent to all joints, hand raking or brooming will be required to provide a dense smooth connection.
   c. All joints shall have the same texture and smoothness as other sections of the layer.

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d. The interface between the HMA mixture and concrete surfaces shall be full depth saw cut to a minimum width of ¼ inch and sealed with a hot poured rubber sealant.

e. Transverse Joints
   1) The roller shall pass over the unprotected end of freshly placed mixture only when placing of the layer is discontinued or when delivery of the HMA mixture is interrupted.
   2) In all cases, the edge of the previously placed layer shall be cut back to expose a clean, even, vertical surface for its full thickness.
   3) In continuing placement of a strip, the mechanical hot mixture will be spread to obtain a joint after rolling which conforms to the required density and smoothness specified.

f. Longitudinal Joints
   1) Longitudinal joints shall be vertically aligned to be within 1 inch of the underlying course and aligned with the final pavement markings.
   2) Inclusion of pay items for "HMA Longitudinal Joint – ft" and/or "HMA Plane of Weakness Joint – ft." indicates that longitudinal and /or plane of weakness joints in the HMA top course shall be saw cut and sealed with hot poured rubber sealant, as shown in the project plans.
   3) Edges of previously placed strips that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be cut back to expose a clean, sound, vertical surface for the full thickness of the course as directed by the Owner.
   4) When placing HMA over a concrete pavement, the longitudinal joints shall align with the joints in the concrete pavement. It shall be the responsibility of the contractor to provide the precise location of the existing longitudinal joints prior to placement of the HMA. In no case shall the variance between the underlying longitudinal joints and the HMA longitudinal joints exceed 1 inch. The longitudinal joints in the HMA shall be saw cut and sealed with hot poured rubber sealant.

g. When the temperature of a previously placed HMA mixture mat falls below 170 degrees F,
   1) The edges of the previously placed HMA mixture mat shall be coated with bond coat material.
   2) The adjacent HMA shall not be placed until the bond coat has "broken".

6. HMA Surface.
   a. A sufficient number of experienced shovelers and rakers shall follow the machine, adding hot HMA mixture and raking the HMA mixture as required to produce a course that, when completed, will conform to all requirements specified herein. Broadcasting or fanning of HMA mixture over areas being compacted will be permitted for HMA base and leveling course but shall not be permitted for HMA top course.
   b. In areas where the use of machine spreading is impractical, the HMA mixture shall be spread in a manner to minimize segregation.

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C. Rolling and Compaction of HMA Mixtures

1. Rollers and Rolling – General
   a. Use roller type indicated in Table 3-3 for the appropriate application.
   b. The Contractor shall provide an adequate number of rollers so as to achieve the minimum required density and finish, adjusting the speed of the paving operation as needed.
   c. Pneumatic-tired rollers shall not mark or rut the surface or displace the pavement edges. The pneumatic tired roller shall be ballasted to obtain the required ground contact pressures as directed by the Owner. To obtain a uniformly textured mat and the desired in place density, the Owner may direct the Contractor to correct any deficiencies that arise at any time during the rolling operations. The roller operations shall be conducted in such a manner as to prevent scuffing or chatter marks in the pavement surface.
   d. Steel rollers wheels shall be kept properly moistened with water, but usage of an excess is prohibited. Pneumatic tired rollers shall be inspected and be verified to be clean.
   e. Rolling of the HMA mixture shall begin as soon after placing as it will bear the roller without undue displacement, picking up the mat or cracking. Rolling can start longitudinally at the extreme sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the drive wheel of the roller. Alternate passes of the roller shall be of slightly different lengths. The maximum roller speed shall not exceed the manufacturer's recommended speed for the type of mixture or thickness of layer being placed. At no time shall the roller finish perpendicular to the direction of travel.
2. Rolling and Compacting Unsupported Edges: When placing the HMA Mixture at an unsupported edge, the drum on the first pass at an unsupported edge shall be 3 inches to 6 inches inside the unsupported edge. On the second pass at an unsupported edge the drum shall extend over the unsupported edge by approximately 6 inches. The drum shall not run on the edge or directly inside the unsupported edge.
3. Rolling and Compacting Joints: When placing the HMA mixture in a lane adjoining a previously placed lane (longitudinal joint), the mixture shall be placed such that it uniformly overlaps the first lane by a maximum of two inches and is placed at a height above the cold mat equal to the breakdown roller depression on the hot mat. Compact the longitudinal joint by rolling from the hot side, keeping the edge of the roller approximately 6 inches to 8 inches inside the cold joint for the first pass. For the second pass of the roller, compact the joint from the hot side while overlapping the cold side by 6 inches to 8 inches.
4. Rolling and Compacting Areas of Limited Accessibility: In all places not accessible to the roller and less than 3 feet in width, the hot HMA mixture shall be compacted by vibratory plate compactors or by other means acceptable to the Owner. Skin patching on an area that has been rolled will not be permitted.
5. HMA Surfaces
   a. After final rolling, the surface may be tested by the Owner using a 10 foot straight edge supported on equal size blocks 1 inch or greater in thickness at each end at selected locations. The variation of the surface from the testing edge of the straight edge between any two contacts with the surface shall at no point exceed:

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1) Three-eighths inch for HMA base course.
2) One-quarter inch for HMA leveling course.
3) One-eighth inch for HMA top course.

b. Finish rolling on the top course shall continue until all roller marks are eliminated.

c. No traffic shall be allowed on the surface being placed until rolling has been completed and the surface has cooled sufficiently to prevent damage from traffic.

3.6 NON-CONFORMING WORK

A. If it is determined by the Owner that the work is outside acceptable tolerances or to be non-conforming work per these specifications, the Contractor will be notified and allowed to make any necessary corrections to their operations.

1. Should the Contractor fail to make the necessary corrections as requested, the Owner will determine the best course of action to correct which could include reducing final payment or hiring outside forces, at the Contractor's expense, to correct.
2. The Contractor shall submit to the Owner for review the means and methods to make deficient areas compliant. Corrections shall be made based on these as directed by the Owner.

B. Non-Conforming Work - Identified during construction.

1. Temperature: HMA placed over surfaces of temperatures under 35 Degrees F, or otherwise outside the limits indicated in Table 3-1, is subject to rejection, removal, and replacement at the direction of the Owner.
2. The Owner may consider acceptance of HMA placed when the surface temperature over which the HMA is to placed is under 35 Degrees F, provided it is otherwise in compliance with these specifications.
3. Layer Thickness shall meet contract documents. Additional layers shall not be placed until resolved. Resolution may require removal and replacement, adjustments in placement of the next layer or grinding.
   a. The Owner may consider acceptance of HMA placed in layers greater than the maximums indicated in Table 3-2, provided that the required density can be obtained through the entire thickness of the layer provided it is otherwise in compliance with these specifications.
4. Yield: Additional course shall not be placed until resolved.
5. Joint Quality: If found to be deficient, the Contractor may be required to saw cut and seal the joint with hot poured rubber sealant or may be required to remove and replace the full width of pavement in the affected areas.
6. Surface Texture (segregation): Remove and replace to the full lane width in the affected area.
7. Surface Texture (foreign material): Remove and replace to the full lane width in the affected area where it is determined to be excessive by the Owner.
8. Surface Smoothness: Remove and replace to the full lane width in the affected area.
   a. If affected areas are less than 250 feet away from one another, the affected areas shall be extended to form a single repair.

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b. Owner reserves the right to measure the surface smoothness with a certified profilometer should the Contractor contest the tolerance measurements.
   1) Costs for profilometer services shall not be borne by the Owner unless measurements show the pavement is within tolerance in all locations questioned.

9. Density
   a. Remove and replace to the full lane width in the affected area, or if acceptable to be left in place by the Owner, a 25% reduction in payment will be assessed.
   b. If in lower courses do not place additional courses until resolved
10. Longitudinal Joint Density
   a. Remove and replace to the full width of the pavement in the affected area.
11. Unsupported Edges: Remove and replace to the full width of the pavement in the affected area.
12. The Owner may require trimming of the Unsupported Edges to the planned pavement surface width.
13. Mixture Properties:
   a. Test second sample, if obtained, for mixture. If the second sample tests do not concur with first sample for the properties that are out of specification, no action is required. If second sample test results concur with first sample for the properties that are out of specification either remove and replace the affected HMA or if acceptable to be left in place by the Owner, a 25% reduction in payment will be assessed.
   b. If the test results of the first sample are within the acceptance limits indicated in Table 3-4 however the test results of the second sample are not within these acceptance limits and there are no further placements of the mixture for the project then either remove and replace the affected HMA or, if acceptable to be left in place by the Owner, a 25% reduction in payment will be assessed.
   c. If only a single sample is obtained (per Article 1.7.A.1) then the test results of that sample will be used to establish compliance to the acceptance limits in Table 3-4. If the test results are not within these acceptance limits, then either remove and replace the affected HMA or if acceptable to be left in place by the Owner, a 25% reduction in payment will be assessed.

C. Non-Conforming Work - Identified during the Maintenance and Guarantee Bond Period.
1. Joint Quality: Saw cut and seal the joint with hot poured rubber sealant or remove and replace the full width of pavement in the affected areas to at least 100 feet beyond the affected area in each direction.
2. Surface Texture (Segregation): Remove and replace the full lane width in the affected area.
3. Rutting and/or Flushing: Remove and replace the full lane width in the affected area.
4. Cracks
   a. For transverse cracks, either route and seal the crack with hot poured rubber sealant or remove and replace with a patch wide enough to accommodate the equipment needed to achieve the required density.
   b. For random cracks remove and replace to the full lane width of the pavement in the affected area.

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c. For edge cracks remove and replace to the full width of the pavement along the affected area.

END OF SECTION

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Table 1-1. Requirements for HMA Mixture Submittals (Marshall Mixtures)

Job Name, HMA Supplier, and HMA Mixture Type
Plant No. and Plant Location
MDOT Form 1867, "Certification Inspection Checklist" for the plant listed on the JMF for current year or the equivalent documentation from the appropriate state agency.
Scale Calibration Certificate for the plant listed on the JMF for the current year.

Aggregate Pit No., Type and Blend %
Aggregate Gradation -Each and Combined
Aggregate Crushed %
Aggregate Soft Particle%
Aggregate Angularity Index
Aggregate L.A. Abrasion
Specific Gravity of Combined Aggregate, G_{sb}
Aggregate Wear Index
RAP Stockpile Summary Sheet

Binder - Supplier and MDOT Certifier Number
Binder - Virgin Grade and Final Grade
Binder - Performance Graded Test results from the Current Year
Binder - Specific Gravity
% Binder from RAP
% New Binder Added
Blending Chart for HMA Binder when RAP is used in the mixture

Mix Properties at Test Points 4 (minimum) and Optimum Binder Content

Binder Content, %
Bulk Specific Gravity, compacted (G_{mb})
Theoretical Maximum Specific Gravity (G_{mm})
Air Voids, %
Voids in Mineral Aggregate, % (VMA)
Voids Filled with Asphalt, % (VFA)
Stability (LBS)
Flow (.01 In)

Worksheets

Regression Analysis for Marshall Mix Design
Bulk Specific Gravity Worksheet – Marshall Specimens
Theoretical Maximum Specific Gravity Worksheet
Fine Aggregate Specific Gravity
Coarse Aggregate Specific Gravity
Combined Specific Gravity (Gsb)

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Table 1-1. Requirements for HMA Mixture Submittals (Superpave Mixtures)

Job Name, HMA Supplier and HMA Mixture Type
Plant No. and Plant Location
MDOT Form 1867, "Certification Inspection Checklist" for the plant listed on the JMF for current year.
Scale Calibration Certificate for the plant listed on the JMF for the current year.

Aggregate Pit No., Type and Blend %
Aggregate Gradation -each and combined
Fine Aggregate Angularity
Aggregate % Sand Equivalent
Aggregate L.A. Abrasion
Aggregate Soft Particle%
Aggregate % Flat and Elongated Particles
Specific Gravity of Combined Aggregate, G_{sb}
Aggregate Wear Index
RAP Stockpile Summary Sheet

Binder - Supplier and MDOT Certifier Number
Binder - Virgin Grade and Final Grade
Binder - Performance Graded Test results from the Current Year
Binder - Specific Gravity
% Binder from RAP
% New Binder Added
Blending Chart for HMA Binder when RAP is used in the mixture

Mix Properties at Test Points 4 (minimum), Optimum Binder Content, and Verification Test Results at N_{MAX}

Binder Content, %
Bulk Specific Gravity(G_{mb}) at N_{DES} and at N_{MAX}
Theoretical Maximum Specific Gravity (G_{mm})
Air Voids % (VMA) at N_{DES}
Voids in Mineral Aggregate (VMA) @ N_{DES}
Voids Filled with Asphalt (VFA) @ N_{DES}
% G_{mm} @ N_{INT} , N_{DES} and N_{MAX}
Fines /EFF Asphalt Ratio

Worksheets

Regression Analysis for Superpave Mix Design
Bulk Specific Gravity – Gyratory Specimens
Theoretical Maximum Specific Gravity
Fine Aggregate Specific Gravity
Coarse Aggregate Specific Gravity
Combined Specific Gravity (Gsb)
Tensile Strength Ratio
MDOT Spreadsheet for Superpave Downgrading, if applicable

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Table 2-1. Master Gradation Ranges for Aggregate Blend for HMA Mixtures (Marshall Mixtures)

HMA Mixture	2C	11A	3C	4C MOD	13A MOD	36A MOD
% Passing 1 ½ inch	100	100				
% Passing 1 inch	91-100	90-100	100			
% Passing ¾ inch	90 max	70-95	91-100	100	100	
% Passing ½ inch	78 max	55-85	90 max	91-100	75-95	100
% Passing 3/8 inch	70 max	40-80	77 max	90 max	60-90	92-100
% Passing No. 4	52 max	25-65	57 max	67 max	45-80	65-90
% Passing No. 8	15-40	15-50	15-45	15-52	30-65	55-75
% Passing No. 16	30 max	10-40	33 max	37 max	20-50	
% Passing No. 30	22 max	7-32	25 max	27 max	15-40	25-45
% Passing No. 50	17 max	5-20	19 max	20 max	10-25	
% Passing No. 100	15 max	4-12	15 max	15 max	5-15	
% Passing No. 200	3-6	3-6	3-6	3-6	3-6	3-10

Note: RAP binder for HMA Mixture 4C MOD is limited to 17%, by weight, of the total binder (Section 2.2.D).
RAP binder for HMA Mixtures 13A MOD and 36A MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D).

Table 2-1. Master Gradation Ranges for Aggregate Blend for HMA Mixtures (Marshall Mixtures)

HMA Mixture	700B MOD	1100L MOD	1100T MOD	1300L MOD 1300T MOD	1500L MOD 1500T MOD
% Passing 1 ½ inch	100				
% Passing 1 inch	80-100				
% Passing ¾ inch		100	100	100	
% Passing ½ inch		90-100	90-100	90-100	100
% Passing 3/8 inch	55-90	65-95	65-95	65-95	92-100
% Passing No. 4				55-75	65-90
% Passing No. 8	30-55	45-70	45-70	45-70	55-75
% Passing No. 16					
% Passing No. 30	15-40	20-45	20-45	20-45	25-50
% Passing No. 50					
% Passing No. 100					
% Passing No. 200	3-10	3-10	3-10	3-10	4-10

Note: RAP binder for HMA Mixtures 1100T MOD, 1300T MOD and 1500T MOD is limited to 17%, by weight, of the total binder. (Section 2.2.D.).

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Table 2-1. Master Gradation Ranges for Aggregate Blend for HMA Mixtures (Superpave Mixtures)

Standard Sieve	HMA Superpave Mix Number				
	5 MOD	4 MOD	3 Leveling Course	3 Base Course	2
	% Passing Criteria (Control Points)				
1 ½ inch					100
1 inch			100	100	90-100
¾ inch		100	90-100	90-100	90 max
½ inch	100	90-100	90 max	90 max	
3/8 inch	90-100	90 max			
No. 4	90 max				
No. 8	47-67	39-58	35-52	23-52	19-45
No. 16					
No. 30					
No. 50					
No. 100					
No. 200	2.0-10.0	2.0-10.0	2.0-8.0	2.0-8.0	1.0-7.0

Notes: RAP binder for HMA Superpave Mixture Number 5 MOD is limited to 17%, by weight, of the total (Section 2.2.D).
RAP binder for HMA Superpave Mixture Number 4 MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D).

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Table 2-2. Physical Requirements for Aggregates for HMA mixtures (Marshall Mixtures)

HMA Mixture	2C	11A	3C	4C MOD	13A MOD	36A MOD
Crushed, %, min, MTM 117	90	90	90	90	90	90
Soft Particle, %, max, MTM 110 (a)	12.0	12.0	12.0	8.0	12.0/8.0 (b)	8.0
Fine Aggregate Angularity, min, MTM 118 (c)	4.0	2.5	4.0	4.0	2.5	3.0
L.A. Abrasion, % loss, max, MTM 102, (d)	40	40	40	40	40	40
Sand Ratio, max (e)	-	-	-	-	50	50

(a) Soft particles maximum is the sum of the shale, siltstone, friable sandstone, ochre, coal, clay-ironstone and any particles that are structurally weak or are non-durable in service.
(b) When HMA mixture is used for HMA leveling or base course /HMA top course
(c) The angularity index of the blended aggregate must meet the minimum requirement. In mixtures containing RAP, the required minimum angularity index must be met by the virgin material.
(d) For the composite mixture. Each individual aggregate must be less than 50.
(e) Percent of material passing the No. 4 sieve as a percent of the percent of material passing the No. 30 Sieve.

Note: RAP binder for HMA Mixture 4C MOD is limited to 17%, by weight, of the total binder (Section 2.2.D). RAP binder for HMA Mixtures 13A MOD and 36A MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D).

Table 2-2. Physical Requirements for Aggregates for HMA mixtures (Marshall Mixtures)

HMA Mixture	700B MOD	1100L MOD	1100T MOD	1300L MOD 1300T MOD	1500L MOD 1500T MOD
Crushed, %, min, MTM 117	25	40	90	90	90
Soft Particle, %, max, MTM 110 (a)	12.0	12.0/8.0 (b)	12.0/8.0 (b)	12.0/8.0 (b)	12.0/8.0 (b)
L.A. Abrasion, % loss, max, MTM 102 (c)	40	40	40	40	40

(a) Soft particles maximum is the sum of the shale, siltstone, friable sandstone, ochre, coal, clay-ironstone and any particles that are structurally weak or are non-durable in service.
(b) When HMA mixture is used for HMA base or leveling course /HMA top course
(c) For the composite mixture. Each individual aggregate must be less than 50.

Note: RAP binder for HMA Mixtures 1100T MOD, 1300T MOD and 1500T MOD is limited to 17%, by weight, of the total binder (Section 2.2.D.).

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Table 2-2. Physical Requirements for Aggregates for HMA Mixtures (Superpave Mixtures EL, EML, EMH, EH)

Mix Type (a)	Percent Crushed Minimum Criteria (b)		Fine Aggregate Angularity, Min		% Sand Equivalent, Min		Los Angeles Abrasion % Loss Max, MTM 102 (c)		% Soft Particles Max, MTM 110 (d)		% Flat and Elongated Particles, Max (e)	
	Top and Level	Base	Top and Level	Base	Top and Level	Base	Top and Level	Base	Top and Level	Base	Top and Level	Base
EL	55/-	-	-	-	40	40	45	45	10	10	-	-
EML	75/-	50/-	43	40	40	40	35	40	5	5	10	10
EMH	90/85	80/75	45	40	45	45	35	35	3	4.5	10	10
EH	100/100	95/90	45	45	50	50	35	35	3	4.5	10	10

(a) EL = ≤ 0.3 ESAL (Equivalent Single Axle Load)
EML = > 0.3 - ≤ 3.0 ESAL
EMH = > 3.0 - ≤ 30 ESAL
EH = > 30 - ≤ 100 ESAL

(b) "XX/YY" denotes that XX percent of the coarse aggregate has one fractured face and YY percent has at least two fractured faces

(c) If a blend of different aggregate sources, the abrasion value applies to each source

(d) Soft particles maximum is the sum of the shale, siltstone, ochre, coal, clay-ironstone, and any particles that are structurally weak or non-durable in service.

(e) Maximum by mass with a 1:5 aspect ratio.

Note: RAP binder for HMA Superpave Mixtures is limited to 17%, by weight, of the total binder when used for HMA top course (See Section 2.2 D.).

Table 2-2. Physical Requirements for Aggregates for HMA Mixtures (Superpave Mixtures E03, E1, E3, E10, E30, E50)

HMA Superpave Mixture Type (f)	Fine Aggregate Angularity, Min (a)		% Sand Equivalent, Min (b)		Los Angeles Abrasion % Loss Min, MTM 102		% Soft Particles Max, MTM 110 (d)		% Flat and Elongated Particles, Max (e)	
	Top and Level	Base	Top and Level	Base	Top and Level	Base	Top and Level	Base	Top and Level	Base
E03			40	40	45	45	10	10		
E1	40		40	40	40	45	10	10		
E3	40 (c)	40 (c)	40	40	35	40	5	5	10	10
E10	45	40	45	45	35	40	5	5	10	10
E30	45	40	45	45	35	35	3	4.5	10	10
E50	45	45	50	50	35	35	3	4.5	10	10

(a) AASHTO T 304/ASTM C1252 Method A, test all materials including RAP which have material retained on the No. 16, No. 30, No. 50 and No. 100 sieves

(b) ASTM D2419, test on all material including RAP

(c) For an E3 Mix type that enters the restricted zone as defined in Table 2-1 the minimum is 43.

(d) Soft particles maximum is the sum of the shale, siltstone, friable sandstone, ochre, coal, clay-ironstone and any particles that are structurally weak or are non-durable in service.

(e) ASTM D 4791. Maximum by weight with a 1:5 aspect ratio.

(f) RAP binder for HMA Superpave Mixtures is limited to 17%, by weight, of the total binder when used for HMA top course (See Section 2.2 D)

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Table 2-3. Specifications for Performance Graded Binder

Specification	PG 52	PG 58			PG 64		PG 70	
	-28	-22	-28	-34	-22	-28	-22	-28
Pavement Design Temperature								
Average 7-day Max. Pavement Design Temp, °C	52	58			64		70	
Minimum Pavement Design Temp, °C	-28	-22	-28	-34	-22	-28	-22	-28
Original Binder								
Flash Point Temp, T48/D92 Min, °C	230	230	230	230	230	230	230	230
Viscosity, T316/D4402: Max 3 Pa•s, Test Temp, °C	135	135	135	135	135	135	135	135
Dynamic Shear, T315/D7175: G*/sin θ, Min 1.00 kPa, Test Temp, °C at 10 rad/s (a) (b)	52	58	58	58	64	64	70	70
Rolling Thin Film Oven (T240/D2872)								
Mass Loss, Max, %	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Dynamic Shear, T315/D7175: G*/sin θ, Min 2.20 kPa, Test Temp, °C at 10 rad/s (b)	52	58	58	58	64	64	70	70
Pressure Aging Vessel (PAV) Residue (R28/D6521)								
PAV Aging Temp, °C (c)	90	100			100		100 (110)	
Dynamic Shear, T315/D7175: G*sin θ, Max 5000 kPa, Test Temp, °C at 10 rad/s (b)	16	22	19	16	25	22	28	25
Physical Hardening (d)	Report	Report			Report		Report	
Creep Stiffness T315/D6648 S Max, 300 MPa M-value, Min 0.300 Test Temp, °C at 60 s	-18	-12	-18	-24	-12	-18	-12	-18

(a) For quality control (QC) of unmodified asphalt cement production, measurement of the viscosity of the original asphalt cement may be used or supplement dynamic shear measurements of G*/sin θ, at test temperatures where the asphalt is a Newtonian fluid. The Contractor may use a standard means of viscosity measurement, including capillary (T201/D2170 or T202/D2171) or rotational viscometer (T316/D4402)

(b) G*/sin θ = high temperature stiffness and G*sin θ = intermediate temperature stiffness.

(c) The PAV aging temperature is based on simulated climatic conditions and is one of the three temperatures: 90°C, 100°C, or 110°C. The PAV aging temperature is 100°C for PG 58- and above, except in desert climates, where it is 110°C

(d) Physical hardening – T313/D6648 is performed on a set of asphalt beams according to ASTM D6648, Section 13.1, except the conditioning time is extended to 24 hours ± 10 minutes at 10° C above the minimum performance temperature. The 24-hour stiffness and m-value are reported for information purposes only.

Notes: Test reference designations TXXX or RXX/DXXXX refer to the AASHTO/ASTM standards existing at the time of the award of the contract.
For specified binders not listed in this table, refer to the MDOT Standard Specifications for Construction existing at the time of the award of the contract.

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Table 2-4. Mix Design Criteria and Volumetric Properties (Marshall Mixtures)

HMA Mixture	2C	11A	3C	4C MOD	13A MOD	36A MOD
Target Air Void, %	3.00	3.00	4.00	4.00	4.00/3.00 (a)	4.00/3.00 (a)
VMA, min, (based on G_{sb})	11.00	11.00	13.00	14.00	14.00	15.00
VFA	65-78	65-78	65-78	65-78	65-78	65-78
Fines to Binder Ratio, max (b)	1.2	1.2	1.2	1.2	1.2	1.2
Flow (.001 inch)	8-16	8-16	8-16	8-16	8-16	8-16
Stability, lbs, min	1200	1200	1200	1200	1200	1200

(a) Target Air Void may be reduced to 3.00% for low volume roads for HMA mixture 13A and 36A if designated in the contract documents.
(b) Ratio of aggregate passing the No. 200 sieve to total asphalt binder content by weight including fines and binder content contributed by RAP

Note: RAP binder for HMA Mixture 4C MOD is limited to 17%, by weight, of the total binder.
RAP binder for HMA Mixtures 13A MOD and 36A MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D).

Table 2-4. Mix Design Criteria and Volumetric Properties (Marshall Mixtures)

HMA Mixture	700B MOD	1100L MOD	1100T MOD	1300L MOD 1300T MOD	1500L MOD 1500T MOD
Target Air Void, %	4.00	3.00	3.00	3.00	3.00
VMA, min (based on G_{sb})	13.00	13.50	13.50	14.00	14.00
VFA	65-78	65-78	65-78	65-78	65-78
Fines to Binder Ratio, max (a)	1.2	1.2	1.2	1.2	1.2
Flow (.001 inch)	8-16	8-16	8-16	8-16	8-16
Stability, lbs, min	700	1100	1100	1300	1500

(a) Ratio of aggregate passing the No. 200 sieve to total asphalt binder content by weight including fines and binder content contributed by RAP

Notes:
Measure and/or calculate volumetric properties from specimens made using a 50 blow Marshall Hammer per the Asphalt Institute Manual MS-2.
Measure the density of the Marshall specimens per ASTM D 2726.
Measure the Maximum Specific Gravity per ASTM D 6857.
Measure Flow and Stability of Marshall specimens per ASTM D 5581.
RAP binder is limited to 17%, by weight, of the total binder for HMA Mixtures 1100T MOD, 1300T MOD and 1500T MOD (Section 2.2.D).

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Table 2-4. Mix Design Criteria and Volumetric Properties (Superpave Mixtures EL, EML, EMH, EH)

HMA Superpave Mixture Number	5 MOD	4 MOD	3	2
$\%G_{mm}$ at the design Number of Gyrations (N_d)	97.0 (a)			
$\%\ G_{mm}$ at the initial Number of Gyrations (N_i)	See Table below			
$\%\ G_{mm}$ at the maximum number of Gyrations (N_m)	≤ 98.0			
VMA Min % at N_d (based on G_{sb})	See Table below (b)			
VFA at N_d	15.00	14.00	13.00	12.00
Fines to effective asphalt binder ratio (P_n200/P_{be})	0.6 - 1.2			
Tensile Strength ratio (TSR)	80% min			

(a) Design all mixtures to 97.0% of the G_{mm} at the design number of gyration (N_d).
(b) For regressed mixtures, the maximum criteria limits do not apply.

Notes: RAP binder for HMA Superpave Mixture Number 5 MOD is limited to 17%, by weight, of the total binder (Section 2.2.D).
RAP binder for HMA Superpave Mixture Number 4 MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D.).

Estimated Traffic (million ESAL)	HMA Superpave Mixture Type	% G_{mm} at N_i	Number of Gyrations (a)			VFA Min-Max Top and Level, %	VFA Min-Max Base, %
			N_i	N_d	N_m		
≤ 0.3	EL	91.5% max	7	50	75	70-80	70-80
> 0.3 - ≤ 3.0	EML	90.5% max	7	75	115	65-78	65-78
> 3.0 - ≤ 30	EMH	89.0% max	8	100	160	65-78 (b)	65-75
> 30 - ≤ 100	EH	89.0% max	9	125	205	65-78 (b)	65-75

(a) Compact mix specimens fabricated in the Superpave gyratory compactor (SGC) to N_d. Use height data provided by the SGC to calculate volumetric properties at N_i. Compact Mix Specimens at optimum Pb (percent asphalt binder content) to verify N_m for mix design specimens only.
(b) 73 to 76% for Mix Number 5 MOD

Notes: Measure and/or calculate volumetric properties from specimens made using a Gyratory Compactor per the MDOT HMA Production Manual existing at the time of the contract award.
Measure the density of the Gyratory Compactor specimens per ASTM D 2726.
Measure the Maximum Specific Gravity per ASTM D 6857.
RAP binder for HMA Superpave Mixture Number 5 MOD is limited to 17%, by weight, of the total binder (Section 2.2.D).
RAP binder for HMA Superpave Mixture Number 4 MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D.).

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Table 2-4. Mix Design Criteria and Volumetric Properties (Superpave Mixtures E03, E1, E3, E10, E30, E50)

HMA Superpave Mixture Number	5 MOD	4 MOD	3	2
%G_{mm} at the design Number of Gyrations (N_d) (a)	97.0			
% G_{mm} at the initial Number of Gyrations (N_i)	See Table below			
% G_{mm} at the maximum number of Gyrations (N_m)	98.0			
VMA Min % at N_d (based on G_{sb})	See Table below (b)			
VFA at N_d	15.00	14.00	13.00	12.00
Fines to effective asphalt binder ratio (P_n200/P_{be})	0.6 to 1.2			
Tensile Strength ratio (TSR)	80% min			

(a) Design all mixtures to 97.0% of the G_{mm} at the design number of gyration (N_d).
(b) For HMA Base Course mixtures, the maximum criteria limits do not apply.

Notes: RAP binder for HMA Superpave Mixture Number 5 MOD is limited to 17%, by weight, of the total binder (Section 2.2.D). RAP binder for HMA Superpave Mixture Number 4 MOD is limited to 17%, by weight, of the total binder when used for HMA top course (Section 2.2.D.).

HMA Superpave Mixture Type (a)	% G_{mm} at N_i	N_i	N_d	N_m	VFA Min-Max Top and Level	VFA Min-Max Base
E03	91.5%	7	50	75	70-80	70-80
E1	90.5%	7	76	117	65-78	65-78
E3	90.5%	7	86	134	65-78	65-78
E10	89.0%	8	96	152	65-78 (b)	65-75
E30	89.0%	8	109	174	65-78 (b)	65-75
E50	89.0%	9	126	204	65-78 (b)	65-75

(a) RAP binder for Mixes used for HMA top course are limited to 17%, by weight, of the total binder (See Section 2.2 D)
(b) 73 to 76% for Mix Number 5

Notes:
Measure and/or calculate volumetric properties from specimens made using a Gyratory Compactor per the MDOT HMA Production Manual existing at the time of the contract award.
Measure the density of the Gyratory Compactor specimens per ASTM D 2726.
Measure the Maximum Specific Gravity per ASTM D 6857.

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Table 3-1. Weather Limitations

Temperature of Surface Being Overlaid, Deg F	Thickness of Course(s) Permitted to be Placed
Under 35	Do not place HMA
At least 35 and less than 40	Place only HMA courses 1 ½" and greater
At least 40 and less than 50	Place only HMA courses 2" and greater
Over 50	Place any HMA course

Notes: Do not place HMA at any temperature when there is frost on the grade or on the surface being paved.
See Table 3-2 for lift thickness ranges for each mixture

Table 3-2. HMA Application Rates

Mixture	Course(s)	Application Rate (lb/yd^2), Min-Max	Thickness (a)
2C	Base	350-500	3" to 4 ½"
11A	Base	350-500	3" to 4 ½"
3C	Leveling	220-330	2" to 3"
4C MOD	Topping	165-275	1 ½" to 2 ½"
13A MOD	Topping, Leveling	165-275	1 ½" to 2 ½"
36A MOD	Topping, Leveling	165-275	1 ½" to 1 ½"
700 B MOD	Base	350-500	3" to 4 ½"
1100L MOD	Leveling	165-220	1 ½" to 2"
1100T MOD	Topping	165-220	1 ½" to 2"
1300 L MOD	Leveling	165-220	1 ½" to 2"
1300 T MOD	Topping	165-220	1 ½" to 2"
1500L MOD	Leveling	165-220	1 ½" to 2"
1500T MOD	Topping	165-220	1 ½" to 2"
2	Base	435-550	4" to 5"
3	Leveling, Base	330-410	3" to 3 ½"
4 MOD	Topping, Leveling	165-275	1 ½" to 2 ½"
5 MOD	Topping	165-220	1 ½" to 2"

(a) Approximate - Based on 110 lbs. per sq yd per inch

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Table 3-3. Roller Type Application Chart

Roller Type	HMA Base Course	HMA Leveling Course	HMA Top Course	Pinching Joints
Pneumatic-tired	Initial Compaction only	Initial Compaction only	No	No
Tandem Steel Wheeled – Vibratory mode	Initial Compaction only	Initial Compaction only	Initial Compaction only	No
Tandem Steel Wheeled – Static mode	Initial and/or Final Compaction	Initial and/or Final Compaction	Initial and/or Final Compaction	Initial and/or Final Compaction

Table 3-4. Acceptance Limits for HMA

Parameter	Top and Leveling Courses	Base Course
% Passing # 8 and Larger Sieves for Aggregate Blend	± 8.0	± 9.0
% Passing # 30 sieve for Aggregate Blend	± 6.0	± 9.0
% Passing #200 Sieve for Aggregate Blend	± 2.0	± 3.0
Binder Content	± 0.5	± 0.5
Air Voids	± 1.0	± 1.0
Voids in Mineral Aggregate (VMA)	± 2.0	± 2.0

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SECTION 02520

CONCRETE PAVING MATERIALS

PART 1 GENERAL

1.1 SUMMARY

A. This Section provides the requirements for the design of Portland Cement Concrete (PCC) concrete mixtures to be used for concrete pavements, curb and gutter, driveways, sidewalk, and barrier wall.

B. Related Requirements
1. Section 02530 - Concrete Curb and Gutter
2. Section 02540 – Sidewalk / Safety Paths / Paving
3. Section 02541 - Quality Assurance and Quality Control of Portland Cement Concrete (PCC)

1.2 MEASUREMENT AND PAYMENT

A. All costs for the design and production of concrete mixtures to the requirements stated herein will be included in the cost for all pay items in which the concrete is a material.

B. The Owner will pay for all QA activities as stated herein.

1.3 REFERENCES

A. Abbreviations and Acronyms
1. ACI - American Concrete Institute
2. ASI – Aggregate Source Index (MDOT Prequalified Aggregate Source List)
3. ASR – Alkali-Silica Reactivity
4. ASTM - American Society for Testing Materials
5. GGBFS – Ground Granulated Blast Furnace Slag
6. MDOT - Michigan Department of Transportation
7. MTM – Michigan Test Methods (MDOT - most current version)
8. NRMCA – National Ready Mix Concrete Association
9. SCM – Supplementary Cementitious Material
10. SSD – Saturated Surface Dry

B. Definitions
1. Admixtures - Chemicals added to concrete to improve its workability and/or its hardened properties.
2. Alkali Loading – The quantity, in lbs. per cubic yard, of alkalis in a concrete mixture calculated from the Equivalent Alkalis of the cement and the cement content in the mixture.
3. Alkali Silica Reactivity (ASR) – The reaction in hardened concrete between alkalis in the cement or from other sources, and silicas from the aggregates that creates a potentially expansive gel that could cause the concrete to crack.

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4. Concrete Mixture - The proposed quantities of all materials used to make a cubic yard of concrete.
5. Concrete Mix Design – A Concrete Mixture with the supporting test data for each material and for the mixture itself.
6. Deleterious ASR - The occurrence of ASR at a level that causes concrete to crack.
7. Equivalent Alkalis – The percent (%) of alkalis in a cementitious material expressed as equivalent sodium oxide (percent Na_2O + 0.658 x percent K_2O).
8. Non-Conforming Work – Work not in compliance with the requirements stated on the project plans and in the project specifications.
9. Optimized Gradation – The combination of aggregates that produce an aggregate blend of specified particle sizes, coarseness factor, and workability factor.
10. Pre-Production Meeting - A meeting with the Owner and all parties involved in the Quality Assurance and Quality Control of the production and placement of the concrete.
11. Quality Assurance (QA) - Activities administered by the Owner dealing with acceptance of the product, including, but not limited to, materials sampling, testing, construction inspection, and review of Contractor QC documentation.
12. Quality Control (QC) - Activities administered by the Contractor to monitor, assess and adjust production and placement processes to ensure the final product will meet the specified levels of quality, including, but not limited to, training, materials sampling, testing, project oversight and documentation.
13. Saturated Surface Dry - The condition of an aggregate in which the surfaces of the particles are dry but the inner-particle voids are saturated with water.
14. Supplementary Cementitious Material (SCM) - Industrial by-products such as fly ash, GGBFS, and silica fume with cementitious properties that are used as a partial replacement for cement in concrete mixtures.

C. Reference Standards - AASHTO
1. AASHTO T 21 - Standard Method of Test for Organic Impurities in Fine Aggregates for Concrete
2. AASHTO T 26 - Standard Method of Test for Quality of Water to Be Used in Concrete

D. Reference Standards - ACI
1. ACI 301- Specifications for Structural Concrete

E. Reference Standards - ASTM
1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C 33 - Standard Specification for Concrete Aggregates
3. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C 88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
5. ASTM C 150 - Standard Specification for Portland Cement
6. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete
7. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete
8. ASTM C 595 - Standard Specification for Blended Hydraulic Cements
9. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

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10. ASTM C 989 - Standard Specification for Slag Cement for Use in Concrete and Mortars
11. ASTM C -1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures
12. ASTM C 1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
13. ASTM C 1293 - Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
14. ASTM C 1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
15. ASTM D 4791 - Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

F. Reference Standards-MTM
1. MTM 102 - Michigan Test Method for Abrasion Resistance by the Los Angeles Machine
2. MTM 108 - Michigan Test Methods for Materials Finer than the No. 75 um (No. 200) Sieve in Mineral Aggregates by Washing
3. MTM 110 - Michigan Test Method for Determining Deleterious and Objectionable Particles in Aggregates
4. MTM 115 - Michigan Test Method for Testing Concrete Durability by Rapid Freezing in Air and Thawing in Water

G. Where referenced, “MDOT Specifications” is a general term that shall include the current version of the MDOT Standard Specifications for Construction and all Supplemental Specifications, Special Provisions, and Errata existing at the time of the award of the Contract.

H. MDOT manuals that are referenced specifically by name shall be the current versions of said manuals existing at the time of the award of the Contract.

1.4 SUBMITTALS

A. Concrete Mix Designs
1. Shall include all the information listed in Table 1-1 for each Concrete Mixture.
2. Shall be submitted for review:
   a. At least fourteen (14) calendar days prior to a Pre-Production Meeting if one is conducted.
   b. At least fourteen (14) calendar days prior to the first placement of the concrete if a Pre-Production Meeting is not conducted.
3. New and /or updated Concrete Mix Design(s) are required if the concrete work extends beyond the calendar year in which the work began.

1.5 QUALITY CONTROL

A. Quality Control of all materials used on the project is the responsibility of the Contractor.

B. Quality Assurance is not a substitute for Quality Control.

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C. The Contractor is responsible for adjustment of Concrete Mixtures during production, and to notify the Owner of such adjustments, to account for:
   1. Changing moisture conditions in the aggregate stockpiles.
   2. Changing weather conditions.
   3. Other factors related to the production and placement of concrete.

D. The Contractor is responsible to submit new Concrete Mix Design(s) that may be required after construction commences in a timely manner to the Owner for review before such concrete is placed.

E. For mixes with Optimized Gradations, the Contractor is responsible for providing the Owner daily updates on the individual aggregate gradations, the gradation of the aggregate blend and the coarseness and workability factors during the entire course of production of the concrete.

1.6 QUALITY ASSURANCE

A. The Owner will review the submitted Concrete Mix Design(s) for compliance to these specifications and provide the Contractor with a status of the review (Refer to Article 3.1) Non-Conforming Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete
   1. Shall be designed to meet the requirements in Table 2-1.
      a. HRC P-NC mixtures are to be used only at the direction of the Owner.
   2. Must be resistant to Deleterious ASR.
      a. An ASTM C 1293 test alone will not be sufficient to show that an aggregate is non-reactive with respect to Deleterious ASR.
      b. Concrete Mixtures that include either of the following are considered resistant to Deleterious ASR:
         1) If a proposed concrete mixture contains cement with an alkali level of less than 0.60% expressed as equivalent sodium oxide (percent Na_2O + 0.658 x percent K_2O).
         2) A **25%** replacement of cement with GGFBS or other SCM.
      c. Concrete Mixtures submitted with either of the following are also considered resistant to Deleterious ASR:
         1) Documentation that testing of all aggregates per ASTM C 1260 show expansions of less than 0.10%.
         2) Documentation that testing of all aggregates per ASTM C 1567 show expansions of less than 0.10 % for samples made with the same SCM and replacement of cement with SCM as proposed for the Concrete Mixture.
      d. At the discretion of the Owner, a Concrete Mixture may be considered resistant to Deleterious ASR if testing per ASTM C 1567 shows expansions of less than 0.10% for samples made with the same aggregates, the same proportions of aggregates, the same cement, the same SCM and the same replacement % of cement with SCM as proposed for the Concrete Mixture.

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3. In the event of Cold Weather, as defined in Sections 02530, 02540 and other sections of these specifications.
    a. Non-chloride accelerating admixtures will be permitted.
    b. The Owner reserves the right to not permit placement of concrete with a replacement of the cement with GGBFS or other SCM.
    c. A Concrete Mixture without a replacement of cement with GBFGS or other SCM will be considered resistant to Deleterious ASR if the Alkali Loading does not exceed 4.0 lbs./cu. yd.
4. The Owner may, in the event of a shortage of SCM materials or other situations beyond the control of the Contractor, evaluate Concrete Mixtures without any SCM replacement of cement for Deleterious ASR based on Alkali Loading.

B. Aggregates
1. Must be from geologically natural sources.
    a. Aggregates produced from slag are not permitted.
    b. Aggregates produced from crushed concrete are not permitted.
2. Shall meet the Grading Requirements in Table 2-2.
3. Shall meet the Physical Requirements in Table 2-3.
4. For HRC 3500 HP mixtures:
    a. Aggregates shall have an Optimized Gradation as per the requirements of Section 3.09 of the 2020 MDOT Materials Quality Assurance Procedures Manual or as indicated in the stated manual in place at the time of the award of the contract (Substitute all references to the “Department” with the “Owner”).

C. Cement and SCM shall meet the requirements indicated in Table 2-4.

D. Water
1. Shall be from a potable source.
2. Shall be clean, clear, and reasonably free of oil, salt, acid, alkali, sugar, vegetable, organic or other matter or substance injurious to the finished product.
3. Shall be tested in accordance with AASHTO T 26 if of questionable quality or from a questionable source.

E. Admixtures
1. Shall meet the requirements indicated in Table 2-5 for the Admixture type.
2. Shall not contain calcium chloride

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PART 3 EXECUTION

3.1 NON-CONFORMING WORK

A. Concrete Mixtures that do not meet this specification shall not be used for the work.

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Table 1-1. Requirements for Concrete Mix Design Submittals

General

- The Concrete Mix Design must be specific to the project it is submitted for.

Batch Plant

- NRMCA Certificate of Conformance for Concrete Production Facilities that spans the dates in which the project is be constructed.
- Scale Calibration/Test sheet from year(s) in which the project is constructed.
- Admixture / Dispenser Calibration Check Sheets from the year(s) in which the project is constructed.

Concrete Mixture

- Project Name and Location
- Supplier Name
- Plant Location and Identification Number or Name
- Supplier Mix ID
- Mix description and use
- Batch Weights, Specific Gravities and Volumes Occupied (yield) for all materials, Dry or SSD
- Dosage Rates for Admixtures in ounces per 100 pounds of cement (oz./cwt)
- Dosage Rates for Materials such as Color Additives, Fibers etc.
- Volume Occupied by Air and Admixtures
- Design Yield for the Concrete Mixture
- Unit Weight for the Concrete Mixture
- Water to Cement Ratio for the Concrete Mixture (See Table 2-1 for requirements)
- Target Air Content and Tolerance Range (See Table 2-1 for requirements)
- Target Slump and Tolerance Range
- Anticipated 28-Day Strength (See Table 2-1 for requirements)

Material Data

- Cement
    - Supplier, Location and Type (See Table 2-4 for requirements).
    - Mill Test Report from the year(s) in which the project is constructed.

- SCM
    - Supplier, Location and Type or Class (See Table 2-4 for requirements).
    - Mill Test Report from the year(s) in which the project is constructed.

- Aggregates
    - Supplier, Source Name and MDOT ASI #, if applicable.
    - Material Type and Aggregate Series/Class (See Tables 2-2 and 2-3).
    - Sieve Analysis for each Aggregate Series/Class from the calendar year in which the project is constructed (See Table 2-2 for requirements).
    - Optimized Gradation Worksheet for HRC 3500 HP mixtures.
    - Test Results for Physical Properties from the calendar year(s) in which the project is constructed (See Table 2-3 for requirements).
    - ASTM C 1260 or ASTM C 1567 mortar bar test results from either of the past two calendar year(s) prior to the year the project is constructed or the year(s) the project is constructed.

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- Water
    - Identification of water source.
    - Statement that water coming from the source is potable.
    - Test results indicating that water coming from the source is potable.

- Admixture Data Sheets

- Data Sheets and Test Results for materials such as Color Additives, Fibers etc.

Performance Data

- Test data for strength, slump, air content and concrete temperature from within the two calendar years prior to the anticipated year of construction for the proposed Concrete Mixture.
- Statistical evaluation of the strength test data per ACI 301 (from 30 sets minimum):
    - Average 7 and 28 Day Strength.
    - Standard Deviation of 28 Day Strength Tests.
    - Required Average Strength based on Statistical Data.
        - f'_{cr} for one Standard Deviation Unit.
        - f'_{cr} for two Standard Deviation Units.

END OF SECTION

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Table 2-1 Concrete Mixtures

Concrete Grade (a)	**HRC 3500**	**HRC 3500 HP**
Concrete Type	Standard	High Performance
Concrete Use	Pavement Driveway Curb and Gutter Sidewalk ADA Ramp Barrier Wall (b)	Pavement Driveway (c)
Total Cementitious Content lb./cu. yd. (d)	564 Min	564 Min
Water to Cement Ratio (e)	0.42 Max	0.42 Max
Minimum SCM Replacement of Cement (f)	25%	25%
Maximum SCM Replacement of Cement (f)	25%	25%
Admixtures (g)	Mix Design	Mix Design
Slump (g)	Mix Design	Mix Design
Air Content, % (h)	5.5 to 8.5	5.5 to 8.5
28 Day Design Compressive Strength, psi, min (i)	3500	3500

(a) Like those found in Table 1004-1 and in Table 1006-3 of the MDOT 2020 Standard Specifications for Construction.
(b) At the discretion of the Owner, may be used for similar exterior items not listed here.
(c) Includes Sidewalk that passes through a Driveway.
(d) The total weight of cement plus all SCM in the mix.
(e) The Water to Cement ratio per the Concrete Mix Design becomes the maximum permitted during construction.
(f) At the direction of the Owner, replacement may not be permitted during Cold Weather (Article 2.1.A.3).
(g) These are at the discretion of the mix designer to produce mixes that meet the placement requirements. The slump shall be provided with a plus/minus tolerance from the target slump as part of the Concrete Mix Design.
(h) At the point of placement when tested for in the field per Section 02540.
(i) Calculated from the average of two lab-cured cylinders cast and cured per ASTM C 31 and tested per ASTM C 39.

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Table 2-2. Grading Requirements for Aggregates for Concrete Mixtures

Concrete Grade (a)	**HRC 3500**	**HRC 3500**	**HRC 3500 HP**
Concrete Type	Standard	Standard	High Performance
Concrete Use	Pavement Driveway Curb and Gutter Sidewalk Barrier Wall ADA Ramp (b)	Pavement Driveway Curb and Gutter Sidewalk Barrier Wall (b)	Pavement Driveway (b)
Material Type	**Coarse**	**Fine**	**Fine Intermediate and Coarse**
Aggregate Series /Class	**MDOT 6A or 6AA (g)**	**MDOT 2NS (g)**	**Optimized (h)**
% Passing 1 ½ inch (d)	100		(i)
% Passing 1 inch (d)	95-100		
% Passing ¾ inch (d)			
% Passing ½ inch (d)	30-60		
% Passing ⅜ inch (d)		100	
% Passing No. 4, (d)	0-8	95-100	(j)
% Passing No. 8 (d)		65-95	
% Passing No. 16 (d)		35-75	
% Passing No. 30 (d)		20-55	
% Passing No. 50 (d)		10-30	
% Passing No. 100 (d)		0-10	
% Loss by Washing (d) (e) (f)	<2.0	0-3.0	<2.0

(a) Like those found in Table 1004-1 and Table 1006-3 of the MDOT 2020 Standard Specifications for Construction.
(b) At the discretion of the Owner, may be used for similar exterior items not listed here.
(c) Includes Sidewalk that passes through a Driveway.
(d) Based on dry weights.
(e) Per MDOT MTM 108.
(f) For material produced entirely by crushing rock, boulders, or cobbles, otherwise 1.0 percent
(g) Identical to those found in Table 902-1 and Section 902.03 of the MDOT 2020 Standard Specifications for Construction.
(h) Meeting the requirements of Section 3.09 of the 2020 MDOT Materials Quality Assurance Procedures Manual (Substitute all references to the "Department" with the "Owner").
(i) Pavements with a minimum design thickness greater than 6 inches – 2-inch maximum particle size aggregate. Pavements with a minimum design thickness 6 inches or less and all other items - 1 / ½-inch maximum particle aggregate size.
(j) No more than 15 % of aggregates from a quarried carbonate source may pass the No. 4 sieve.

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Table 2-3 Physical Requirements for Aggregates for Concrete Mixtures (a)

Concrete Grade (b)	**HRC 3500**	**HRC 3500 HP**
Concrete Type	Standard	High Performance
Concrete Use	Pavement Driveway Curb and Gutter Sidewalk Barrier Wall ADA Ramp (c)	Pavement Driveway (d)
Coarse and Intermediate Aggregates		(e)
LA Abrasion, Loss, % max (MTM 102)	40	40
Magnesium Sulfate Soundness (5 cycles), Loss, % max (ASTM C 88) (f)	18	18
Flat and Elongated Particles, ratio, % max (ASTM D 4791)		15.0
Soft Particles, % max, (MTM 110)	3.0	2.0
Clay-Ironstone particles, % max	2.0	1.0
Chert, % max (MTM 110)	7.0	2.5
Sum of Soft Particles and Chert, % max (MTM 110)	9.0	4.0
Freeze-Thaw Dilation, % per 100 cycle max (MTM 115) (g)	0.067	0.040 / 0.067 (h)
Maximum 24-hour soak absorption, %		2.50
Fine Aggregates		
Darkest Plate Number, AASHTO T 21	Plate 3 (i)	Plate 3 (i)

(a) Identical to those indicated in Table 902-2 and Section 902.03 of the MDOT 2020 Standard Specifications for Construction and Section 3.09 of the 2020 MDOT Materials Quality Assurance Procedures Manual, with the exception that a requirement for Magnesium Sulfate Soundness has been added.
(b) Like those found in Table 1004-1 and Table 1006-3 of the MDOT 2020 Standard Specifications for Construction.
(c) At the discretion of the Owner, may be used for similar exterior items not listed here.
(d) Includes Sidewalk that passes through a Driveway.
(e) Must meet the combined physical requirements for MDOT Class 6AAA aggregate (Table 902-2) and Section 902.03 of the MDOT 2020 Standard Specifications for Construction and Section 3.09 of the 2020 MDOT Materials Quality Assurance Procedures Manual as are duplicated in this table.
(f) Not specified by MDOT, added requirement per ASTM C 33.
(g) If the bulk dry specific gravity is more than 0.04 less than the bulk dry specific gravity of the most recently tested freeze–thaw sample, the aggregate will be considered to have changed characteristics and be required to have a new freeze-thaw test conducted prior to use.
(h) For Coarse / Intermediate Aggregate.
(i) Gardener Color Standard No. 11

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Table 2-4. Specifications for Cementitious Materials

Cementitious Material	Type or Class	Specification
Cement	Type I or II	ASTM C 150
Cement	Type IL	ASTM C 595
Cement	Type IS (a)	ASTM C 595
Cement	Type IP (b)	ASTM C 595
Cement	Type IT (c)	ASTM C 565
GGBFS	Grade 100	ASTM C 989
Fly Ash	Class C	ASTM C 618
Fly Ash	Class F	ASTM C 618
Silica Fume	Dry Densified	ASTM C 1240
Other SCM	As Identified	Applicable ASTM Specification

(a) No less than 25% and no more than 25% GGBFS permitted.
(b) No less than 25% and no more than 25% Fly Ash permitted.
(c) No less than 25% (GGBFS + Fly Ash) and no more than 25% (GGBFS + Fly Ash).

Table 2-5. Specifications for Concrete Admixtures

Type	Description	Specification
Type A	Air Entrainment	ASTM C 494
Type B	Retarding	ASTM C 494
Type C	Accelerating (a)	ASTM C 494
Type D	Water Reducing and Retarding	ASTM C 494
Type E	Water Reducing and Accelerating	ASTM C 494
Type F	Water Reducing High Range	ASTM C 494
Type G	Water Reducing High Range and Retarding	ASTM C 494
Type S	Special Performance	ASTM C 494

(a) Type C, Accelerating Admixture, may not contain Calcium Chloride

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