SPECIAL EXPERIMENTAL PROJECT (SEP-14)

Alternate Pavement Bidding

Michigan Department of Transportation
US-31 Alternate Pavement Bidding Project Final Report
Control Section 11056 Job Number 50757A/87343A

Prepared by:
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Southwest Region
Michigan Department of Transportation

March 8, 2012

Introduction

The Michigan Department of Transportation (MDOT) submitted a final SEP-14 report for the use of alternate pavement bidding on M-6 in August 2001. The SEP-14 work plan was developed in September 2000 to allow both the concrete and asphalt paving industries to compete for the paving work on M-6, a new limited access freeway near Grand Rapids, MI.

MDOT's typical process selects one pavement option early in the design based on the results of a life cycle cost analysis. The SEP-14 work plan permits MDOT to develop structurally equivalent concrete and hot mix asphalt (HMA) pavement cross sections for a project. HMA and concrete paving contractors are then allowed the opportunity to competitively bid on the project. This process is intended to increase competition which may result in more favorable bids for MDOT.

In 2008, MDOT requested to pilot an alternate pavement bidding program based on the original SEP-14 work plan developed for M-6. The pilot program allows a limited number of highway projects to proceed with an alternate pavement bidding component. In 2008 and 2009, the FHWA approved adding projects to the SEP-14 work plan developed for M-6. Several of these projects have since been removed as alternate pavement bidding candidate projects, and a list of projects and their current status is provided in Exhibit 5.

This report provides detailed information on the alternate pavement bidding project along US-31 in Berrien County. Additional reports will be provided as additional alternate pavement projects are completed.

US-31 Alternate Pavement Bidding Project Background (MDOT Control Section 11056, Job No. 50757/87343A)

MDOT selected a section of US-31 in Berrien County to pilot an Alternate Pavement Bidding (APB) project. US-31 is the first Design-Bid-Build APB project awarded since M-6. The US-31 APB project reconstructed a three and one third mile section of rural divided freeway, including reconstruction of two ramps on each bound.

The US-31 APB project was awarded on April 28, 2009, and construction was completed in November of 2009.

US-31 APB Project Procedure

Life Cycle Cost Analysis

MDOT developed the concrete and hot mix asphalt (HMA) pavement designs through the departments standard procedures, which utilize the 1993 AASHTO Guide for Design of Pavement Structures. During the advertisement of the APB project, contractors were not permitted to propose changes to the design of the pavement structure. In order to account for the varying life cycle costs by each pavement structure, MDOT developed equations that would consider the initial construction costs, future maintenance costs, and user delay costs for each

pavement alternative. The equations convert a contractors bid to an Equivalent Uniform Annual Cost (EUAC) for each pavement type. The contractor whose bid equated to the lowest EUAC would be selected for the project. The initial construction costs and the user delay costs were to be provided by the contractor in their bid and MDOT estimated the future maintenance costs based on historical data. The contractor's bid was then entered into the equation associated with the specified pavement type. The contractor's bid included all work to construct the project including the pavement, earthwork, signing, restoration, etc. Exhibit 4 contains the Special Provisions for HMA and Concrete including their related pay items used on this project.

To account for delays to the traveling public, MDOT incorporated user delay costs into the project. Contractors were required to include a lump sum dollar amount in their bid that would reflect the cost of the delays to the public. MDOT provided the daily rates contractors would be charged for each day they had lane and ramp restrictions on US-31. Exhibit 2 contains the final user delay special provision on this project.

The US-31 project incorporated MDOT's frequently used special provisions, as well as additional Unique Special Provisions and Notice to Bidders, for concrete and HMA paving, and for the material and workmanship warranty requirements. Exhibit 3 contains these Unique Special Provisions and Notice to Bidders.

Contracting Industry Involvement

Through this project MDOT has reinforced the concept that early coordination with industry is critical when venturing into new methods or contract procurement.

A letter (See Exhibit 1) was provided to the Michigan Concrete Paving Association (MCPA), the Asphalt Paving Association of Michigan (APAM) and the Michigan Infrastructure and Transportation Associates (MITA) that detailed the development of the EUAC. This letter gave Michigan's contracting associations detailed information on how the EUAC equation was developed and how it would be utilized in the US-31 APB project. It also explained that user delay costs were determined by a lane rental pay item (the lane rental item was later changed to the user delay cost item, which went through industry approval).

The APAM stated that they believe the 26 year evaluation period currently used in MDOT's LCCA process should be a longer duration in order to adequately assess the actual maintenance costs on a pavement. However, APAM agreed this project should proceed per the current LCCA process.

US-31 Bid Evaluation

The US-31 APB project received bids from both HMA and concrete contractors.

The low bid was determined by adding the user delay cost to the cost for the contract work items. There were five bidders, three concrete and two HMA. All bidders were under the engineer's estimate for the contract work items. The low bid, after consideration of user cost delay, was the third lowest bidder with contract work items. Their bid was $1,156,427 over the low bid for contract work items.

This project had an inconsistent history. It was originally a concrete overlay, scheduled for 2006. The funding was needed elsewhere for an emergency, so it was removed from the 5 Year Plan (5YP). It was placed back into the 5YP in April 2006 as northbound (JN 50757) in 2009 and southbound (JN 87343) in 2010. The northbound was funded with state bond funding and southbound had federal participation. There was early discussion about this project being an APB project, but it was taken off the list a year later. The standard Life Cycle Cost Analysis (LCCA) procedure was then used on US-31 to determine the pavement section, as is performed on all MDOT trunk line reconstruction projects with pavement costs over $1,000,000. The LCCA was requested in September 20007 and was completed in late October 2007.

The Life Cycle Cost Analysis identified HMA as the preferred alternative due to a lower Equivalent Uniform Annual Cost (EUAC). The notification for The Plan Review meeting for JN 50757 was sent on April 23, 2008, with the meeting scheduled for May 8, 2008. The project at that time was northbound only and was designed as HMA. On May 19, 2008, the Engineering Operations Committee (EOC) approved this project and JN 87343 (SB US-31 FY10) as APB projects. In late August 2008, the two projects were combined to achieve a possible savings of up to $2,000,000 due to larger quantities and efficiency of operations for a contractor. The Plan Completion date was revised from September to October, due to the extra design required to prepare two sets of plans and to add the other bound. The concrete design never went through a Plan Review and was not reviewed closely at OEC (Omissions and Errors Check). This became an issue during construction as bridge approach work in both sets of plans had been accidentally omitted as well as tie in to the ramps on the Tourist Information Center (building never built, but pavement put in during original 1979 project). This late identification as an APB project would create a series of problems during the advertising period. The addenda also became very complicated as making any change to the proposal or plans required an addendum and attachments for both sets of plans and proposals. Major addendum items included not only basic modifications to the plans, but also elimination of the original Notice to Bidders for Alternate Pavement Bid Calculations, which was replaced by the Special Provision for Alternate Pavement Bid Calculations, and also the addition of several other SP's and NTB. See Exhibit 6 for Contractor Inquiries and the associated Addenda.

Two sets of plans were prepared. One set was for the concrete alternative and one set was for the hot mix asphalt (HMA) alternative. The typical cross sections used needed to be structurally equivalent and the sections used were developed during the LCCA process. MDOT's Construction & Technology (C&T) division followed the 1993 AASHTO "Guide for Design of Pavement Structures" and used AASHTO pavement software DARWin Version 3.1, 1997, as approved by the EOC on June 3, 1999. There were two proposals as well, one for each alternative, with the pertinent specifications and pay items for each material. The majority of the pay items on the job were the same for each alternative, as much of the work would be completed regardless of pavement (drainage, right-of-way fence, maintenance of traffic crossovers, etc.). Initially, the plan sets were designed to be one set only. It was decided not to use this method, to decrease confusion during the bidding and construction process.

Final Evaluation of the US-31 Alternate Pavement Biding Project

The US-31 project was constructed entirely with hot mix asphalt (HMA) pavement. The successful low bidder for this project bid the project with an alternate Maintenance of Traffic (MOT) scheme. This allowed them to use less days in their calculations, which helped them attain the project. The length of overall time to complete the project was no shorter; the contract used all days available in the original progress clause in the proposal. The progress clause allowed 146 week days for the work. This was for all work, not just the days of having single lane daily closures as was computed for the User Cost Delay that was used for the bidding. The low bidder used the equivalent of 154 Single Lane Days, and all other bidders ranged from 230 days to 462 days for Single Lane Days. Their proposed change in the MOT was to build an additional lane in the median, at their own expense, in order to carry three lanes of traffic. In the two stages, they had two lanes in one direction maintained with one lane in the other direction. When traffic was crossed over to build the other bound, they changed the direction of the two maintained lanes. This permitted them to use fewer days in their calculation when lanes were closed to traffic. All other contractors used two lanes closed to traffic when an entire bound was closed, with a single lane in each direction on the other bound.

The alternate MOT scheme during the bid process was not forbidden by the contract documents. This resulted in a higher overall cost to MDOT, with no savings to the drivers of this corridor. It did not decrease the delay experience by the motorists as this section of US-31 does not carry heavy volumes. The construction time period was not shortened in duration. The construction went from May 2009 until November 2009. MDOT accepted the proposed changes in MOT simply because it was not forbidden. MDOT believes the alternate pavement bidding component of the project added more than one million dollars, nearly 10% of the engineer's estimate. Additional internal costs to develop the alternate pavement bidding component were incurred, but difficult to quantify. Since this project, every Special Provision for Maintaining Traffic has forbidden any changes to the MOT scheme as designated in the plans and proposals. This was an important "lesson learned" for MDOT.

On January 12, 2010, MDOT held a post-construction meeting with the contractor and appropriate MDOT staff. Items discussed relating to the Alternate Pavement Bidding included the cost of extras for concrete items that were overlooked during the alternate bid process and the changes made to the MOT scheme by the contractor which impacted MOT quantities, particularly temporary pavement, modified earthwork and temporary pavement markings. It was noted that this was a learning experience for everyone being one of the first alternate bid projects in the state. It was suggested by construction staff that Echelon paving should have been used for the best quality centerline joint, but the change could not be made after bid due to the expense and impacts on schedule. Another discussion during the meeting in regards to APB, was the challenge created by having to pay for HMA in SYD for comparison to the concrete option, as tracking for HMA is normally done by the Ton.

To date, the MCPA has not voiced concerns with MDOT's alternate pavement bidding process, and supports the current process on future alternate pavement bid pilot projects. The APAM, at various meetings with MDOT, has reiterated their belief that the 26 year evaluation period

currently used in MDOT's LCCA process should have a longer duration in order to adequately assess the actual maintenance costs on a pavement. MDOT has formed a technical committee to evaluate if changes are needed in the LCCA process, and is reviewing APAM's concern.

On September 16, 2009, MDOT issued a moratorium on Alternate Pavement Bid projects. Four projects for 2010 were removed from the APB project list (M-53 in Metro Region, US-12 in Southwest Region, US-10 in Bay Region and I-196 in Grand Region). In July of 2010, the moratorium was lifted and the US-31 (Oceana County) project was selected to continue the APB program. A technical committee was also formed to evaluate the process and recommend criteria for future APB project selection. MDOT will continue to meet with industry on future alternate pavement projects as our process becomes more formalized.

Update on Other Alternate Pavement Bidding Projects

MDOT let a design-build alternate pavement bid project on I-475 in Genesee County that was awarded on December 16, 2009. The contractor used concrete pavement.

MDOT let an alternate pavement bid project on I-94 in St Clair County that was awarded on December 16, 2009. The contractor used concrete pavement.

MDOT let an alternate pavement bid project on US-31 in Oceana County that was awarded on April 15, 2011. The contractor used concrete pavement.

FHWA has approved and MDOT is in the process of designing alternate pavement bid projects on US-10 in Bay Region, M-231 in Grand Region, and US-24 in Metro Region.

MDOT will provide additional reports on each alternate pavement project once additional projects are completed, or as requested by the FHWA. MDOT expects to gather a better understanding of the effects of the alternate pavement component as more projects are placed under contract. These findings will be detailed in future reports.

Exhibit 1

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

KIRK T. STEUDLE
DIRECTOR

December 10, 2008

Mr. Glenn J. Bukoski, P.E.
Vice President of Engineering Services
Michigan Infrastructure & Transportation Association
2937 Atrium Drive
Okemos, Michigan 48864

Dear Mr. Bukoski:

US-31 in Berrien County, Alternate Pavement Bidding Project
CS 11056 JN 50757A and 87343A

The Michigan Department of Transportation (MDOT) plans to advertise a project on US-31 that will include an alternate pavement bidding component. The project will be advertised in January 2009, and let in March 2009.

MDOT has calculated and established equations to determine the Equivalent Uniform Annual Cost (EUAC) for each pavement type. These equations will be used to assist in determining the contractor for this project. A copy of the methodology used to determine the EUAC values and the cross section proposed for each pavement design is enclosed.

The equations are as follows:

Hot Mix Asphalt Pavement
EUAC = (Contract Work Items + Lane Rental + $745,189.05) x 0.054658622075

Concrete Pavement
EUAC = (Contract Work Items + Lane Rental + $501,662.47) x 0.054658622075

MDOT is requesting your input on the methodology used in developing the equations that have been established for this alternate pavement bidding project. MDOT is requesting your comments on or before Thursday, December 18, 2008. Comments may be mailed, faxed 517-241-2567, or e-mailed to my attention, at friendj@michigan.gov. A meeting will be scheduled if comments received by MDOT warrant a meeting.

If you have any questions, please contact me at 517-335-1697.

Sincerely,

John C. Friend
Engineer of Delivery

Enclosure

NOTICE TO BIDDERS FOR

ALTERNATE PAVEMENT BID CALCULATIONS

The Contractor shall submit its bid through MDOT's Construction Contract Bid Letting Process. MDOT will receive Contractor's bids and MDOT will following the following procedures to determine the selected Contractor for this Project.

This Project is an alternate pavement bid Project. Contractors are allowed to submit a bid on one of the alternates in the bidding documents. Contractors are not allowed to bid both alternates, and shall submit a bid that includes the price for either the concrete pavement alternative or the hot mix asphalt alternative.

Determination of the selected Contractor will be based on the bid that has the lowest life cycle cost according to the formulas below. The Contractor's bid must be submitted electronically. The life cycle cost will be determined by the Equivalent Uniform Annual Cost (EUAC) for each pavement type (see below). MDOT will manually enter each Contractor's bid into the equations to determine the Contractor with the lowest life cycle cost. The Contractor with the lowest life cycle cost will be selected Contractor for this Project.

The Contractor will determine the number of calendar days they need to use any lane closures to build the project, both mainline and ramps. This will be used to determine User Delay Cost. The values for the US-31 and ramp closures are given in the table below. The closures are valued per hour and the calculation runs for 24 hours a day. If any portion of an hour is used, a full hour will be used in the calculation.

Lane Closure Hourly Assessments for User Cost Delay

Lane Closures	Hourly Assessment
US-31 Single Lane	$268.40
Ramp B (NB Off-Ramp)	$285.14
Ramp C (SB On-Ramp)	$186.94
Ramp F (SB On-Ramp)	$120.25
Ramp E (NB On-Ramp)	$22.00

In addition to the requirements of subsection 102.13 of the Standard Specifications for Construction, the following shall apply to this contract. The Contractor is instructed to bid the Contract Work Items as follows:

For the **HMA** Bidder:
Section 1 + Section 2 = Contract Work Items
EUAC = (Contract Work Items + User Delay Cost + $745,189.05) x 0.054658622075

For the Concrete Bidder:
Section 1 + Section 3 = Contract Work Items
EUAC = (Contract Work Items + User Delay Cost + $501,662.47) x 0.054658622075

For the purpose of this Notice To Bidders, the following definitions apply.

1. **Designated Traffic Lane -** Any traffic lane in use by traffic prior to the beginning of the project. Designated traffic lanes include lanes closed to traffic by any staging or Maintaining Traffic Special Provisions contained within this contract.

2. **Lane Closure -** For the purpose of determining User Cost Delay, lane closure shall mean denying traffic to any designated traffic lane or any portion thereof for mainline, and ramp(s) listed in this Notice To Bidders. A lane closure will be required when the Contractor's operations have resulted in a traffic lane width less than 11 feet, or as shown on the plans, or a reduction in the minimum vertical clearance allowed of a traffic lane.

US-31: Alternative Pavement Bidding

CS 11056 - JN 50757 & 87343

$$Equivalent\ Uniform\ Annual\ Cost\ (EUAC) = \sum Net\ Present\ Value\ (NPV) \times \frac{i \times (1+i)^n}{(1+i)^n - 1}$$

where: $i = 2.8\%$
$n = 26\ years$

Therefore: $EUAC = \sum NPV \times 0.054658622075$

$$\sum NPV = Contract\ Work\ Items + User\ Delay\ Cost + Future\ Maintenance\ Cost$$

$$Contract\ Work\ Items = Cost\ of\ All\ Bidding\ Items\ in\ the\ advertised\ proposal$$

$$Contract\ Work\ Items + User\ Delay\ Cost = Total\ Contractor\ Bid\ \ for\ the\ Project$$

$$US\text{–}31\ Single\ Lane\ Closure = \frac{\$6055.29 \times 5\ days + \$7406.98 \times 2\ days}{7\ days} = \frac{\$6441.49\ \ per\ day}{24\ hours} = \$268.40\ \ per\ hour$$

Single Ramp Closure = calculated the same as above, with values as follows:

Ramp B (NB Off-Ramp): $285.14 *per hour*
Ramp C (SB On-Ramp): $186.94 *per hour*
Ramp F (SB On-Ramp): $120.25 *per hour*
Ramp E (NB On-Ramp): $22.00 *per hour*

$$UserCostDelay = Bid\ Hours\ of\ US\text{–}31\ Single\ Lane\ Closure \times \$268.40\ per\ hour + \\ + \sum Bid\ Hours\ of\ Respective\ Ramp\ Closure \times Respective\ \$\ per\ hour$$

$$Future\ Maintenance\ Cost = \$56{,}971.64\ per\ lane\ mile\ \ for\ HMA^* \\ = \$38{,}353.40\ per\ lane\ mile\ \ for\ Concrete^*$$

*Based on values from MDOT's *Pavement Design and Selection Manual*

Multiply *Future Maintenance Cost* by the *# of total lane miles* to bring into common units.

$$\#\ of\ \ total\ lane\ miles = 3.270\ miles \times 4\ lanes = 13.080\ lane\ miles$$

$$Future\ Maintenance\ Cost = \$56{,}971.64 \times 13.080 = \$745{,}189.05\ \ for\ HMA \\ = \$38{,}353.40 \times 13.080 = \$501{,}662.47\ \ for\ Concrete$$

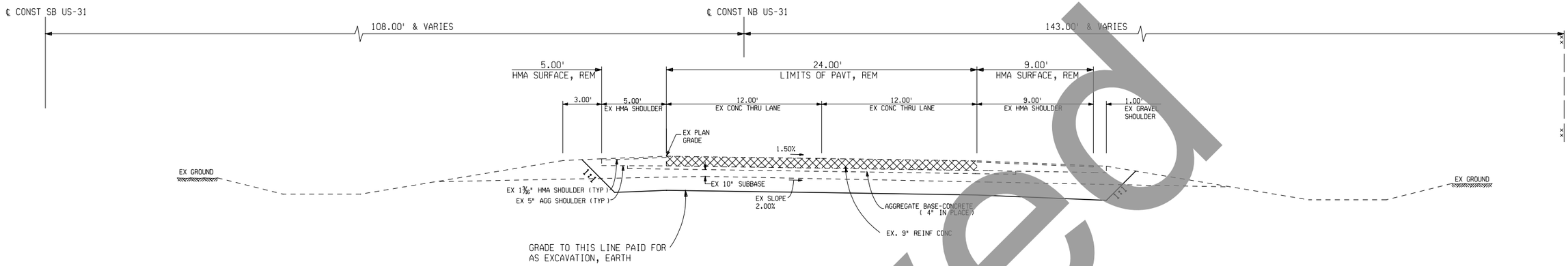
For the **HMA** Bidder:

$$EUAC = (Contract\ Work\ Items + Lane\ Rental + \$745{,}189.05) \times 0.054658622075$$

For the **Concrete** Bidder:

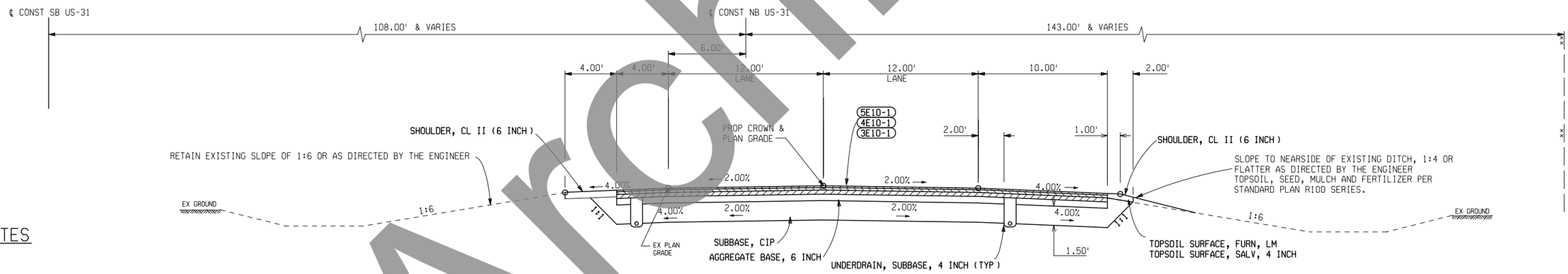
$$EUAC = (Contract\ Work\ Items + Lane\ Rental + \$501{,}662.47) \times 0.054658622075$$

			FINAL R.O.W.
AUTH	DATE	NO.	REVISION



EX. TYPICAL SECTION US 31

TO APPLY:
STA 100+00.00 TO STA 128+66.62 ℄ CONST NB US31
STA 99+65.67 TO STA 126+01.25 ℄ CONST SB US31 (REVERSED)
STA 147+81.54 TO STA 165+95.80 ℄ CONST NB US31
STA 150+80.89 TO STA 166+58.39 ℄ CONST SB US31 (REVERSED)
STA 207+12.62 TO STA 272+57.88 ℄ CONST NB US31
STA 202+10.51 TO STA 272+54.69 ℄ CONST SB US31 (REVERSED)



NOTES

HMA APPLICATION ESTIMATE

IDENT NO.	ITEM	RATE PER SYD	PERFORMANCE GRADE	REMARKS
5E10-1	HMA,5E10	165#	PG 64-28	TOP CSE (MAINLINE, RAMPS & SHDRS)
4E10-1	HMA,4E10	285#	PG 64-28	LEVEL CSE (MAINLINE, RAMPS & SHLDRS)
3E10-1	HMA,3E10	417.5#	PG 64-28	BASE CSE (MAINLINE, RAMPS & SHLDRS)
5E10-2	HMA Approach	165#	PG 64-28	TOP CSE (RAMP GORE AREAS, REST AREA RAMPS)
4E10-2	HMA Approach	285#	PG 64-28	LEVEL CSE (RAMP GORE AREAS)
3E10-2	HMA Approach	417.5#	PG 64-28	BASE CSE (RAMP GORE AREAS)
4E1-1	HMA Approach	220#	PG 58-28	TOP CSE, TEMPORARY CROSSOVERS, HMA MIX 4E1
2E1	HMA Approach	440#	PG 58-28	BASE CSE, MEDIAN/TEMPORARY CROSSOVERS, HMA MIX 2E1
5E10-3	HMA Approach	0-165#	PG 64-28	TOP CSE (REST AREA RAMPS)
4E1-2	HMA,4E1	220#	PG 58-28	TEMP. SHLDR RESURFACING
	* HMA BOND COAT	0-0.10 GAL		

*FOR INFORMATION ONLY

PROP. TYPICAL SECTION US 31

TO APPLY:
STA 100+00.00 TO STA 128+66.62 ℄ CONST NB US31
STA 99+65.67 TO STA 126+01.25 ℄ CONST SB US31 (REVERSED)
STA 147+81.54 TO STA 165+95.80 ℄ CONST NB US31
STA 150+80.89 TO STA 166+58.39 ℄ CONST SB US31 (REVERSED)
STA 207+12.62 TO STA 272+57.88 ℄ CONST NB US31
STA 202+10.51 TO STA 272+54.69 ℄ CONST SB US31 (REVERSED)

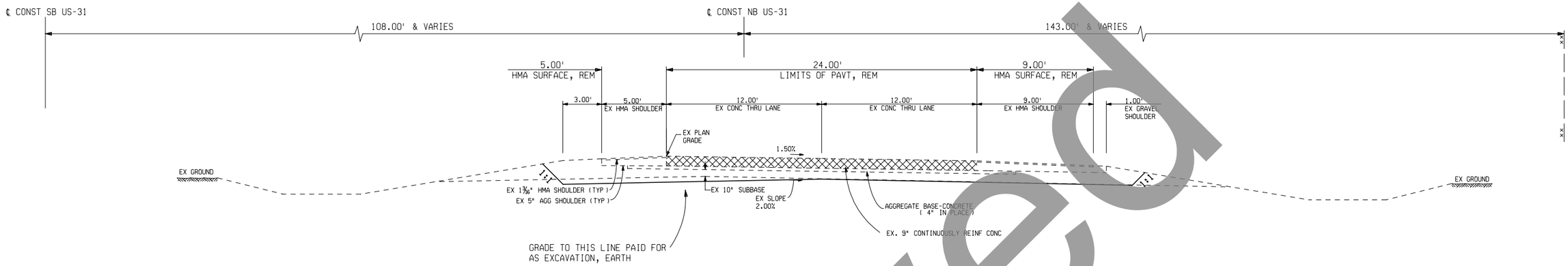
MDOT Michigan Department of Transportation

TYPICAL CROSS SECTIONS - HMA ALTERNATIVE

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W	SHEET NO. CONST.
10/17/08	11056	50757A	WOOLCOCK		1004

DATE:
WORKED ON BY: E. KERCHEVAL
DATE: 11/01/07
DATE:
CHECKED BY:
FILE NAME: 50757TY1HMA.dgn

			FINAL R.O.W.
AUTH	DATE	NO.	REVISION



EX. TYPICAL SECTION US 31

TO APPLY:
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STA 99+65.67 TO STA 126+01.25 ℄ CONST SB US31 (REVERSED)
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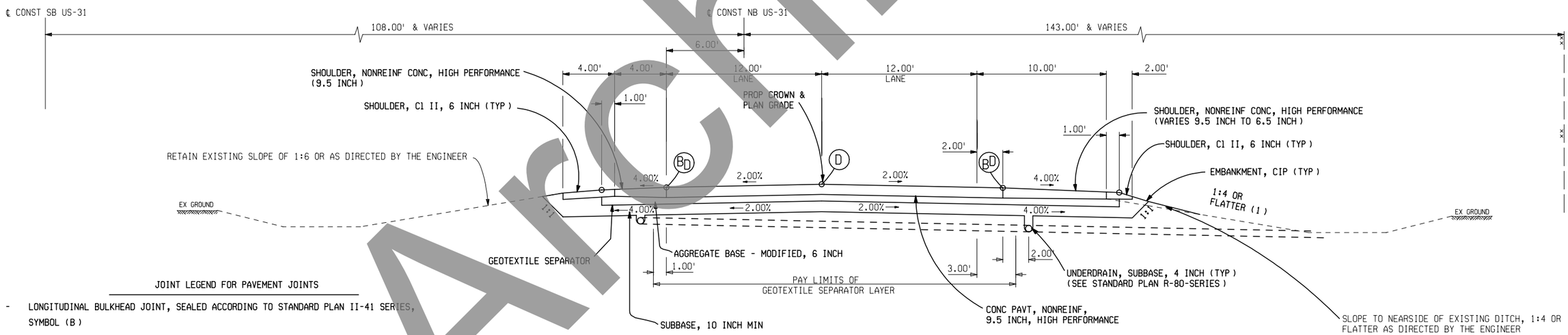
STA 150+80.89 TO STA 166+58.39 ℄ CONST SB US31 (REVERSED)
STA 207+12.62 TO STA 272+57.88 ℄ CONST NB US31
STA 202+10.51 TO STA 272+54.69 ℄ CONST SB US31 (REVERSED)



JOINT LEGEND FOR PAVEMENT JOINTS

B - LONGITUDINAL BULKHEAD JOINT, SEALED ACCORDING TO STANDARD PLAN II-41 SERIES, SYMBOL (B)

BD - OPTIONAL B OR D JOINT.

D - LONGITUDINAL LANE TIE JOINT WITH TIE BARS, SEALED ACCORDING TO STANDARD PLAN II-41 SERIES, SYMBOL (D).

NOTES:
(1) GRADE TO BOTTOM OF FORESLOPE

PROP. TYPICAL SECTION US 31

TO APPLY:
STA 100+00.00 TO STA 128+66.62 ℄ CONST NB US31
STA 99+65.67 TO STA 126+01.25 ℄ CONST SB US31 (REVERSED)
STA 147+81.54 TO STA 165+95.80 ℄ CONST NB US31
STA 150+80.89 TO STA 166+58.39 ℄ CONST SB US31 (REVERSED)
STA 207+12.62 TO STA 272+57.88 ℄ CONST NB US31
STA 202+10.51 TO STA 272+54.69 ℄ CONST SB US31 (REVERSED)

MDOT Michigan Department of Transportation

TYPICAL CROSS SECTIONS - CONCRETE ALTERNATIVE

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W	SHEET NO. CONST.
10/17/08	11056	50757A	WOOLCOCK		2004

FILE NAME: 50757TYICONC.dgn CHECKED BY: DATE: WORKED ON BY: E. KERCHEVAL DATE: 11/01/07 WORKED ON BY: D. BURNS DATE: 02/20/08

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
ALTERNATE PAVEMENT BID CALCULATIONS

a. Description. This Project is an alternate pavement bid Project. Contractors are allowed to submit a bid on one of the alternates in the bidding documents. Contractors are not allowed to bid both alternates, and must submit a bid that includes the price for either the concrete pavement alternative or the hot mix asphalt alternative.

The Contractor must submit its bid through MDOT's Construction Contract Bid Letting Process. MDOT will receive Contractor's bids and MDOT will utilize the following procedures to determine the selected Contractor for this Project.

Determination of the selected Contractor will be based on the bid that has the lowest life cycle cost according to the formulas below. The Contractor's bid must be submitted electronically. The life cycle cost will be determined by the Equivalent Uniform Annual Cost (EUAC) for each pavement type (see below). MDOT will manually enter each Contractor's bid into the equations to determine the Contractor with the lowest life cycle cost. The Contractor with the lowest life cycle cost will be the selected Contractor for this Project.

b. Definition of Terms. For the purpose of this Special Provision, the following definitions apply.

1. Designated Traffic Lane. Any traffic lane in use by traffic prior to the beginning of the project. Designated traffic lanes include lanes closed to traffic by any staging or Maintaining Traffic Special Provisions contained within this contract.

2. Lane Closure. For the purpose of determining user delay cost, lane closure will mean denying traffic to any designated traffic lane or any portion thereof for mainline, and ramp(s) listed in this Special Provision. A lane closure will be required when the Contractor's operations have resulted in a traffic lane width less than 11 feet, or as shown on the plans, or a reduction in the minimum vertical clearance allowed for a traffic lane.

3. Daily User Delay. The amount, as shown in Table 1, under Daily Assessments, which represents the average daily cost for each designated traffic lane closure. Any portion of a day that a designated traffic lane closure exists will be considered as a full day for assessing user delay.

4. Total Contract Amount. The total contract amount paid to the Contractor based on the contract unit prices for items of work included in Sections 1 or 2, any adjustments as provided for in the contract documents, any assessment of disincentive or liquidated damages as provided for in the contract documents.

c. Proposal Submission, Award and Execution of the Contract. The Contractor must submit a bid for items in either Section 1 (HMA) or Section 2 (Concrete) as applicable to the

contract. The Contractor will determine the number of calendar days they need to use any lane closures to build the project, both mainline and ramps. This will be used to determine User Delay Cost. The daily assessment values for the US-31 and ramp closures are given in the table below. The closures are valued per calendar day.

Table 1 - Lane Closure Daily Assessment for User Delay Cost

Lane Closures	Daily Assessment
US-31 Single Lane	$6441.49
Ramp B (NB Off-Ramp)	$6843.41
Ramp C (SB On-Ramp)	$4486.52
Ramp F (SB On-Ramp)	$2885.95
Ramp E (NB On-Ramp)	$527.96

Details of the assessment procedures specific to the user delay costs for mainline and ramp lane closures are provided in section (d) of this Special Provision.

1. Preparation of Proposal. In addition to the requirements of subsection 102.05 of the Standard Specifications for Construction, the following shall apply to this contract. User Delay Cost, Mainline and User Delay Cost, Ramp B - F **must** be bid. **A negative amount will not be permitted for these items.** If the Contractor leaves this item blank, the Department will consider the proposal to be irregular as specified by subsection 102.06 of the Standard Specifications for Construction.

The amount bid for these items must be based on the bidder's estimate of the number of lane closures on designated traffic lanes and the daily assessment values as described in this Special Provision.

User Delay Cost, Mainline = No. days of US-31 Single Lane Closure x $6441.49 per day
User Delay Cost, Ramp __ = No. days of Ramp __ Closures x Ramp __ $ per day

The amount bid for these items will affect the determination of the lowest bidder. Partial days are not to be used in this calculation; only full days are allowed. The Contractor should not include the anticipated user delay costs in other items of the contract, as unbalancing may occur and the bid may be rejected.

2. Consideration of Proposals. In addition to the requirements of subsection 102.13 of the Standard Specifications for Construction, the following will apply to this contract. The Contractor is instructed to bid the Contract as follows:

For the HMA Bidder:
Section 1 = Contract Work Items
Section 3 = User Delay Cost

For the Concrete Bidder:
Section 2 = Contract Work Items
Section 3 = User Delay Cost

Determination of the EUAC will be done by MDOT based on the bids submitted for either

Section 1 or Section 2; and Section 3. The EUAC will be used to determine the lowest bidder and subsequent award of the project. EUAC will be calculated by MDOT as shown below:

$$\text{Equivalent Uniform Annual Cost (EUAC)} = \sum \text{Net Present Value (NPV)} \times \frac{i \times (1+i)^n}{(1+i)^n - 1}$$

where: $i = 2.8\%$
$n = 26$ years

Therefore: $EUAC = \sum NPV \times 0.054658622075$

∑ NPV = (Contract Work Items + User Delay Cost + Future Maintenance Cost)

Where :

Contract Work Items = Cost of all items in the advertised proposal, either Section 1 or Section 2 for HMA or Concrete respectively

User Delay Cost = The summation of all items in Section 3 which the Contractor calculated based on the No. of days of closure and the daily assessment values in Table 1

Future Maintenance Cost = $56,971.64 per lane mile for HMA *
$38,353.40 per lane mile for Concrete *

*Based on values from MDOT's Pavement Design and Selection Manual

Multiply Future Maintenance Cost by the No. of total lane miles to bring into common units.

No. of total lane miles = 3.270 miles x 4 lanes = 13.080 miles

Future Maintenance Cost = $56,971.64 x 13.080 = $745,189.05 for HMA
= $38,353.40 x 13.080 = $501,662.47 for Concrete

Therefore: EUAC Calculates to be:

EUAC HMA = (Contract Work Items + User Delay Cost + $745,189.05) x 0.054658622075

EUAC Conc = (Contract Work Items + User Delay Cost + $501,662.47) x 0.054658622075

The lowest calculated EUAC, as verified by the Department, will be the apparent low bid and will be reviewed according to subsection 102.10 of the Standard Specifications for Construction.

It will not be necessary for the proposal guaranty to include the amounts bid for the items of User Delay Cost. The bid amounts for the items of User Delay will not be used in the calculation of the Contractor's prequalification limit; the net classification for this contract; the

subcontracting limitation for this contract or the original total contract amount that is used to determine payment for Mobilization according to subsection 150.02 of the Standard Specifications for Construction.

Any other reference in the plans and specifications to the total contract amount will be considered to be modified by this Special Provision and will not include the bid amounts for the items of User Delay.

d. Measurement and Payment. User Delay Cost, Mainline and User Delay Cost, Ramp B - F will be calculated in dollars, and will be the total count of days that designated traffic lanes have lane closures within the project limits multiplied by the daily assessment values for each ramp and for US-31 as show in Table 1 of this special provision.

Contract Item (Bid Item)	**Bid Unit**
User Delay Cost, Mainline	Lump Sum
User Delay Cost, Ramp B	Lump Sum
User Delay Cost, Ramp C	Lump Sum
User Delay Cost, Ramp E	Lump Sum
User Delay Cost, Ramp F	Lump Sum

1. Assessments. The Engineer will utilize the bid for each user delay cost item as well as the daily assessment values in Table 1 to determine the number of days for lane closures for US-31 and each ramp respectively. The Engineer will keep records of the days assessed for lane closures on US-31 and each ramp respectively. The Contractor and the Engineer will compare records of the days assessed for lane closure and bring these records into agreement at least once a week. If the Contractor maintains a lane closure longer than the number of days calculated from the bid user delay cost for the respective facility (main line or ramp), the Engineer will assess a penalty, based on the daily assessment values in Table 1 for the respective lanes closures, for each day over the original bid number of days for lane closure. Delay experienced that qualifies for an extension of time per Section 108.09 will not count toward the user delay assessment.

2. Adjustments to Work That Affect Lane Closure. When the Engineer makes adjustments to work quantities or changes to the work as defined in Division 1 of the Standard Specifications for Construction, consideration will be given to modifying the lane closure time frames from the user delay amounts to coordinate with the changes made by the Engineer.

3. If the Contractor proposes changes in the stage construction plans or the maintaining traffic requirement, and these changes are approved by the Engineer, the cost of these changes will be the Contractor's responsibility. No adjustment will be made to the bid user delay cost items nor the number of lane closure days calculated from the original bid.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SUPERPAVE HOT MIX ASPHALT PERCENT WITHIN LIMITS (PWL) ON US-31

a. Description. This special provision sets forth the quality control and quality assurance procedures that will be followed for acceptance of and payment for Superpave Hot Mix Asphalt (HMA). Except as explicitly modified by this special provision, all materials and HMA mixture requirements of the MDOT Standard Specifications for Construction and the contract documents apply.

1. Terminology.

Quality Control (QC). All activities dealing with process control to ensure quality, including but not limited to training, materials sampling, testing, project oversight and documentation. The Contractor's HMA Quality Control Procedures are contained in the HMA-QC Plan.

Quality Assurance (QA). All activities dealing with acceptance of the product, including but not limited to materials sampling, testing, construction inspection, and review of Contractor quality control documentation. The Engineer's HMA Quality Assurance Procedures are contained in various MDOT procedures manuals and in the HMA-QA Plan.

HMA Design. The selection and proportioning of aggregate(s), mineral filler (if required), reclaimed asphalt pavement (RAP), and asphalt binder to meet mixture design criteria.

Job Mix Formula (JMF). An HMA Design for a specific project. This may include adjustments to the mix design to optimize the field application.

Target Value. A JMF parameter value which may be adjusted, if approved by the Engineer, to account for changes in the physical properties of the mixture.

Binder Content. The percent by weight of asphalt cement in the total mixture.

Voids in Mineral Aggregate (VMA). The volume of void space between the aggregate particles of a compacted paving mixture that includes the air voids and the asphalt binder not absorbed into the aggregate, expressed as a percent of the total volume of mixture.

Effective Specific Gravity (Gse). The ratio of the oven dry weight in air of a unit volume of an aggregate (excluding voids permeable to asphalt) at a stated temperature to the weight of an equal volume of water at a stated temperature.

Bulk Specific Gravity of Aggregate (Gsb). The ratio of the oven dry weight in air of a unit volume of an aggregate at a stated temperature to the weight of an equal volume of water at a stated temperature.

Maximum Specific Gravity of Mixture (Gmm). The ratio of the weight in air of a unit volume of an un-compacted HMA at a stated temperature to the weight of an equal volume of water at a stated temperature.

Rounding of Numbers and Significant Figures. Rounding of numerical data will follow the Rounding Method as described in the *HMA Production Manual* and the associated MTMs.

Percent Within Limits (PWL). The percentage of material within the specification limits or tolerance for a given quality index parameter.

QC Action Limits (Table 4 Col. II). A range of values established by the Contractor in the HMA-QC Plan or specified in Table 4 that, if exceeded on two consecutive QC tests, requires that the Contractor take corrective action to bring the mixture produced into conformance with the specifications.

QC Suspension Limits (Table 4 Col. III). A range of values established by the Contractor in the HMA-QC Plan or specified in Table 4 that, if exceeded on a single QC test, requires that the Contractor suspend operations and determine, document and correct the cause before continuing production.

QA Suspension Limits (Table 4 Col. IV). A range of values defined in Table 4 that, if exceeded on two consecutive QA tests may result in the Engineer issuing a Notice of Non-Compliance with Contract Requirements (Form 1165).

QA Sublot Rejectable Quality Limits (RQL) (Table 4 Col. V). A range of values defined in Table 4 that, if exceeded on a single QA test may result in the Engineer issuing a Notice of Non-Compliance with Contract Requirements (Form 1165).

QA Lot Acceptable Quality Limits (AQL) (Table 4 Col. VI. PWL value for an individual quality index parameter that will still result in a Pay Factor (PF) of 100.00 for that quality index parameter. Acceptable Quality Limits are specified in Table 4.

QA Lot Rejectable Quality Limits (RQL) (Table 4 Col. VII). PWL value for an individual quality index parameter that will result in either PF = 50.00; remove and replace or corrective action plan. Rejectable Quality Limits are specified in Table 4.

Outlier. Test result that appears to deviate markedly from test results for other samples from the same lot. An apparent outlier will be evaluated by the Engineer to determine if the results will be retained in the associated PF calculation.

Quality Characteristic (Table 4 Col. I). The material and mixture characteristics of HMA that are deemed to have direct bearing on the quality and performance of the HMA pavement and for which specification limits have been established.

Quality Index Parameter. The HMA quality characteristics that are evaluated under the Department's Quality Assurance Acceptance Program and on which payment for HMA material is based. The Quality Index Parameters for this project are VMA, Air Voids, Binder Content, and In-Place Density.

Lot. A lot is made up of a discrete tonnage of one mixture. Each lot is typically made up of five sublots.

Sublot. A portion of a lot represented by a complete set of quality assurance tests. Sublots will be approximately equal size of 1000 tons. The Contractor and the Engineer may agree to reduce the typical 1000 ton sublots based on project staging or other project conditions.

Small Tonnage. If the total tonnage of a specific mixture does not exceed 5000 tons, the mixture wll be tested according to the Small Tonnage Acceptance Criteria in subsection (f.9) of this special provision.

Small Tonnage Testing. If the total tonnage of a specific mixture does not exceed 5000 tons, the mixture will be considered a single small tonnage production lot - consisting of a minimum of three and maximum of seven equal small tonnage production sublots (maximum of 1000 ton sublots) and will be tested and approved in accordance with the Small Tonnage Acceptance Criteria in subsection (f.9) of this special provision. The Initial Production Lot requirements of Section (e) of this special provision will not apply to small tonnage mixtures. For quantities of 500 tons or less, Visual Inspection (Materials Quality Assurance Procedures Manual Section A.9) may be used in lieu of Small Tonnage Testing.

Alternate PWL Acceptance. For the following construction processes:

- Hand Patching
- Joint Repair
- Driveways
- Scratch Course
- Widening/Tapers/Gores of less than 3 feet

Alternate PWL Acceptance consisting of a minimum of three approximately equal sublots (maximum of 1000 ton sublots) will be tested and approved in accordance with the Small Tonnage Acceptance Criteria in subsection (f.9) of this special provision.

Density Acceptance will be in accordance with subsection (f.5) Alternate Acceptance In-Place Density Method.

Sampling will be in accordance with MTM 313.

The Initial Production Lot requirements of Section (e) of this special provision will not apply to Alternative Acceptance Procedure.

Scratch Course density is not measured.

Initial HMA Production. A process used in which HMA Production for specific HMA mixtures and HMA plants are limited to 800 to 1000 tons per day for a maximum of 3 (consecutive or separate) days and 750 tons for the fourth and subsequent days until it is determined that HMA Production has met the requirements in Section (e) prior to moving into Unlimited Daily HMA Production.

Unlimited Daily HMA Production. Unrestricted daily HMA production tonnage.

2. Partnering Sessions. The Engineer will schedule a pre-production meeting. The pre-production meeting will be held a minimum of 7 calendar days prior to the start of production. The Engineer will provide written notification to all parties a minimum of 14 calendar days prior to the meeting.

At the pre-production meeting the HMA-QC Plan will be discussed, the HMA-QA Plan will be reviewed, and the roles and responsibilities of all parties involved in the work covered by this special provision will be discussed. A discussion of the elected binder content procedure will occur at the pre-production meeting. The Contractor will notify the Engineer in writing at the pre-production meeting which method, binder content back calculated or vacuum extraction, they elect to use for Binder Content acceptance per mix design. For each mix, the method chosen will be used exclusively throughout the project for QA acceptance, including Dispute Resolution.

Department personnel attending the meetings will include the following:

- MDOT Project or Resident Engineer
- Field inspector for the project
- All Traveling Mix Inspectors [TMI(s)] with responsibility for this project
- Any consultant involved in any part of the HMA sampling or testing on this project

Contractor personnel attending the partnering meetings will include the following:

- Project Superintendent
- HMA-QC Plan Administrator
- Any subcontractor involved in any part of the HMA quality control sampling or testing on this project

b. Contractor Quality Control. Be responsible for the quality of the HMA produced and placed on this project and perform quality control sampling and testing, provide inspection, and exercise management control to ensure that work conforms to the contract requirements. Perform all testing in accordance with the accepted HMA-QC Plan. Provide the Engineer the opportunity to observe sampling and testing. Sample, test, and evaluate all HMA mixtures in accordance with the requirements of this special provision.

Establish and follow an HMA-QC Plan for HMA production and placement as required by Section 503 of the Standard Specifications for Construction. Utilize personnel and testing equipment capable of providing a product that conforms to contract requirements. Do not start work on the subject items without an accepted HMA-QC Plan.

Perform quality control sampling, testing, and inspection during all phases of the work at the minimum guidelines specified for that item or at an increased frequency sufficient to ensure that

the work conforms to the contract requirements. Continual production of non conforming material at a reduced price in lieu of making adjustments to bring material into conformance will not be allowed.

The Engineer will not sample or test for quality control or assist in controlling the HMA production and placement operations. The results of department QA testing may not be available for use in quality control activities and should not be included in the HMA-QC Plan discussion.

1. HMA-Quality Control Plan. Develop and follow an HMA-QC Plan that addresses personnel; sampling and testing equipment and calibration records; supplies and facilities for obtaining samples, performing tests, and documenting results; and other activities to control the quality of the product to meet contract requirements. Include methodology for addressing material that appears to be inconsistent with similar material being sampled. Perform all QC sampling and testing according to the *HMA Production Manual* unless specifically documented in the HMA-QC Plan and discussed at the pre-production meeting.

A. Plan Submittal. Submit the HMA-QC Plan to the Engineer for review and acceptance a minimum of 14 calendar days prior to the pre-production meeting.

B. Plan Acceptance. Revisions to the HMA-QC Plan may be required by the Engineer prior to its acceptance. The Engineer will request plan revisions in writing on or before the day of the pre-production meeting. If revisions are required by the Engineer, these revisions must be made and the HMA-QC Plan accepted before HMA production or placement commences.

Acceptance of the HMA-QC Plan does not imply any warranty by the Engineer that the HMA-QC Plan will result in production of HMA that complies with all contract requirements. It remains the responsibility of the Contractor to demonstrate such compliance.

C. Plan Modification. The HMA-QC Plan may be refined or modified as work progresses. Such refinements or modifications are subject to review and acceptance by the Engineer.

2. HMA-Quality Control Plan Contents. Include the following specific items in the HMA-QC Plan.

A. Quality Control Organization. Include an organization chart showing key personnel involved in production, placement, compaction, and quality control for this project. Provide the names of the HMA-QC Plan Administrator and Quality Control Technician(s) [QCT(s)]. Clearly identify all subcontractor personnel involved in HMA quality control.

Maintain consistency in the Quality Control Organization throughout the life of the project to the extent practicable. Substitution of qualified personnel is allowed provided that the names are forwarded to the Engineer prior to the substitution.

B. Quality Control Personnel Qualifications and Responsibilities. Provide the qualifications of each individual or position listed on the organization chart and a brief

narrative of their area of responsibilities. Describe the coordination of the activities of the Plan Administrator and the QCT(s).

(1) Plan Administrator. This individual will be responsible for administering the HMA-QC Plan and will institute any actions necessary to successfully implement the HMA-QC Plan.

(2) Quality Control Technicians (Plant). All equipment calibration; quality control sampling and testing; and quality control documentation must be performed by qualified technicians. Document the certification of all QCT(s) through the Michigan Bituminous QC/QA Technician Certification Program or other approved program.

(3) Placement Personnel. Identify the personnel that will be responsible for inspecting all transport, lay down and compaction equipment to ensure it is operating properly and for verifying that all lay down and compaction conforms to the contract requirements.

C. Mix Design. Provide the approval status and a copy of the mix design for all HMA mixtures to be produced for this contract and the plant location for production of each mixture.

D. Quality Control Sampling and Testing. Complete and include the schedule of QC testing for the quality characteristics shown in Table 1. For each quality characteristic listed, define test method; minimum sampling and testing frequency; when the sampling and testing will be performed in relationship to production; and sampling location. Describe the random sampling method used.

Minimum QC sampling locations must be determined independently from QA sampling locations. In addition to the minimum QC sampling required by Table 1, additional non-random QC testing may be included in the HMA-QC Plan, except as otherwise specified.

E. Quality Control Laboratory Facilities. Provide the location of the testing facilities and include a copy of the plant certification. All laboratories that prepare mix designs or perform quality control testing of HMA materials must demonstrate that they are equipped, staffed, and managed so as to be capable of mixing and testing HMA in accordance with the applicable test methods.

F. Corrective Action. Tables 2 and 4 specify the action limits and/or list the quality characteristics for which action limits must be defined in the HMA-QC Plan. Complete and include Tables 2 and 4 with the QC Action Limits defined as indicated. Describe the procedures that will be followed to ensure that test results are properly reviewed and that corrective action, based on the test results, is taken and documented when necessary to control HMA quality.

G. Suspension of Production. Table 4 specifies the QC Suspension Limits. Discuss the steps to be taken when any suspension criteria is met. Steps must include notifying the Engineer and making all necessary corrections whenever production is suspended. Include discussion of the following suspension criteria, as a minimum.

(1) QC Suspension limits specified in Table 4 Col. III for any of the quality

characteristics are exceeded.

(2) The PWL for VMA, Air Voids, Binder Content, or In-Place Density is below 50 for any lot.

(3) The HMA-QC Plan is not followed.

(4) Visible pavement distress occurs such as segregation or flushing.

(5) Additional QC suspension criteria may be included.

H. Control Charts. Discuss the use of control charts for all quality characteristics listed in Table 1. Include examples of the control charts to be used. As a minimum, the control charts must identify the project number, the contract item (pay item) code, the test number, test parameter, the specification limits, the action limits, suspension limits, and the test results. Keep the control charts current and available in an accessible location at the laboratory facility.

I. Plant Reports. At the request of the Engineer, the Contractor will provide copies of plant certification and electronic daily cumulative project tonnage report.

c. Quality Control Sampling and Testing During Production.

1. Fifteen cores approximately 6 inches in diameter will be allowed per lot of material for quality control of In-Place Density.

2. At the time any QA or QC cores are taken, remove free standing water from the core hole; fill with hot mixture, and compact. Obtain and document approval for the method of filling holes and for obtaining compaction at the pre-production meeting.

3. At the time any QA or QC sample is collected from behind the paver, provide and place loose mixture according to MTM 324 or as directed by the Engineer.

4. In addition to maintaining test reports and control charts, enter all QC data into the PWL Program that can be downloaded from the Construction and Technology web site, provide the results to the Engineer as they become available.

5. Sample and test the plant produced material in accordance with the approved HMA--QC Plan.

d. HMA-Quality Assurance Plan. The Engineer will develop and follow an HMA-QA Plan. The Engineer will submit the HMA-QA Plan to the HMA-QC Plan Administrator a minimum of 7 calendar days prior to the pre-production meeting. The HMA-QA Plan will be reviewed at the pre-production meeting and any proposed changes will be documented.

All QA sampling and testing will be performed according to the *HMA Production Manual* unless specifically documented in the HMA-QA Plan and discussed at the pre-production meeting. The Engineer will provide the Contractor the opportunity to observe QA sampling and testing. The following specific items will be included in the HMA-QA Plan.

1. Quality Assurance Organization**.** Key personnel involved in sampling, testing, construction inspection, review of quality control, and quality assurance management will be identified. The names of the Engineer, support staff, and Quality Assurance Technician(s) [QAT(s)] involved in HMA quality assurance for this project will be included along with phone numbers, fax numbers, and e-mail addresses. The Engineer will notify the HMA-QC Plan Administrator of any deletions or additions to the HMA quality assurance team.

2. Quality Assurance Personnel Qualifications and Responsibilities. The HMA-QA Plan will include a brief narrative of the area of responsibilities of each HMA quality assurance team member and will describe the coordination of the activities of the Engineer, support staff and the QAT(s).

A. HMA-Quality Assurance Plan Administrator. The Engineer will be responsible for administering the HMA-QA Plan and will institute any actions necessary to successfully implement the HMA-QA Plan.

B. Quality Assurance Technicians. All equipment calibration and maintenance; quality assurance sampling and testing; and quality assurance documentation will be performed by qualified technicians. All QAT(s) will be certified through the Michigan Bituminous QC/QA Technician Certification Program or other approved program. Certifications required for QAT(s) will be included in the project files.

C. Construction Personnel. The personnel responsible for field inspection and for obtaining QA samples will be identified. Certifications/qualifications required for individuals collecting QA samples will be included in the project files.

D. Laboratory Facilities. The testing facilities with responsibility for QA testing on this project will be identified. All laboratories that perform quality assurance testing of HMA materials must demonstrate that they are equipped, staffed, and managed so as to be capable of testing HMA in accordance with the applicable test methods.

e. Initial Production Lot Procedure. The purpose of the Initial Production Lot is:

- To verify that the produced mixture is within specification limits.
- To verify test results, procedures, and equipment used are capable of generating QC test results that agree with QA results to within allowable tolerances.
- To establish roller patterns that will achieve the desired compaction results.

Prior to proceeding with unlimited daily HMA production; successfully produce, place, and test a minimum of one Initial Production Lot constructed, per plant, with each of the specific HMA mixture types to be used on this project. The Initial Production Lots will be placed in a similar manner as full production on the jobsite.

The In-Place Density QC Suspension Limits (Table 4 Col. III) do not apply to initial production lots.

1. JMF Adjustment Requests. JMF adjustments may be requested prior to the Initial Production Lot run based on test data submitted from previous use of the approved mix designs. The previous usage may be on commercial, local agency, or state construction

projects. JMF adjustments may also be requested based on the Initial Production Lot(s) results.

2. Initial Production Lot. An Initial Production Lot will consist of one day of HMA Production ranging from 800 tons to 1000 tons. Each Initial Production Lot will be evaluated as a single lot. The Contractor will be allowed to construct three Initial Production Lots for a given mixture. The mixture will be subject to pay adjustments and/or removal based on test results for a complete Initial Production Lot.

3. Initial Production Lot Sampling and Testing. Each Initial Production Lot will consist of four approximately equal sublots.

A. The Engineer will:

(1) Collect one 45,000 gram Initial Production Lot split sample per sublot, and provide the Contractor with splits of all sublot samples, for testing of all quality characteristics listed in Table 1. These split sample test results will be evaluated using the current lab correlation procedure found in the *HMA Production Manual*. The Department's split portion will be used as the QA acceptance test.

(2) Collect one independent 20,000 gram sample per sublot using the same random number as the 45,000 gram sample for possible dispute resolution of the Initial Production Lot results.

(3) Locate and mark four random core locations per sublot, take possession of the cores when extracted by the Contractor and test the In-Place Density.

(4) Complete all tests and report all results to the Contractor within 48 hours of the time of sampling.

B. The Contractor must:

(1) Conduct tests on the Initial Production Lot split sample collected by the Engineer for all QC quality characteristics listed in Table 1.

(2) Complete all tests and report all results to the Engineer within 48 hours of the time of sampling.

(3) Continue with production only when all of the conditions in subsections (e.3.C) and (e.3.D) of this special provision are met.

(4) Construct additional Initial Production Lots as required in subsection (e.3D).

C. The current lab Correlation Procedure in the *HMA Production Manual* will be used to evaluate the Contractor's and the Engineer's test results for Initial Production Lot split samples which must correlate.

If the Initial Production Lot split sublot sample test results do not correlate, the Contractor and the Engineer will jointly review the results, check equipment and review the test procedures for all testing laboratories to determine if there is an identifiable

cause for the discrepancy; recalibrate equipment; and arrange for independent assurance sampling and testing reviews for the QAT(s) and QCT(s), if necessary, before continuing with production or conducting tests on a subsequent Initial Production Lot. If the vacuum extraction process is used to determine the binder content, the Engineer and Contractor will communicate the number of washes used.

If mutually agreed upon by the Engineer and Contractor, split sampling frequency during the Initial Production Lots can be modified or waived.

D. The Contractor will be allowed to construct up to three Initial Production Lots for a given mixture on three separate days. After the third Initial Production Lot is constructed, paving will be suspended unless the requirements for moving into Unlimited Daily Production have been achieved as outlined below.

Prior to proceeding with full HMA production, the PWL value for each measured QA property (In-Place Density, Air Voids, Binder Content & VMA) for an Initial Production Lot must be equal to or greater than 80.

If the first Initial Production Lot does not achieve a PWL value equal to or greater than 80 for each measured QA property, the acceptance and payment for the tonnage of material for the first Initial Production Lot will be adjusted as described in Sections (k) and (l) of this special provision.

If the second Initial Production Lot for the mixture does not achieve a PWL value equal to or greater than 80 for each measured QA property, the acceptance and payment for the tonnage of material for the second Initial Production Lot will be adjusted as described in Sections (k) and (l) of this special provision.

If the third Initial Production Lot does not achieve a PWL value equal to or greater than 80 for each measured QA property, the acceptance and payment for tonnage of material for the third Initial Production Lot will be adjusted as described in Sections (k) and (l) of this special provision.

The Contractor will produce a fourth Initial Production Lot that will be approximately 750 tons and will consist of four approximately equal sublots. If the fourth or any subsequent Initial Production Lot does not achieve a PWL value equal to or greater than 80 for each measured QA property then it will be removed and another Initial Production Lot will be attempted.

All costs associated with this removal and replacement will be borne by the Contractor.

MDOT will complete all Initial Production Lot tests and report all results to the Contractor within 48 hours of the time of sampling.

E. The Initial Production Lots can be waived and the Contractor allowed to go to Unlimited Daily Production if all of the following criteria are met:

(1) The mix design must have passed Initial Production Lot requirements on another project from the current or prior season. If a waiver was used on the prior season then the Initial Production Lot will not be waived for the current season.

(2) On the previous project, an overall PWL value of 85 for each QA value must have been achieved for the last two full (or last full production lot if there were fewer than 2 full production lots) lots of production.

(3) The mix must be produced from the same plant and location that was used on the previous project.

f. Quality Assurance Sampling and Testing. Acceptance of HMA is the responsibility of the Engineer and will be accomplished by conducting QA sampling and testing, monitoring the Contractor's adherence to the HMA-QC Plan, and inspection of field placed material (see Section 104 Standard Specifications for Construction). The Engineer will notify the Contractor prior to conducting QA sampling. This notification shall be done in a manner that allows the contractor to witness the sampling but does not provide for the opportunity for the contractor to alter their production in anticipation of a sample being taken.

1. Random Sampling. Except as modified herein, QA sample locations will be determined as outlined in Section A-12 of the *Materials Quality Assurance Procedures Manual*.

A. Prior to the pre-production meeting, the Engineer will generate three columns of random numbers using a computer spreadsheet program or a calculator. The random numbers will be used for the longitudinal and the transverse measurement for determining the core location.

For HMA mixture sample location, use the random number from the third column, then multiply it by sublot tonnage. An excess amount of random numbers will be generated to take into account overruns or any situation where another random number is required.

B. At the pre-production meeting, each page that lists random numbers, with the numbers covered by a separate sheet of paper, will be presented to be signed by the HMA-QC Plan Administrator and the Engineer.

C. The original signed list will be placed in the project file and a copy will be provided to the field inspector for the project.

D. When the project is completed, a copy of the list of random numbers will be provided to the Contractor upon request.

2. Production Lot size. The Engineer will test HMA material for Air Voids, VMA, Binder Content, and In-Place Density on a lot-by-lot basis. Each lot will be divided into sublots of approximately equal size and not be greater than 1000 tons.

If only one or two sublots remain at the end of production of a mixture, the test results for these sublots will be combined with the previous lot for evaluation of PWL and PF.

3. Plant Produced Material (Mixture) Quality Assurance Sampling**.** Location of QA sample sites within each sublot will be by a random process managed by the Engineer. Immediately after the Engineer acquires the samples, fill the voids with HMA in accordance

with MTM 324.

The Engineer will sample the mixture in accordance with MTM 324, collecting two separate 20,000 gram samples at each sample site. These are the QA and dispute resolution samples. The Engineer will assign an identifier to each sample consisting of contract ID, mixture, lot and sublot and deliver the samples to the testing facility identified in the HMA-QA Plan where one will be tested and the other retained for possible appeal testing.

Sampling for wedging operations will be in accordance with MTM 313.

4. Plant Produced Material (Mixture) Quality Assurance Testing. Plant produced material acceptance testing will be completed by the Engineer within four calendar days after the Engineer has taken the samples from the project site. The Engineer will conduct the following tests.

A. Maximum Specific Gravity, Gmm (MTM 314)

B. Bulk Compacted Density, Gmb @ Ndes (AASHTO TP 4-97)

C. Air Voids, Nini*, Ndes, Nmax*, (AASHTO PP28-97) (* for information only)

D. Voids in Mineral Aggregate, VMA (AASHTO PP28-97)

E. Voids Filled with Asphalt, VFA* (AASHTO PP28-97) (* for information only)

F. Ratio of Fines to Effective Asphalt Binder, P#200/Pbe

G. Composition of the Mixture –

Method 1 – Asphalt binder content based on calculated value using sublot maximum specific gravity (Gmm) and current JMF effective specific gravity (Gse); Gradation (ASTM C 136, C117) and Crushed particle content (MTM 117) from extracted (AASHTO T 164) or incinerated (MTM 319) aggregate.

Method 2 – Asphalt binder content based on vacuum extraction by MTM 325 and the "Checklist for HMA Mixture Analysis Vacuum Extraction", of the *HMA Production Manual*. Gradation (ASTM C 136, C117) and Crushed particle content (MTM 117) based on extracted (AASHTO T 164) aggregate.

Method 1 or 2 will be selected by the contractor for each mix at the pre-production meeting. The method selected cannot be changed during mix production without submitting a new mix design to the MDOT C&T Central Laboratory for verification.

5. In-Place Density Quality Assurance Sampling. The Engineer will locate and mark all QA core locations. All QA coring operations will be completed by the Contractor including dispute resolution and sublot retest coring. The Engineer will test all QA cores. If, for any reason, a core is damaged or determined not to be representative at the time of coring, the Engineer will evaluate and document the problem and determine if re-coring is necessary.

Core sample locations will be marked after final rolling. Core sample locations will be marked at the completion of a sublot, prior to traffic staging changes, or at another time that is independent of paving operations. The Engineer will identify four core sample locations for each sublot based on longitudinal and transverse measurements. The Contractor will provide and pay for traffic control as required in the special provision for maintaining traffic for all coring procedures including dispute resolution and sublot retest coring.

The Engineer will mark each core location with a 2 inch diameter paint dot, which represents the center of the core. When sampling behind the paver, cores will not be taken from 5 feet before the sampling area through 5 feet after the sampling area. If the random core location falls within these areas, new longitudinal and transverse random numbers will be selected and the core sample site moved to the new location. If the center of the core is less than 5 inches from either edge of pavement, another transverse random number will be selected and the core sample site moved to the new location.

Notify the Engineer in advance of coring to ensure that MDOT has a representative to witness the coring operation and take immediate possession of the cores. Drill a core sample approximately 6 inches in diameter at each core location. Do not damage cores during removal from the roadway. Measure cores at the time they are extracted from pavement.

Any core disqualified based on the minimum thickness criteria will be discarded and a new core location will be selected by the Engineer. If more than 50 percent of the cores in a lot are disqualified, production shall stop. Production will not be allowed to continue until the Engineer has confirmed that the paving operation is meeting the contract application rate. All previous pavement, base aggregate or bond coat material will be sawed off the bottom of the core samples by the Engineer.

The minimum core thickness for each mixture type is:

Hot Mix Asphalt Mixture No.	**Minimum Core Thickness**
2	3 inch
3	2 1/4 inch
4	1 1/2 inch
5	1 1/8 inch
LVSP	1 1/4 inch

A. Alternate Acceptance In-Place Density Method

Density acceptance for Hand Patching, Joint Repairs, Driveways, Scratch Course, and Widening/Tapers/Gores of less than 3 feet will be as follows. Density acceptance for these processes will be by density gauge. The Contractor will establish the compaction effort for each pavement layer to achieve the required in place density values. After the final rolling, the Engineer will use a density gauge using the Gmm from the job mix formula (JMF) for acceptance. A minimum of six random locations per sublot will be tested for density. If the average of the density values is equal to or greater than 92.00 percent of the Gmm, the pavement density will be accepted. If the average of the sublot

density tests are less than 92.00 percent of the Gmm, the Contractor will take corrective action to achieve a minimum average of 92.00 of the Gmm.

Sampling will be in accordance with MTM 313.

6. In-Place Density Quality Assurance Testing. Pavement In-Place Density acceptance testing will be completed by the Engineer within 4 calendar days after the Engineer has taken possession of the cores at the project site. Testing will be in accordance with MTM 315. The Engineer's test results on the compacted HMA will be used as a basis of acceptance and payment.

At the completion of lot testing all individual tests for In-Place Density will be checked for apparent outliers in accordance with ASTM E 178 Standard Practice for Dealing with Outlier Observations at a significance level of 5 percent (following the example in subsection 6.2 of that standard). If a test result is determined to be an apparent outlier the doubtful value will be investigated.

This investigation will include, but may not be limited to, visual and physical examination of the core (i.e. short core, core damaged during transport or during laboratory handling); and a careful review of the sampling and testing procedure including data entry and calculations (i.e. was raw data transposed or incorrectly entered into test calculations). If no documentable reason is found for the apparent outlier, the value will remain as part of the In-Place Density PF calculations. If a documentable reason is found for the apparent outlier, the value will be discarded and the remaining test results will be used to calculate the In-Place Density PF.

7. Quality Assurance Stop Production Criteria. The Engineer will issue a Notice of Non-Compliance with Contract Requirements (Form 1165) and HMA production must stop when any one or more of the following criteria are met or exceeded:

A. One or more of the QA Suspension Quality Limits in Table 4 Col. IV is exceeded for consecutive QA tests.

B. One or more of the QA Sublot Rejectable Quality Limits in Table 4 Col. V is exceeded for a single QA test.

C. The PWL for VMA, Air Voids, Binder Content or In-Place Density is below 50 when calculated according to Section (k) of this special provision.

D. The HMA-QC Plan is not followed.

E. Visible pavement distress occurs such as segregation or flushing.

Resume production only after making all necessary adjustments to bring the mixture into conformance with all applicable specifications; documenting these adjustments as discussed in the HMA-QC Plan; and receiving a Notice to Resume Work (Form 1165) from the Engineer.

8. Sublot Removal and Replacement Criteria. Exceeding one or more of the QA Sublot Rejectable Quality Limits in Table 4 Col. V may result in removal and replacement of the

associated sublot of material.

9. Small Tonnage Acceptance Criteria. If the total tonnage of a specific mixture does not exceed 5000 tons, the total quantity of that mixture will be considered as a lot and will be divided into a minimum of 3 approximately equal sublots (maximum of 1000 ton sublots) up to a maximum of 7 sublots for testing and acceptance. The sublot size shall be approved by the Engineer prior to production of small tonnage mixtures.

Sampling will be in accordance with the provisions stated herein or MTM 313 where applicable.

All quality assurance sampling and testing procedures and acceptance criteria described in this special provision will apply.

g. Daily Asphalt Binder Certification Verification Samples. Obtain the asphalt binder sample, correctly label the sample container, and complete a Sample Identification (Bituminous Material) (Form 1923B). The form must be filled out correctly and completely, and signed before the sample is given to the Engineer. The daily asphalt binder sample must be taken from a sampling spigot located on the pipeline supplying asphalt binder to the plant, in a position between the asphalt binder pump and the point where the asphalt binder enters the mixture. Personnel safety is critical in selecting the position of the sampling spigot. Give the binder sample and completed Form 1923B to the Engineer.

Collect the daily asphalt binder sample in a 1 pint (16 ounce), slip top, seamless ointment tin. The tin must be at least three quarters full. Three 1 pint containers must be obtained if the binder being sampled has the "P" designation (e.g., PG 70-28P). One of these three containers must be marked with the letter "R", designating it as a referee sample. This is described in the Special Provision for Polymer Modified Performance Grade Binders included in the contract documents. All containers must be labeled in a legible format with the following information.

- MDOT control section and job number
- Binder grade
- Binder supplier certifier number
- Supplier name, city and state
- Date sampled
- Mix type

The Engineer may request to witness the sampling of the asphalt binder upon any visit to the HMA plant. The Engineer will complete the 1923B form for the witness sample. The witness sample will become the daily asphalt binder sample of record. Any other binder sample taken that same day will be discarded.

The Engineer may request a copy of the MDOT Binder Certification Documents. These copies must be presented to the Engineer when the respective daily binder samples and 1923B forms are picked up at the plant. The Engineer will review these documents and communicate any problems that may arise. The Engineer will deliver the certification documents to the MDOT C&T Central Laboratory.

h. Dispute Resolution Process for Plant Produced Material (Mixture).

1. Lot Dispute Resolution.

A. Lot Dispute Resolution Criteria. The QA results for a lot, including an initial production lot, may be eligible for Dispute Resolution only if the PF for Air Voids, Binder Content, or VMA based on the QC test results is larger than the corresponding PF for Air Voids, Binder Content, or VMA based on the QA test results. Only independent random QC test results from the corresponding sublots in the lot under Dispute Resolution will be used by the Engineer when processing the Dispute Resolution request. The QC testing and sampling used for Dispute Resolution must be conducted in the same manner as the QA testing. The PF for Air Voids, Binder Content, and VMA will be recomputed based on the Dispute Resolution sample test results.

B. Dispute Resolution Schedule.

(1) Request for Dispute Resolution testing must be submitted in writing within 2 working days of receipt of the results of the quality index analysis, including the PF for Air Voids, Binder Content, VMA and In-Place Density, for the lot.

(2) The request for Dispute Resolution must include the QC test results for the lot. A signed statement certifying that the QC test results are true and accurate must accompany the request for Dispute Resolution.

(3) The Engineer will document receipt of the request for Dispute Resolution and will deliver the Dispute Resolution samples to the MDOT C&T Central Laboratory within 1 working day of the receipt of the request.

(4) The MDOT C&T Central Laboratory will complete all Dispute Resolution testing and return test results to the Engineer within 14 calendar days upon receiving the Dispute Resolution samples.

C. Dispute Resolution Testing Process.

(1) All sublot dispute resolution samples will be tested. Binder Content will be determined using the method specified by the Contractor for the specific mix. VMA will be recalculated using the new Binder Content values from the existing specimens if they are not in dispute.

(2) All dispute resolution results will replace original QA test results.

(3) The Overall Lot Pay Factor and the lot pay adjustment for the lot under Dispute Resolution will be recalculated.

(4) If the recalculated Overall Lot Pay Factor is less than or equal to the original QA Overall Lot Pay Factor, all costs associated with completing the Dispute Resolution sample testing will be borne by the Contractor.

(5) If the recalculated Overall Lot Pay Factor is greater than the original QA Overall Lot Pay Factor, all costs associated with completing the Dispute Resolution sample testing will be borne by the Department.

2. Sublot Retest. If any one or more QA sublot RQL (Table 4 Column V) is exceeded, the Engineer will direct the corresponding sublot Dispute Resolution sample to be tested and the results will be substituted for the QA results for Air Voids, Binder Content and VMA. The PFs for Air Voids, VMA, Binder Content and Density will be recomputed. All costs associated with completing the Sublot Retest testing will be borne by the Department.

i. Dispute Resolution Process for In-Place Density

1. Lot Dispute Resolution.

A. Lot Dispute Resolution Criteria. The QA In-Place Density results for a lot, including an initial production lot, may be eligible for Dispute Resolution if the lot PF for In-Place Density based on the QC test results is larger than the corresponding PF based on the QA test results. Only independent random QC test results (minimum of two random sublot cores from each sublot) from the corresponding lot under Dispute Resolution will be used by the Engineer when processing the Dispute Resolution request. The lot PF for In-Place Density will be recomputed based on the Dispute Resolution sample test results.

B. Dispute Resolution Schedule

(1) Request for In-Place Density Dispute Resolution testing must be submitted in writing within 2 working days of receipt of the lot In-Place Density test results.

(2) The request for Dispute Resolution must include the QC test results for the lot. A signed statement certifying that the QC test results are true and accurate must accompany the request for Dispute Resolution.

(3) The Engineer will document receipt of the request for Dispute Resolution.

(4) The Engineer will check the lot In-Place Density test results for data entry and mathematical errors. If there are errors, the lot PF for In-Place Density will be recomputed on the recalculated test results.

(5) If it is determined that the test discrepancy has not been resolved, Dispute Resolution coring will be completed within 5 calendar days of the receipt of the request for Dispute Resolution. The Gmm from the original QA test results will be used to calculate the new In-Place Density values. If either Air Voids, Binder Content, or VMA are in Dispute Resolution for the same lot, the new Gmm value will be used only to calculate the new Dispute Resolution In-Place Density values. The Dispute Resolution cores will be delivered to the MDOT C&T Central Laboratory within 1 work day after completion of the re-coring procedure.

(6) The MDOT C&T Central Laboratory will complete all Dispute Resolution testing and return test results to the Engineer within 7 calendar days upon receiving the Dispute Resolution samples. If there is a Dispute Resolution in process for Air Voids, Binder Content, or VMA, MDOT C&T Central Laboratory will complete all Dispute Resolution testing and return test results within 14 calendar days upon receiving the Dispute Resolution samples.

C. Dispute Resolution Testing Process

(1) The Engineer will check the lot In-Place Density test results for data entry and mathematical errors. If there are errors, the lot PF for In-Place Density will be recomputed on the recalculated test results.

(2) If it is determined that the test discrepancy has not been resolved, the Engineer will locate and mark the Dispute Resolution core locations by adding 1.0 foot longitudinally to all of the original QA cores tested using the same transverse offset. The Engineer will take possession of the cores when cut and extracted by the Contractor and submit them to MDOT C&T Central Laboratory for testing. The Dispute Resolution density cores will be tested in accordance with MTM 315. The Gmm from the original QA test results will be used to calculate the new In-Place Density values. If Air Voids, Binder Content, or VMA are in Dispute Resolution for the same lot, the new Gmm value will be used only to calculate the new Dispute Resolution In-Place Density values.

(3) All lot Dispute Resolution core samples will be tested.

(4) All lot Dispute Resolution core results will replace original QA test results.

(5) The Overall Lot Pay Factor and the lot pay adjustment for the lot under Dispute Resolution will be recalculated.

(6) If the recalculated Overall Lot Pay Factor is less than or equal to the original QA Overall Lot Pay Factor, all costs associated with completing the Dispute Resolution sample testing will be borne by the Contractor.

(7) If the recalculated Overall Lot Pay Factor is greater than the original QA Overall Lot Pay Factor, all costs associated with completing the Dispute Resolution sample testing will be borne by the Department.

2. Sublot Retest**.** If any one or more QA Density sublot RQL (Table 4 Column V) is exceeded, the Engineer will direct the corresponding sublot Dispute Resolution cores to be sampled and tested and the results will be substituted for the QA results. The PF for Density will be recomputed. All costs associated with completing the Sublot Retest testing will be borne by the Department.

j. Pavement and Shoulder Thicknesses. The Department will take cores from the pavement to determine the thickness of the pavement in accordance with the Special Provision "DETERMINATION OF PAVEMENT THICKNESS ON US-31 BY THE CORING METHOD". Temporary bituminous pavement, pavements within 4.0 feet of an obstruction, pavement areas less than 250 syd, or pavements less than 3 feet in width will be cored at the discretion of the Engineer.

1. Thickness Corrections. When the total base course has been placed, cores will be taken from locations randomly selected within pavement units. The total thickness of the cores will be measured, recorded and compared to the thickness shown on the plans. If the

core thickness is less than the plan thickness, the deficiency may be made up on succeeding courses at no additional expense to the Department. If the thickness exceeds the plan thickness by more than 0.25 inches, the Engineer will determine the appropriate corrective action at no expense to the Department. When the leveling and top course has been placed, full depth cores will be taken from the pavement units that correspond to the same pavement units where base course cores were taken. The thickness of the cores will be measured and recorded. If the total thickness is less than the total plan pavement thickness, appropriate price adjustments, as specified in this special provision, will apply.

2. Price Adjustments. The contract price for the bituminous pavement deficient in total thickness will be adjusted according to the following provisions:

Cores will be classified according to Table 5.

When an initial core from a pavement unit is classified other than Type A, additional cores will be taken in accordance with the Special Provision for Determination of Pavement Thickness on US-31 by the Coring Method.

To determine the contract price adjustment for bituminous pavement deficient in total thickness, the contract price of each individual bituminous pavement layer will be reduced by the percent indicated in Table 5 for the area of pavement determined deficient.

Pavement units represented by three cores, the initial core which falls in the B thickness range will be paid for at the adjusted price as specified in Table 5. In determining the average thickness, measurements of individual cores which exceed the specified pavement thickness by more than 0.20 inches will be considered as the specified thickness plus 0.20 inches.

Initial cores in the C thickness range represent an area of 10 feet (5 feet on either side of the core) by the width of the pavement unit. Such areas will be deducted from the remainder of the pavement unit. The remainder of the pavement unit will be represented by a new initial core and the above procedure will apply. The Contractor shall remove and replace C range areas as specified by the Engineer. Any area of pavement removed must not be less than 3 feet in length. The areas replaced with pavement meeting the specified requirements will be paid for at the contract unit prices.

k. Documentation. The following documentation must be current and available for review as stated herein. All required documentation will be reviewed at the post-production meeting.

1. Quality Control Records. Maintain a complete record of all quality control tests and inspections. Make these records available at the laboratory facility at all times for the Engineer to review. Update all records within 24 hours of test completion. Failure to keep the required documentation updated constitutes a violation of the HMA-QC Plan. Furnish

copies of individual records to the Engineer upon request and all records within 7 working days of completion of the project. Report all sampling and testing on MDOT approved forms. The records must contain, as a minimum, the accepted HMA-QC Plan, signed originals of all QC test results and raw data, random numbers used and resulting calculations made for QC sampling locations if applicable, control charts, and summaries of all test results.

2. Quality Assurance Records**.** The Engineer will maintain a complete record of all quality assurance tests and inspections. Records will be updated within 1 working day of test completion. Copies of individual records will be furnished upon request. The records will contain, as a minimum, the HMA-QA Plan, signed originals of all QA test results and raw data, random numbers used and resulting calculations made for QA sampling locations if applicable, and summaries of all test results.

I. Quality Index Analysis. The Engineer's QA test results for plant produced material (mixture) and In-Place Density will be evaluated according to the MDOT PWL Worksheet. The upper and lower specification limits used in the quality index analysis are shown in Table 3. The Engineer will calculate PWL, PF and payment for all HMA material covered by this special provision using the MDOT PWL Worksheet. All values of PWL and PF in these formulae are percents not decimals. All values of PWL are carried to whole numbers and PF are carried to two decimal places as shown in the MDOT PWL Worksheet.

1. Pay Factor for Air Voids (PF_{AV}).

A. If PWL for Air Voids (PWL_{AV}) is between 100 and 70, use the following formula to determine PF_{AV}. Round the value of PF_{AV} two decimal places.

$$PF_{AV} = 55+(0.5xPWL)$$

B. If PWL for Air Voids is between 70 and 50 inclusive, use the following equation to determine PF_{AV}. Round the value of PF_{AV} two decimal places.

$$PF_{AV} =37.5+(0.75xPWL)$$

C. If PWL for Air Voids is less than 50, the Engineer may elect to do one of the following:

(1) Require removal and replacement of the entire lot with new QA sampling and testing and repeat the evaluation procedure.

(2) Allow the lot to remain in place and apply an Overall Lot Pay Factor of 50.00.

(3) Allow submittal of a corrective action plan for the Engineer's approval. The corrective action plan may include removal and replacement of one or more sublots. If one or more sublots are replaced, the sublot(s) will be retested and the Overall Lot Pay Factor will be recalculated according to this special provision. If the Engineer does not approve the plan for corrective action, subsections (1) or (2) above will be applied.

2. Pay Factor for Binder Content (PF_{BINDER}).

A. If PWL for Binder Content (PF_{BINDER}) is between 100 and 70, use the following formula to determine PF_{BINDER}. Round the value of PF_{BINDER} two decimal places.

PF_{BINDER} = 55+(0.5xPWL)

B. If PWL for Binder Content is between 70 and 50 inclusive, use the following equation to determine PF_{BINDER}. Round the value of PF_{BINDER} two decimal places.

PF_{BINDER}=37.5+(0.75xPWL)

C. If PWL for Binder Content is less than 50, the Engineer may elect to take one of the actions specified in subsection (k.1.C) above.

3. Pay Factor for VMA (PF_{VMA}).

A. If PWL for VMA (PWL_{VMA}) is between 100 and 70, use the following formula to determine PF_{VMA}. Round the value of PF_{VMA} two decimal places.

PF_{VMA} = 55+(0.5xPWL)

B. If PWL for VMA is between 70 and 50 inclusive, use the following equation to determine PF_{VMA}. Round the value of PF_{VMA} two decimal places.

PF_{VMA}=37.5+(0.75xPWL)

C. If PWL for VMA is less than 50, the Engineer may elect to take one of the actions specified in subsection (k.1.C) above.

4. Pay Factor for In-Place Density (PF_D).

A. If PWL for In-Place Density (PWL_D) is between 100 and 70, use the following formula to determine PF_D. Round the value of PF_D two decimal places.

PF_D = 55+(0.5xPWL)

B. If PWL for In-Place Density is between 70 and 50 inclusive, use the following equation to determine PF_D. Round the value of PF_D two decimal places.

PF_D=37.5+(0.75xPWL)

C. If PWL for In-Place Density is less than 50; the Engineer may elect to take one of the actions specified in subsection (k.1.C) above.

5. Overall Lot Pay Factor (OLPF).

OLPF = (0.40 x PF_D)+ (0.30 x PF_{AV}) + (0.15 x PF_{BINDER}) + (0.15 x PF_{VMA})

m. Measurement and Payment. Separate payment will not be made for providing and

maintaining an effective HMA quality control program as specified by this special provision. All costs associated with the work described in this special provision will be included in the applicable unit prices for the related HMA mixtures. HMA, (type) will be measured as specified in subsection 502.04 of the Standard Specification for Construction and the contract documents. If HMA Quality Initiative is not included in the contract as a pay item, there will be no payment for this item of work.

Payment for HMA pay items will be based on the contract prices for the completed items of work as adjusted according to this special provision. Adjusted payment for HMA, (type) will be calculated on a lot-by-lot basis.

The Overall Lot Pay Factor (OLPF) will be used to determine the lot pay adjustment as follows:

Lot Payment Adjustment = (OLPF-100)/100 x (Contract Unit Price) x (Lot Quantity).

Contract Item (Pay Item)	**Pay Unit**
HMA Quality Initiative	Dollar

Table 1: Minimum Quality Control Sampling and Testing Requirements

Quality Characteristic	Test Method	Minimum Test Frequency	Sampling Location	Sampling Method
Aggregate Gradation (optional)	As defined in HMA-QC Plan	As defined in HMA-QC Plan	As defined in HMA-QC Plan	Random AASHTO T 2
Aggregate Moisture	As defined in HMA-QC Plan	As defined in HMA-QC Plan		
PG Binder Content	As defined in HMA-QC Plan	1 per day	As defined in HMA-QC Plan	Random AASHTO T 168
Combined Mixture Gradation	As defined in HMA-QC Plan	1 per day	As defined in HMA-QC Plan	Random AASHTO T 168
Maximum Theoretical Specific Gravity	MTM 314	1 per day	As defined in HMA-QC Plan	Random MTM 313
Bulk Specific Gravity	As defined in HMA-QC Plan	1 per day	As defined in HMA-QC Plan	Random AASHTO T 168
Volumetrics: Air Voids	As defined in HMA-QC Plan	1 per day	As defined in HMA-QC Plan	Random AASHTO T 168
Volumetrics: VMA	As defined in HMA-QC Plan	1 per day	As defined in HMA-QC Plan	Random AASHTO T 168
Fines to Effective Binder	As defined in HMA-QC Plan	1 per day	As defined in HMA-QC Plan	Random AASHTO T 168
In-Place Density(a)	As defined in HMA-QC Plan	1 per day	From compacted HMA	Random AASHTO T 168

a. A maximum of 15 cores per lot of material will be allowed.

Table 2: Action and Suspension Limits for Combined Gradation (from JMF)

	HMA Mixture									
	5		4		3		2		LVSP	
Sieve Size	QC Action	QC Sus-pension	QC Action	QC Sus-pension	QC Action	QC Sus-pension	QC Action	QC Sus-pension	QC Action	QC Sus-pension
3/4 inch	Defined		Defined		Defined	± 10	Defined	± 10	Defined	
1/2 inch	In the		In the	± 10	In the	± 10	In the	± 10	In the	± 10
3/8 inch	HMA-QC	± 10	HMA-QC	± 10	HMA-QC	± 10	HMA-QC	± 10	HMA-QC	± 10
No. 4	Plan	± 8	Plan	± 8	Plan	± 8	Plan	± 8	Plan	± 8
No. 8		± 8		± 8		± 8		± 8		± 8
No. 30		± 6		± 6		± 6		± 6		± 6
No. 200		± 2		± 2		± 2		± 2		± 2

Table 3: HMA Quality Index Parameter Specification Limits

Quality Index Parameter	Specification Limits	
	Lower	Upper
Air Voids, (%@ Ndes) leveling and top course	3.00	5.00
Air voids base/shoulders	2.00	4.00
VMA		
LVSP	14.00	16.00
2	12.00	14.00
3	13.00	15.00
4	14.00	16.00
5	15.00	17.00
GGSP (Gap SMA)	17.00	19.00
Binder Content	JMF ± 0.40	
Mat Density, %Gmm	92.00%	None Specified

The Binder Content used as the target will be the value in the approved JMF.

Table 4: Quality Control and Quality Assurance Limits

Col. I - Quality Characteristic	Col. II - QC Action Limits (a)	Col. III - QC Suspension Limits (b)	Col. IV - QA Suspension Limits Form 1165 (a)	Col. V - Sublot RQL Form 1165 (c)	Col. VI - Lot AQL (d)	Col. VII - Lot RQL (d)
Aggregate Gradation (optional)						
Aggregate Moisture						
Binder Content	± 0.50 JMF	± 1.00 JMF			$PWL_{BINDER} \geq 90$ For any lot	$PWL_{BINDER} < 50$ For any lot
Combined Mixture Gradation	Defined in the HMA-QC Plan	Refer to Table 2				
Maximum Theoretical Specific Gravity	± 0.013 JMF	± 0.020 JMF				
Bulk Specific Gravity						
Volumetrics: Air Voids	Defined In the HMA-QC Plan	- 1.00 or + 1.00 of Spec Limits in Table 3		- 1.00 or + 1.00 of Spec Limits in Table 3	$PWL_{AV} \geq 90$ For any lot	$PWL_{AV} < 50$ For any lot
Volumetrics: VMA	Defined In the HMA-QC Plan	- 1.00 or + 3.00 of Spec Limits in Table 3		- 1.00 or + 3.00 of Spec Limits in Table 3	$PWL_{VMA} \geq 90$ For any lot	$PWL_{VMA} < 50$ For any lot
Fines to Effective Binder	Defined In the HMA-QC Plan	0.60 – 1.40 (a)	0.60 – 1.40			
In-Place Density	Defined in the HMA-QC Plan	Defined in the HMA-QC Plan		Average Sublot Value < 90.00%	$PWL_D \geq 90$ For any lot	$PWL_D < 50$ For any lot

a. Limits apply to two consecutive QC or QA tests.
b. Limits apply to single QC tests.
c. Specified. Limits apply to a single QA sublot Air Void or VMA test or on the sublot average In-Place Density.
d. Specified. Limits apply on a lot-by-lot basis. Based on QA results for the lot.

TABLE 5: Classification of Cores and Price Adjustment for Bituminous Pavement and Shoulders Deficient in Total Thickness

Total Pavement Thickness		
Core Type	Deficiency in Total Pavement Thickness Determined by Cores, inches	Contract Unit Price Decrease, Percent(b)
A	0.20 Or less	0
B	0.21 to 0.30	5
B	0.31 to 0.40	15
B	0.41 to 0.50	25
B	0.60 to 1.00	50
C	1.01 and over	100(a)

a. Remove and replace pavement
b. Decrease in Contract Unit Price applies to each individual Bituminous pavement layer.

NOTICE TO BIDDERS
US – 31 ALTERNATE BID PROJECT

Hot Mix Asphalt (HMA) quality assurance (QA) and quality control (QC) will use traditional tonnage methods. Each Lot of HMA will be converted to a square yard quantity based on actual area placed per the plans for applying pay adjustment factors.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
DETERMINATION OF PAVEMENT THICKNESS ON US-31 BY THE CORING METHOD

C&T:CJB 1 of 5 C&T:APPR:JWB:SJP:04-06-09

a. Description. This Special Provision describes the procedure for selection of pavement units to be cored, requirements for the number of cores to be taken, the method of measurement for length of core, and the procedures for reporting results. This Special Provision shall pertain to both Concrete and Bituminous Pavements.

Reference to standard specifications shall be interpreted as the Standard Specifications for Construction.

Reference to Core Types A, B, and C refer to ranges of pavement thickness, with regard to contract price adjustments, as described in subsection 602.04.H of the Standard Specifications, for Concrete Pavements, and Table 5 of the Special Provision for Superpave Hot Mix Asphalt Percent Within Limits (PWL) on US-31.

b. Reference Documents.

1. MDOT Standards: Standard Specifications for Construction.

2. AASHTO Standards:

A. R11 - Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values.

B. T148 - Measuring Length of Drilled Cores.

c. Terminology.

Additional Core. A core taken because the initial core from a pavement unit indicates pavement thickness in a penalty range.

Initial Core. The first core taken from a pavement unit.

Pavement Unit. An area of pavement selected for coring for determination of pavement thickness.

Random Sampling. Is defined in the MDOT Guidelines for Random Sampling for Quality Assurance/Quality Control Projects in the MDOT Quality Assurance Procedures Manual.

Straddler Core. A core taken to determine the limits of pavement in the C penalty range.

Substitute Additional Core. A core taken outside a pavement area having a deficiency in the C penalty range which is substituted for an additional core from the pavement unit.

Substitute Initial Core. A core taken outside a pavement area having a deficiency in the C penalty range which is substituted for the initial core from the pavement unit.

d. Determination of Pavement Units. To determine the frequency of coring, divide the pavement into units. The width of a unit is a lane or a separately paved shoulder. The width of each lane or shoulder will be determined from the Typical Sections shown on the plans.

Determine the length of a unit as described below.

1. Divide areas 3000 feet or more in length and 3 feet or more in width into units of 1500 feet of pavement for each lane or separately paved shoulder, starting at the end of the pavement bearing the smaller station number. The length of the last unit will be variable to conform to the remaining pavement limits, and will be from 750 feet to 2250 feet in length.

2. Divide areas less than 3000 feet in length but at least 250 square yards in each lane or a separately paved shoulder into units of 500 linear feet. Areas of 250 square yards or more but less than 500 linear feet will be considered as one unit. The length of the last unit will be variable to conform to the remaining pavement limits.

NOTE 1: The standard specifications and the Superpave Hot Mix Asphalt Percent Within Limits (PWL) on US-31 provide that temporary pavement, and pavement within 4 feet of an obstruction, pavement areas of less than 250 square yards, or pavement less than 3 feet in width, will be cored at the discretion of the Engineer

NOTE 2: While requirements for coring are different depending on the area of pavement, any price adjustments (or requirements for replacement) should be as indicated in the standard specifications or the Special Provision for Superpave Hot Mix Asphalt Percent Within Limits (PWL) on US-31.

e. Coring Procedure.

1. Identification of Cores. Each core taken for project acceptance purposes must be numbered with consecutive numbers starting January 1 each year. A consecutive core number is assigned to the initial core of each added pavement unit regardless of the core's location within the limits of a single project or from within various projects. All cores taken from a pavement unit shall bear the same number as the initial core. Suffixes, as described below must be added to cores other than initial cores to identify their core type, as described in subsection e.3. The assignment of suffixes must represent the order in which the cores were taken.

A. When cores are required to determine deficiencies in pavement thickness, the suffix shall be letters A, B, C, etc.

B. When an alternate core is taken, the suffix shall be the letter "X".

2. Initial Core. Take one core (the "initial" core) from each prescribed pavement unit. The Engineer will select the longitudinal location at random, except the cores will not be

taken within 2 feet of transverse joints. The Engineer will select the transverse location at random, except that cores will not be taken within 2 feet of longitudinal joints or an edge of bituminous pavement, or in the area of thickened edges of lanes.

Record the stationing of each core to the nearest 1 foot. Record the transverse location relative to centerline, edge of pavement, or other reference to the nearest 2 inches.

3. Classification of Cores. After measuring the core as described below, classify the core in accordance with the results for pavement thickness in accordance with the ranges indicated in Table 602-2 of the standard specifications, for Concrete Pavement and in accordance with Table 5 of the Special Provision for Special Provision for Superpave Hot Mix Asphalt Percent Within Limits (PWL) on US-31. The resulting classification will determine the procedure to be followed, as described in subsections e.4 and e.5.

4. Core Type A. When the initial core from a pavement unit is classified as Type A, no additional cores will be taken from that pavement unit.

5. Core Type Other Than Type A. When the initial core from a pavement unit is classified as other than Type A, take "additional" cores as described below.

A. Core Type B. When the initial core is classified as Type B, take two additional cores from within the pavement unit. When coring is being done on a square yards basis, the two additional cores will be taken at random from within the pavement unit, as determined by the Engineer.

(1) If the measurement of the two additional cores are within the Type A or B range, no further cores will be taken within the pavement unit.

(2) If the measurements for either or both additional cores are in the C range, follow the requirements of subsection e.5.B.2.

B. Core Type C. When the initial core is classified as Type C, take "straddler" cores at random transversely within the pavement unit, but spaced at 10 feet longitudinal intervals in each direction from the C core until, in each direction, a core is obtained which is no longer in the C range. The first core taken in each direction which is not in the C range will determine the extent of the area having a deficiency in the C range. The procedure to be followed after defining the limits of the C deficiency area is as described in subsection e.5.B.(1) for cases where the initial core indicated a C deficiency, or subsection e.5.B.(2) for cases where an additional core indicated a C deficiency.

(1) Initial Core Classified as C. The first straddler core taken that is not in the C range will become the "substitute initial" core for the pavement unit. The second straddler core taken that is not in the C range will be used only in the determination of the extent of pavement in the C range. If the first straddler (substitute initial core) is classified as A, no additional cores will be taken, as described in subsection e.4. If the first straddler (substitute initial core) is classified as A or B, take two additional cores as described in subsection e.5.A.

(2) Additional Core Classified as C. The first straddler core taken that is not in the C range will become a "substitute additional" core and will meet for one of the two additional cores to be taken as described in subsection e.5.A.(1). The second

straddler core taken that is not in the C range will be used only in the determination of the extent of pavement in the C range.

f. Measurement of Cores. Measurement for Thickness of Pavement. Make measurements for the length of a core for determining pavement thickness in accordance with AASHTO T 148, and round the results using the rounding method of AASHTO R 11. Due to construction practices and different pavement types, the base course material may vary between core locations of contiguous pavement coring units. The measurement of a core as described in subsections f.1 and f.2 will be governed by the actual base course material displayed at the core location.

1. For Concrete or Bituminous pavement placed over a dense-graded aggregate, clean the bottom of cores by tooling and wire brushing as necessary to remove sand and loosely attached coarse particles. Measure the length of the core, round the results to 0.05 inches and report as "actual depth" on the field worksheet.

2. For Concrete pavement placed over an open-graded aggregate (OGA), tool the bottom of cores to remove particles of the OGA projecting significantly beyond the lower surface of the mortar, then measure the length of the core. Record the length of the core (thickness of pavement) to the nearest 0.05 inches as the "actual depth" on the worksheet. Deduct 0.25 inches from the actual depth (before rounding the raw data) and report to the nearest 0.05 inches as the "adjusted depth".

NOTE 3: The 0.25 inch deduction for Concrete pavement placed over OGA is based on laboratory testing and is the approximate increase in length of the core over the thickness of concrete placed, due to mortar separating from the concrete and surrounding and bonding to particles in the OGA. The increased quantity of concrete required due to loss of mortar into the OGA is estimated to be less than 2 percent of the volume of concrete required.

g. Report. Report the results of the determinations by this test method on Form 502.

1. Form 502. Report the project limits of roadways and the individual limits of the ramps, shoulders, and other pavement areas by their P.O.B. and P.O.E. stations. Stationing limits of bridges and gaps will be reported but will not be included in the determination of the length of a unit. Station equations will be reported. All cores taken on a project will be reported. Each core in the report will be identified by core number, station, transverse location, actual depth and adjusted depth as described in subsection f.1, core length surplus or shortage, date core was taken, lane description, and lane width.

NOTE 4: The standard specifications or the Special Provision for Superpave Hot Mix Asphalt Percent Within Limits (PWL) on US-31 provide that individual core length measurements in excess of the plan thickness by more than 0.20 inches will be considered as the specified thickness plus 0.20 inches and will be reported as a "surplus" of 0.20 inches.

2. When three cores are taken from a pavement unit as described in subsection e.5.A, the measurements for thickness will be averaged by the Construction Division or the Project Engineer as provided in subsection g.3.

3. When averaging the lengths of three cores, include the length in excess of specified pavement thickness only as permitted by the standard specifications or the Special Provision for Superpave Hot Mix Asphalt Percent Within Limits (PWL) on US-31.

Exhibit 4

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
HIGH PERFORMANCE
PORTLAND CEMENT CONCRETE
GRADE P1 (MODIFIED)

a. Description. This special provision sets forth requirements for furnishing Portland cement concrete, Grade P1 (Modified), for mainline, shoulder, and miscellaneous pavement applications. The Contractor does not have the option of using other concrete Grades or Types in lieu of Grade P1 (Modified), as described in this special provision. All work shall be according to the Standard Specifications for Construction and this special provision.

b. Materials.

1. **Aggregates.** Coarse aggregate classification shall meet the grading and physical requirements described herein. Intermediate aggregate classification shall be either a Michigan Class 26A or 29A. The fine aggregate classification shall meet the requirements for natural sand Number 2NS. All aggregates shall originate only from natural geological sources. The following specified material values include any standard bias or precision based on laboratory or operator results. A listing of aggregate sources meeting the following specified values for dilation and absorption is available from the Engineer.

   Provide a detailed stockpile management plan, describing process controls for shipping, handling, and storage of each aggregate (including the use of radial stackers with elevating conveyors) to minimize segregation and contamination, including proposed method(s) for aggregate quality control and quality assurance verification sampling and testing.

Grading Requirements for Coarse Aggregate

Classification	Sieve Analysis (b) (MTM 109) Total Percent Passing						Loss by Washing (MTM 108) % Passing No. 200 (b)
	2 "	1-1/2 "	1 "	3/4 "	1/2 "	3/8 "	
Coarse Aggregate	100	90 - 100	60 - 85	30 - 60	10 - 30	0 - 8	1.0 max.

Note: (b) References footnote included in Table 902-1.

The physical requirements for the coarse aggregate shall be as specified for Class 6AAA coarse aggregate according to Table 902-2 of the Standard Specifications for Construction with the following additions:

Absorption (24-hour soak method), percent max. (a)	2.50
Freeze-Thaw Dilation, percent per 100 cycles, max. (b)	0.040
Flat and Elongated Pieces, 3:1 ratio, percent max. (c)	15.0

Note: (a) Based on most current Department laboratory test results for oven-dried Class 6 aggregate.
(b) Based on most current Department laboratory test results for Class 6 aggregate.
(c) ASTM D 4791. Section 8.4 will be followed. The test will be performed on the material down to and including the 3/4 inch sieve.

The grading requirements for the Class 26A and 29A intermediate aggregates shall be according to Table 902-1 of the Standard Specifications for Construction.

The physical requirements for the Class 26A and 29A intermediate aggregates shall be as specified in Table 902-2 of the Standard Specifications for Construction with the following addition:

Freeze-Thaw Dilation, percent per 100 cycles, max. (a)	0.067
Sum of Soft Particles and Chert, % max. (MTM 110)	4.0
Loss by Washing (MTM 108) % Passing No. 200, percent max. (b)	2.0

Note: (a) Based on most current Department laboratory test results for Class 6 aggregate.
(b) References footnote included in Table 902-1.

The freeze-thaw dilation per 100 cycles for the coarse and intermediate aggregates shall be based on the most current department test results using Class 6A/6AA coarse aggregate.

The bulk dry specific gravity of the coarse and intermediate aggregates shall not be more than 0.04 below the most current Department test results using Class 6A/6AA coarse aggregate.

All coarse and intermediate aggregates shall be maintained in a saturated surface-dry condition prior to batching concrete.

The Contractor shall provide the Engineer with written verification from the aggregate supplier(s) that the coarse and intermediate aggregates meet the specified physical requirements. Acceptable verification will include records of the supplier=s quality control testing.

The on-site blend of the coarse, intermediate, and fine aggregates shall be based on the gradation of each individual aggregate classification, as received. The Contractor shall determine the on-site gradation for each aggregate prior to developing the initial concrete mixture proportions (mix design).

All on-site aggregate gradation testing records and reports shall be maintained, as required in Section 604 of the Standard Specifications of Construction.

The Contractor may propose an alternative composite gradation of coarse, intermediate, and fine aggregates provided the following criteria are met:

A. Aggregate particles retained on the 3/4 - inch sieve and greater must conform to the physical requirements for coarse aggregate included in this special provision.

B. Aggregate particles passing the 3/4 - inch sieve through those retained on the No. 4 sieve must conform to the physical requirements for intermediate aggregate included in this special provision.

C. Aggregate particles passing the No. 4 sieve must conform to the physical requirements for natural sand Number 2NS.

D. Source selection for the coarse, intermediate, and fine aggregates to be used in the concrete mixture shall be submitted to the Engineer at the Pre-Construction meeting. The Contractor's proposed alternative composite gradation shall also be submitted at this time. The Contractor's proposal shall include the target gradation values, in terms of the percent retained on each individual sieve size for each aggregate classification. Production tolerances applied to each individual sieve size will be those specified for the respective standard aggregate classifications. The proposal shall also include the percentage proportions for each aggregate classification to be used in the concrete mixture.

E. The proposal shall include documentation verifying that the final proposed composite gradation blend conforms to the grading requirements specified in subsection b.1.G, and shall produce an on-site optimization of the concrete mixture, as described in subsection b.3, Concrete Mixture Requirements.

F. A representative production stockpile of each aggregate classification shall be available and accessible to the Engineer for sampling at each aggregate production facility.

G. The Engineer may sample each of the coarse, intermediate, and fine aggregate production stockpiles at each aggregate production facility, blend the aggregates at the percentage proportions proposed by the Contractor, and compare the percent retained on any individual sieve for conformance to the following requirements:

Grading Requirements for Composite Gradation

Sieve Size	% Retained
2 inch	0
1-1/2 inch	0 – 15
1 inch	5 – 15
3/4 inch	5 – 15
1/2 inch	5 – 15
3/8 inch	5 – 15
No. 4	5 – 15
No. 8	5 – 15
No. 16	5 – 15
No. 30	5 – 15
No.50	0 - 15
No. 100	< 8
No. 200	< 3

H. The Engineer will have 14 calendar days to review the Contractor's alternative composite gradation proposal, including sampling of materials at each aggregate production facility and laboratory testing for conformance to final proposed blend.

I. Alternative composite gradation submittals that do not include all required documentation will be considered incomplete and the Engineer will return them without review.

J. Aggregates shall not be shipped to the project site until the Engineer has approved the Contractor's alternative composite gradation proposal.

K. If the aggregate producer is a Prequalified Aggregate Source, the producer may request (by letter to the Department) that the project-specific aggregate classification(s) be included on their current list of prequalified aggregates for this project.

2. **Cementitious Materials.** All materials used in the concrete mixture shall be from MDOT approved sources.

Fly ash shall be Class F according to subsection 901.07 of the Standard Specifications for Construction. Class C fly ash is not permitted.

The cementitious material content given in Table 605-1 of the Standard Specifications for Construction does not apply. The cementitious material content shall be between 470 and 564 lbs/yd^3.

If GGBFS is added to the concrete mixture, the maximum substitution amount, based on 1.0 times the weight of Portland cement reduced, shall not exceed 40 percent by weight of the total cementitious material. A ternary blend of Portland cement, fly ash, and GGBFS is allowable, provided the maximum individual substitution amounts are not exceeded and the combined total does not exceed 40 percent.

The combined weight of Portland cement, fly ash and GGBFS shall be used to determine compliance with the water-cement ratio and minimum and maximum cementitious material contents. The maximum water-cement ratio for Grade P1 concrete included in Table 605-1 of the Standard Specifications for Construction does not apply. The water-cement ratio shall not exceed 0.45. A water reducing or water reducing retarding admixture is permitted.

3. **Concrete Mixture Requirements.** Except as modified herein, the Contractor shall be responsible for determining the concrete mixture proportions (mix design) according to Section 605 of the Standard Specifications for Construction. Strength requirements shall be as specified for Grade P1 concrete.

Individual(s) performing sampling and testing of aggregates must possess current certification as a Michigan Certified Aggregate technician (MCAT).

The current Shilstone concrete mixture design and analysis method shall be used to produce and monitor on-site aggregate gradations to maintain continual optimization of the concrete mixture proportions. The on-site proportioned blend of coarse, intermediate, and fine aggregates shall produce a Coarseness Factor (CF) of 50 to 72 and a Workability Factor (WF) of 32 to 40, as defined by the Shilstone Company, Inc.

All concrete mixture proportion records and reports shall be maintained, as required in Section 604 of the Standard Specifications of Construction.

c. Construction. Construction of Portland cement concrete pavement shall be according to subsection 602.03 of the Standard Specifications for Construction with the following additions:

The Contractor shall verify the composite aggregate gradation prior to initial startup of paving.

The Contractor shall sample coarse, intermediate, and fine aggregates for gradation testing prior to each days paving. At least one additional sample blend shall be tested by the Contractor at random during daily paving to verify ongoing gradation uniformity. The frequency of the Contractor's on-site gradation testing shall be maintained to provide representative gradation information necessary to make appropriate adjustments to the concrete mixture proportions. If the moving average of four tests falls outside the grading requirements for composite gradation, specified in Subsection b.1.G, and the Coarseness Factor (CF) and Workability Factor (WF) do not meet the requirements specified in Subsection b.3, production will be suspended until the appropriate adjustments are made to the composite gradation blend, as approved by the Engineer.

The Contractor shall notify the Engineer of any proposed modification to the concrete mixture proportions necessary to maintain continual optimization of the concrete mixture, as described above.

The Engineer will notify the Contractor when a quality assurance verification test is required. Using the concrete batch plant, produce a minimum four cubic yard dry batch of the normal production composite aggregate blend. Construct a mini-stockpile of the dry batched composite aggregate blend according to the method(s) described in the stockpile management plan. Provide a representative split sample to the Engineer for verification testing by the department. A minimum of four quality assurance verification tests will be required for the project, as directed by the Engineer.

Handling and proportioning equipment at the batching facility shall be capable of simultaneously and separately controlling each aggregate classification according to NRMCA requirements. Additional equipment to assure proper handling and proportioning may be required to prevent segregation and contamination with foreign material.

The Contractor shall assure that the spacing and operating frequency of the paver vibrators are within manufacturer tolerances. If requested by the Engineer, the Contractor shall be prepared to provide written documentation that the paver vibrators are operating according to manufacturer requirements.

The Contractor shall monitor the project site environmental conditions for air temperature, wind speed, and relative humidity to avoid any adverse conditions that would cause uncontrolled/random cracking of the pavement. In addition, the Contractor shall continually monitor concrete mixture properties to minimize the increased potential for shrinkage cracking to occur.

The Contractor shall apply both applications of curing compound within 30 minutes of finishing the pavement. The Contractor shall supply the Engineer with verification that the specified application rates were attained.

d. Measurement and Payment. The completed work as described will be paid for at the contract unit prices for the following contract items (pay items):

Contract Item (Pay Item)
Pay Unit

Conc Pavt, Nonreinf, ____ inch, High Performance……..Square Yard
~~Conc Pavt, Misc, Nonreinf, ____ inch, High Performance……Square Yard~~
~~Conc Pavt, Reinf, ____ inch, High Performance……Square Yard~~
~~Conc Pavt, Misc, Reinf, ____ inch, High Performance……Square Yard~~
Shoulder, Nonreinf Conc, High Performance……Square Yard
~~Shoulder, Reinf Conc, High Performance……Square Yard~~

Conc Pavt, Nonreinf, ____ inch, High Performance, **Conc Pavt, Misc, Nonreinf, ____ inch, High Performance**, **Conc Pavt, Reinf, ____ inch, High Performance**, and **Conc Pavt, Misc, Reinf, ____ inch, High Performance** will be measured and paid for by area in square yards based on plan quantities. The pay items used will be based on whether or not reinforcement is required, the thickness specified, and the type of pavement specified. **Shoulder, Nonreinf Conc, High Performance** and **Shoulder, Reinf Conc, High Performance** will be measured and paid for by area in square yards based on plan quantities.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SUPERPAVE HMA MIXTURES ON US-31

C&T:CJB 1 of 5 C&T:APPR:JWB:SJP:04-06-09

a. Description. Furnish a HMA mixture using Superpave Mixture Design Methods. The HMA mixture will be provided according to the requirements of the standard specifications except where modified herein.

b. Mix Design. Provide the HMA mixture design. The design will be submitted and evaluated according to the HMA Production Manual, Procedures for HMA Mix Design Processing.

c. Recycled Mixtures. The Contractor may substitute Reclaimed Asphalt Pavement (RAP) for a portion of the new materials required to produce HMA mixture. The mixture will be designed and produced to meet all of the criteria herein.

d. Materials. The mixture will consist of aggregates of the highest quality available to meet the minimum specifications herein. Tables 1-6 and 10 provide the required aggregate properties, Tables 7-8 provide the Mix Design Criteria and Volumetric Properties and Table 9 provides the Superpave Gyratory Compactor (SGC) compaction criteria. Criteria specified below apply to the combined aggregate blend. For mixture design purposes, top and leveling courses are defined as the mixture layers within 4 inches of the surface; the base course is defined as all layers below 4 inches of the surface. For mixture layers which fall within the 4 inch threshold, the following rule should apply: If less than 25 percent of a mixture layer is within 4 inches of the surface, the mixture layer should be considered to be a base course. For projects that specify a mix type E03, the Contractor may choose to use a mix type LVSP according to the requirements specified herein.

e. Measurement and Payment.

All bituminous pavements will be measured and paid for by area in square yards based on plan quantities. The pay item will be based on: the thickness specified, and the type of pavement specified.

Contract Items (Pay Item)	**Pay Unit**
HMA, 3E10, 3-3/4 inch	Square Yard
HMA, 4E10, 2-1/2 inch	Square Yard
HMA, 5E10, 1-1/2 inch	Square Yard

The mixture designation, E _, is determined by the ESALs (million) on the design lane over the design life. This number is to be used when determining Mix Design Properties from Tables 1 thru 6, and Tables 8 and 9.

Table 1: Crush Minimum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	55/-	-
< 0.3	E03	55/-	-
< 1.0	E1	65/-	-
< 3.0	E3	75/-	50/-
< 10	E10	85/80	60/-
< 30	E30	95/90	80/75
<100	E50	100/100	95/90

Note: "85/80" denotes that 85 percent of the coarse aggregate has one fractured face and 80 percent has two fractured faces.

Table 2: Fine Aggregate Angularity Minimum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	-	-
< 0.3	E03	-	-
< 1.0	E1	40	-
< 3.0	E3	40(a)	40(a)
< 10	E10	45	40
< 30	E30	45	40
<100	E50	45	45

a. For an E3 mixture type that enters the restricted zone as defined in Table 10, the minimum criteria shall be 43.

Table 3: Sand Equivalent Minimum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	40	40
< 0.3	E03	40	40
< 1.0	E1	40	40
< 3.0	E3	40	40
< 10	E10	45	45
< 30	E30	45	45
<100	E50	50	50

Table 4: L.A. Abrasion Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	45	45
< 0.3	E03	45	45
< 1.0	E1	40	45
<3.0	E3	35	40
< 10	E10	35	40
< 30	E30	35	35
<100	E50	35	35

Table 5: Soft Particles Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	10	10
< 0.3	E03	10	10
< 1.0	E1	10	10
< 3.0	E3	5	5
< 10	E10	5	5
< 30	E30	3	4.5
<100	E50	3	4.5

Note: "Soft Particles Maximum" is the sum of the shale, siltstone, ochre, coal, clay-ironstone and particles which are structurally weak or are found to be non-durable in service.

Table 6: Flat and Elongated Particles Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	-	-
< 0.3	E03	-	-
< 1.0	E1	-	-
< 3.0	E3	10	10
< 10	E10	10	10
< 30	E30	10	10
<100	E50	10	10

Note: Maximum 10 percent by weight with a 1 to 5 aspect ratio.

Table 7: Superpave Mix Design Criteria

Design Parameter	Mixture Number				
	5	4	3	2	LVSP
Percent of Maximum Specific Gravity (%G_{mm}) at the design number of gyrations, (N_d) (See Note)	96.0 % (a)				96.0% (a)
%G_{mm} at the initial number of gyrations, (N_i)	See Table 9				
%G_{mm} at the maximum number of gyrations, (N_m)	98.0%				
VMA min % at N_d (based on aggregate bulk specific gravity, (G_{sb}))	15.00	14.00	13.00	12.00	14.00
VFA at N_d	See Table 8 (b)				
Fines to effective asphalt binder ratio (P_{No200}/P_{be})	0.6 - 1.2				
Tensile strength ratio (TSR)	80 % min				

a. For mixtures meeting the definition for base course: Mixtures shall be designed to 96.0% of Maximum Specific Gravity (%G_{mm}) at the design number of gyrations, (N_d). During field production Percent of Maximum Specific Gravity (%G_{mm}) at the design number of gyrations, (N_d) may be increased to 97.0%.

b. For base course or regressed shoulder mixtures the maximum criteria limits do not apply.

Note: Target Air Voids will be lowered by 1.0 percent if used in a separate shoulder paving operation unless noted otherwise on the plans.

Table 8: VFA Minimum and Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	70-80	70-80
< 0.3	E03	70-80	70-80
< 1.0	E1	65-78	65-78
< 3.0	E3	65-78	65-78
< 10	E10	65-78(a)	65-75
< 30	E30	65-78(a)	65-75
<100	E50	65-78(a)	65-75

a. For mixture Number 5, the specified VFA range shall be 73% - 76%.

Table 9: Superpave Gyratory Compactor (SGC) Compaction Criteria

Estimated Traffic (million ESAL)	Mix Type	%G_{mm} at (N_i)	Number of Gyrations		
			N_i	N_d	N_m
< 0.3	LVSP	91.5%	6	45	70
< 0.3	E03	91.5%	7	50	75
< 1.0	E1	90.5%	7	76	117
< 3.0	E3	90.5%	7	86	134
< 10	E10	89.0%	8	96	152
< 30	E30	89.0%	8	109	174
<100	E50	89.0%	9	126	204

Note: Compact all mixture specimens fabricated in the SGC to N_d. Use height data provided by the SGC to calculate volumetric properties at N_i. Compact specimens at optimum P_b to verify N_m.

Table 10: Aggregate Gradation Requirements

Standard Sieve	Percent Passing Criteria (control points)				
	Mixture Number				
	5	4	3	2	LVSP
1 1/2 inch				100	
1 inch			100	90 - 100	
3/4 inch		100	90 - 100	90 max	100
1/2 inch	100	90 - 100	90 max		75 - 95
3/8 inch	90 - 100	90 max			60 - 90
No. 4	90 max				45 - 80
No. 8	32 - 67	28 - 58	23 - 49	19 - 45	30 - 65
No. 16					20 - 50
No. 30					15 - 40
No. 50					10 - 25
No. 100					5 - 15
No. 200	2.0 - 10.0	2.0 - 10.0	2.0 - 8.0	1.0 - 7.0	3 - 6
Sieve	**Restricted Zone** (see notes)				
No. 4				39.5	-
No. 8	47.2	39.1	34.6	26.8 - 30.8	-
No. 16	31.6 - 37.6	25.6 - 31.6	22.3 - 28.3	18.1 - 24.1	-
No. 30	23.5 - 27.5	19.1 - 23.1	16.7 - 20.7	13.6 - 17.6	-
No. 50	18.7	15.5	13.7	11.4	-

Note: The final gradation blend must pass between the control points established. The following conditions must be satisfied in order for the final gradation blend to enter the restricted zone (restricted zone does not apply to LVSP):

1. Mixture types E03, E1, E10, E30 and E50 may enter the restricted zone provided the final gradation blend enters from above the maximum density line.

2. Mixture type E3 may enter the restricted zone provided the final gradation blend enters from above the maximum density line and the fine aggregate angularity of the final blend is a minimum of 43.

If these criteria are satisfied, acceptance criteria and associated incentive/disincentive or pay adjustment tied to this gradation restricted zone requirement which may be included in other contract documents, do not apply. Otherwise, final gradation blend has to be outside of the area bounded by the limits set for the restricted zone.

Note: Sand Ratio for LVSP – no more than 50 percent of the material passing the No. 4 sieve shall pass the No. 30 sieve.

Exhibit 5

Alternate Pavement Bidding Projects to Date as of 1-9-2012

Control Section	Job No	Route	Region	POB	POE	Contracting Method	Let Date	Fix Type
41064	53508	M-6	Grand	I-96	M-37	DBB	December-00	Reconst
41064/ 70025	53511/ 54361	M-6	Grand	M-37	US-131	DBB	December-02	Reconst
77024(44044)	74766	I-69	Metro	Lapeer/St. Clair County Line	Miller Road	DBF	August-08	Reconst
11056	50757/ 87343	US-31	Swest	State Line	US-12	DBB	March-09	Reconst
25132	44785	I-475	Bay	I-75	Bristol Rd	DB	November-09	Reconst
77111	80911	I-94	Metro	Fred Moore Hwy	N/Allington Rd	DBB	November-09	Reconst
64015	90073	US-31	Grand	Polk Road	Pentwater River	DBB	Mar-11	Reconst
56045	106848	US-10	Bay	Isabella Co. line	M-18	DBB	Nov-12	Major Rehab
70114	88886	M-231	Grand	M-45	Little Robinson Creek	DBB	Mar-13	New Const
82052	76899	US-24	Metro	Carter Rd	S. of Penn Rd	DBB	Oct-20	Reconst

Exhibit 6

Michigan Department of Transportation
Notice to Bidders Inquiry Response

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Contract ID: 11056-50757 Letting Date/Item Number: 0904 001

Responded By: Erin Kercheval, Assistant Development Engineer

The following question(s) and answer(s) are provided below in response to an inquiry received regarding the above project.

(Q) 1.) A detailed take-off of the HMA bid items are as follows:
a.) Line 0520 Bid Item 5020046 HMA 3E10: take-off quantity = 36,199 Ton; HMA 3E10 Bid quantity = 40,165 Ton; difference = 10%
b.) Line 0540 Bid Item 5020052 HMA 4E10: take-off quantity = 24,710 Ton; HMA 4E10 Bid quantity = 27,760 Ton; difference = 10%
c.) Line 0550 Bid Item 5020058 HMA 5E10 take-off quantity = 14,306 Ton; HMA 5E10 Bid quantity = 16,055 Ton; difference = 10%
2.) A detailed take-off of the Concrete pavement bid items are as follows:
a.) Line 1944 Bid Item 6027011 Conc Pavt, Misc, Nonreinf, 9.5", High Perf.: take-off quantity = 23,882 Syd; Bid quantity = 37,725 Syd; difference = 37%
b.) Line 1950 Bid Item 6027011 Conc Pavt, Nonreinf, 9.5", High Perf.: take-off quantity = 98,692 Syd; Bid quantity = 99,174 Syd; difference = negligible (0%)

(A) **We routinely estimate HMA quantities to include an additional 10% for overrun which occurs during standard construction practices. Due to the nature of the bidding procedures for this particular project, the HMA quantities shall be adjusted down to reflect actual plan quantities. This change shall be made in addendum No. 3.**

(Q) Addendum #2 replaced the "Notice to Bidder" in both the HMA and Concrete bid documents. The new Notice does not take the Lane rental cost into consideration. To be able to do a true comparison between Alternate Bids, shouldn't MDOT establish a line item for the contractor to bid the Lane Rental cost in both the HMA and concrete bid documents?

(A) **Line items will be added for Lane Rental items, under a new non-bid section per Addendum No. 3. The current Notice to Bidder will be removed and a new Special Provision for these items will be issued in Addendum No.3.**

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Contract ID: 11056-50757 Letting Date/Item Number: 0904 001

Responded By: Erin Kercheval, Assistant Development Engineer

The following question(s) and answer(s) are provided below in response to an inquiry received regarding the above project.

(Q) According to Addendum 3 the lane rental will be assessed according to Table 1 on Page 122B. Will each lane on US 31 be charged at $6,441.49 per day totaling $12,882.98 per day US 31 is closed during the course of construction when two lanes are taken on NB or SB US 31? Or will be a flat charge of $6,441.49 per day be charged regardless of the single or double lane closure. Please Clarify.

(A) There is no lane rental on this project. The USER COST DELAY for the main line pavement section is $6441.49 per day per lane closed on US-31.

(Q) Addendum # 3 calls out the user delays as a daily calculation for user delay. The previous spec on proposal page 276 shows the user delays as hourly costs.

The use of hourly calculations are much more accurate. The hourly cost also encourages less user impacts when tasks can be done in less than 24 hours. For example a lane might be opened at Noon on a Saturday when the work is completed if hourly usage is calculated. In the same scenario there is no incentive to open the lane until midnight.

Could this be revised back to the original hourly calculation?

(A) Bid the total number of days based on full days required to facilitate construction operations.

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Contract ID: 11056-50757 Letting Date/Item Number: 0904 001

Responded By: Erin Kercheval, Assistant Development Engineer

The following question(s) and answer(s) are provided below in response to an inquiry received regarding the above project.

(Q) The basis of this question is that the Contractor bids a dollar amount for User Delay Cost, Mainline such as $2,500,000.00 Lump Sum but the job goes faster than was estimated thus when the Assessments for User Delay Cost, Mainline are calculated to be an amount less than the bid, such as actual amount is only $2,250,000.00, do the remaining dollars get paid to the Contractor?

(A) The pay items listed in the Special Provision for Alternate Pavement Bid Calculations are for use in the determining the User Delay Cost to insert into the EUAC formulas for determining the low bidder. There is no payment to the Contractor with these items. If a Contractor uses more time to build the job than was used in the calculation of User Delay Cost, there will be an assessment of penalty based on the daily assessments in Table 1 on Page 2 in the referenced Special Provision.

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Contract ID: 11056-50757 Letting Date/Item Number: 0904 001

Responded By: Erin Kercheval, Assistant Development Engineer

The following question(s) and answer(s) are provided below in response to an inquiry received regarding the above project.

(Q) When submitting bids for item 0904 001 using expedite bid, the bid amount submitted currently includes the quality initiative for asphalt and concrete due to the fact this is a pre entered amount. Is this quantity going to be removed from option 1 or 2 prior to bidding the opposite option?

(A) **Any items listed in the proposal for either option, shall be included in the final bid amount of that option.**

(Q) This question is in regards to the User Delay question that was previously asked and page 5 of 5 under the notice to bidders for alternate pavement bid calculations. Where in Expedite Bid will the bidders enter the user delay total prior to submitting the bid to calculate the EUAC as seen in the table on page 5 of 5?

(A) **This Notice to Bidders is being modified under Addendum No. 2. User Delay Cost is being removed from the equation.**

(Q) Comparing the asphalt alternate and the concrete alternate, the shoulders on the concrete alternate show a transition from 9.5" to 6.5" to account for the slope difference in the subbase (2%) and the finished shoulder (4%). In the asphalt alternate, the cross section shows the asphalt is full depth across the shoulder section. Will the top of the subbase change to 4% or will the asphalt be thinned out at the outside shoulder?

(A) **The HMA section shall be constructed as shown in the typical. The HMA should not be thinned out, and the subbase shall remain at 2%. This means that the subbase will be less than 18" beneath the shoulders.**

ADDENDUM NO. 2 (Excerpt)

Proposal

13. In the HMA Proposal, **replace** pages 256 through 260, titled “NOTICE TO BIDDERS FOR ALTERNATE PAVEMENT BID CALCULATIONS” with pages 256 Revised through 257 Revised, titled “NOTICE TO BIDDERS FOR ALTERNATE PAVEMENT BID CALCULATIONS”.

14. In the Concrete Proposal, **replace** pages 276 through 280, titled “NOTICE TO BIDDERS FOR ALTERNATE PAVEMENT BID CALCULATIONS” with pages 276 Revised through 277 Revised, titled “NOTICE TO BIDDERS FOR ALTERNATE PAVEMENT BID CALCULATIONS”.

ADDENDUM NO. 3 (Excerpt)

Proposal

9. On page 29, **add** Section 0003 for non-bid items.

10. On page 29, under Section 003 **add** line number 2780, item description "1047051 User Delay Cost, Mainline", quantity and units 1.00 LS.

11. On page 29, under Section 003 **add** line number 2790, item description "1047051 User Delay Cost, Ramp B", quantity and units 1.00 LS.

12. On page 29, under Section 003 **add** line number 2800, item description "1047051 User Delay Cost, Ramp C", quantity and units 1.00 LS.

13. On page 29, under Section 003 **add** line number 2810, item description "1047051 User Delay Cost, Ramp E", quantity and units 1.00 LS.

14. On page 29, under Section 003 **add** line number 2810, item description "1047051 User Delay Cost, Ramp F", quantity and units 1.00 LS.

15. After page 89, **insert** SPECIAL PROVISION FOR ALTERNATE PAVEMENT BID CALCULATIONS.

17. In the HMA Proposal, **remove** pages 256 through 257, titled "NOTICE TO BIDDERS FOR ALTERNATE PAVEMENT BID CALCULATIONS".

18. In the Concrete Proposal, **remove** pages 276 through 277, titled "NOTICE TO BIDDERS FOR ALTERNATE PAVEMENT BID CALCULATIONS".

ADDENDUM NO. 5 (Excerpt)

Proposal

1. Page 8, line 0520, **delete** the item description, "HMA, 3E10," code no. 5020046, quantity and units 40,165.000 Ton.

2. Page 8, line 0540, **delete** the item description, "HMA, 4E10," code no. 5020052, quantity and units 27,760.000 Ton.

3. Page 8, line 0550, **delete** the item description, "HMA, 5E10," code no. 5020058, quantity and units 16,055.000 Ton.

4. On page 8, **add** the line number 0561, item description "5020317 HMA, 4E10, 2 ½ inch", quantity and units 178,973.00 Syd.

5. On page 8, **add** the line number 0562, item description "5020361 HMA, 5E10, 1 ½ inch", quantity and units 178,973.00 Syd.

6. On page 8, **add** the line number 0571, item description "5027011 HMA, 3E10, 3 3/4 inch", quantity and units 178,973.00 Syd.

7. After page 92, **insert** "SPECIAL PROVISION FOR SUPERPAVE HMA MIXTURES ON US-31", "SPECIAL PROVISION FOR SUPERPAVE HOT MIX ASPHALT PERCENT WITHIN LIMITS (PWL) ON US-31", and "SPECIAL PROVISION FOR DETERMINATION OF PAVEMENT THICKNESS ON US-31 BY THE CORING METHOD", consecutively.

8. In the HMA Proposal after page 244, **insert** "NOTICE TO BIDDERS US-31 ALTERNATE BID PROJECT".

9. In the Concrete Proposal after page 264, **insert** "NOTICE TO BIDDERS US-31 ALTERNATE BID PROJECT".