

# **MIDOT**

**Michigan Department of Transportation**

## **Final Report on the Alternate Bidding of Pavements on the M-6 Southbelt Project**

**August 2001**

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# **CHAPTER 1**

## **INTRODUCTION AND BACKGROUND**

### **1.1 Introduction**

The Michigan Department of Transportation (MDOT) has engaged the services of Parsons Brinckerhoff (PB) to develop recommendations for a process whereby alternate pavement bidding could be utilized on the M-6 South Beltline Project in Grand Rapids, Michigan.

Due to the specialized nature of this assignment, PB assembled a Team of subconsultants who are nationally and internationally recognized in the areas of pavement design, performance evaluation, rehabilitation and life-cycle cost analysis. Two Team members were selected based upon their involvement with each of the two pavement types and the third member was selected based upon expertise in the areas of pavement management systems and life-cycle cost analysis.

PB, in conjunction with MDOT, developed an outline for this assignment, which is as follows:

1. Public announcement
2. Individual meetings with representatives of the pavement industries
3. Preparation of a White Paper
4. Joint meeting with both industries
5. Formulation of recommendations on a process by the PB Team
6. Development of an alternate bidding process by the PB team in conjunction with MDOT

In initial discussions with MDOT, concerning this assignment, some basic guidelines were developed that must be incorporated into any process recommendations presented by the PB Team. The first guideline was that any process must provide a level playing field and provide a fair and competitive environment for all bidders. Second, any process must be structured within the framework of existing Michigan State Law as it pertains to the selection of pavements. Third, all stakeholders must be invited to participate in the development of a process. Fourth, that any recommendations made pertaining to a process must be technically sound. And last, that if the PB Team determines that there is no technically feasible way of devising a process for alternate bidding of pavements, our recommendations to MDOT will state that.

The public announcement was made to public officials, industry representatives and the press on August 19, 1999 in Grand Rapids, Michigan. The announcement stated MDOT's intention to attempt to develop a process for alternate bidding of pavement to be used on the M-6 South Beltline Project, identified the Team members and described the outline for developing a process. At the announcement, representatives from both the asphalt and

concrete industries were invited to participate in the development of an alternate pavement bidding process.

Following the public announcement, individual meetings with representatives of the two pavement industries were scheduled. The PB Team and representatives of MDOT met with representatives of the Michigan Asphalt Paving Association on October 19, 1999 and with representatives of the Michigan Concrete Pavers Association on October 20, 1999.

At the meetings, with industry representatives, the PB Team solicited industry concerns, issues, ideas and recommendations for an alternate bidding process. As a result of the meetings, a great deal of information was gathered and many aspects of that information are discussed in detail in Chapters 2 and 3 of the White Paper prepared by the PB Team.

As a result of the individual industry meetings a number of issues were found to be common to both industries as they pertain to alternate bidding. A list of the issues that both industries support and are opposed to are as follows:

Both industries support

- The use of current MDOT Standard Pavement Sections for both concrete and asphalt as developed using 1993 AASHTO Guide for Design of Pavement Structures
- The current MDOT procedures for determining life cycle costs of asphalt concrete overlays over rubblized PCC pavements and unbonded PCC overlays of old PCC pavements and would support similar procedures for determining life cycle costs for new asphalt and concrete pavements
- The existing 5-year warranty of Workmanship and Materials and would like to see this warranty applied to alternate bidding
- An Exceptional Pavement Performance incentive for pavements which exhibit exceptional performance after the initial 5-year warranty period
- A joint meeting with representatives of both industries, MDOT and the PB Team for the purpose of discussing a procedure for implementing alternate bidding and to attempt to reach consensus on issues necessary for the development of an alternate bidding process

Both industries are opposed to

- Design-Build where the contractor would be responsible for the design of the pavement section
- Responsibility of future pavement maintenance

Following the individual industry meetings each industry was asked to prepare a list of issues they felt were critical to the development of an alternate bidding process which would provide a level playing field and a fair and competitive bidding environment for all bidders. These issues and other issues, concerns and ideas raised during the individual industry meetings were incorporated into the agenda for the joint industry meeting which

was held on March 15, 1999 at the Genoa Woods Conference Center in Brighton, Michigan.

## 1.2 Background

Current practice is for MDOT staff to perform a life-cycle cost analysis for pavement type selection in accordance with Public Act No.79 of 1997, which states in part, "...The department shall develop and implement a life-cycle cost analysis for each project for which total pavement costs exceed \$1,000,000 funded in whole, or in part, with state funds. The department shall design and award paving contracts utilizing material having the lowest life-cycle cost. ....As used in this section, "life-cycle cost" means the total of the cost of the initial project plus all anticipated costs for subsequent maintenance, repair, or resurfacing over the life of the pavement. Life-cycle cost shall also compare equivalent designs and shall be based upon Michigan's actual historic project maintenance, repair, and resurfacing schedules and costs as recorded by the pavement management system, and shall include estimates of user costs throughout the entire pavement life."

In a continuing effort to design and construct and maintain high quality pavements, MDOT has adopted a number of practices and analytical tools that allow them to better manage their road system. Currently, MDOT performs a complete condition survey of the entire roadway system every 2-years. The pavement condition is then determined objectively using the Pavement Management System. Actual historical data can then be assembled to develop maintenance and service life lengths for the pavements and pavement maintenance strategies can be developed. This information can then be utilized in the life-cycle cost (LCC) analysis.

Equivalent pavement designs are determined by using 1993 AASHTO Guide for Design of Pavement Structures. Costs of initial pavement construction are determined from actual average unit prices bid on recent construction projects. MDOT compiles the average unit prices on a semi-annual basis and an 18-month rolling average is utilized in the LCC analysis.

MDOT, in conjunction with the University of Michigan, has developed a computer model to determine User Delay Costs related to roadway maintenance procedures. This program is used in determining User Delay Costs associated with the various maintenance procedures that must be performed during the life of various pavements.

When each element of the LCC analysis has been input for each of the various equivalent pavements, a pavement type selection is determined based on the lowest Equivalent Uniform Annual Cost (EUAC).

MDOT has worked closely with both the concrete and asphalt industries in developing LCC analysis procedures for major rehabilitation fixes such as Hot Mix Asphalt overlays over rubblized Portland Cement Concrete and Unbonded Concrete overlays over repaired concrete pavement. LCC analysis procedures have also been developed for both new and reconstructed Hot Mix Asphalt and Jointed Concrete Pavements. The procedure includes the determination of initial and future construction unit costs, pavement service lives, the

timing and extent of maintenance procedures required, and User Delay Costs associated with the initial construction and the maintenance procedures required during the service life of the pavements.

In addition to the agreement reached between MDOT and the concrete and asphalt industries on issues related to LCC analysis, MDOT has also worked closely with both industries in adopting innovative construction contracting methods.

Through cooperation with both industries, MDOT has developed Materials & Workmanship pavement warranty specifications. These specifications are being used on all projects that the Department is letting on the high traffic volume portion of the network. Approximately 350 projects have been let, to date, with pavement warranty specifications.

MDOT, working with both industries, has developed a procedure for incentive payment for Extraordinary Pavement Performance. The incentive payments apply to exceptional pavement performance beyond an initial warranty period and the amount is based on the savings realized by the increased service life exhibited by the pavement.

Given the innovative practices already adopted by MDOT and the level of partnering cooperation that exists between MDOT and the concrete and asphalt industries, the next logical progression would be the development of a process that would allow alternate bidding of pavement types.

## **CHAPTER 2 DEVELOPING A FRAMEWORK FOR AN ALTERNATE BIDDING PROCESS**

### **2.1 Introduction**

Following discussions with MDOT and the individual paving industry meetings the PB Team analyzed two basic approaches to alternate bidding of pavements. The first approach was for MDOT to provide pavement designs and a method of determining life-cycle costs for each pavement design. MDOT would also determine construction methods and would assume long-term risks associated with the pavement designs. Contractors would compete on the basis of the initial pavement costs adjusted by life cycle equivalency factors.

The second approach to alternate bidding of pavements would give the contractor the responsibility of designing a pavement structure that would meet or exceed performance specifications established by MDOT. The contractor would also assume the responsibility for ensuring that the pavement design provided meet long-term performance requirements established by MDOT. This latter requirement could be met by either a Design-Build-Maintain contract or a Design-Build-Extended Warranty contract.

It was clear from the individual paving industry meetings that neither industry wanted to assume the responsibility neither for the design nor for the long-term maintenance of the pavement. Additionally, MDOT did not want to relinquish their control of the pavement design or their control and responsibility of the long-term maintenance.

The PB Team in conjunction with MDOT began to develop a framework for an alternate pavement bidding process based on the first approach discussed above. With input received from both industries a number of design and construction issues were identified. These issues were distributed to all parties and were included in the agenda for the joint industry meeting.

### **2.2 Joint Industry Workshop**

The joint workshop was held with representatives of the Michigan Department of Transportation, Federal Highway Administration, Michigan Asphalt Paving Association, Michigan Concrete Pavers Association and the PB Team on March 15, 2000 at the Genoa Woods Conference Center in Brighton, Michigan.

The purpose of the workshop was to present key issues, pertaining to alternate bidding of pavement types, to the group and to attempt to reach the maximum level of consensus on those issues.

Professional facilitators were on hand to keep the group focused on the task, and to monitor the process and timing of the meetings, while, helping to ensure that all participants were recognized and given the floor to express their views.

The process of building toward consensus proceeded as follows. An issue was called by the facilitator, followed by a brief summary (2-3 minutes) by one of the team members to explain the issue and its implication for alternate bidding. This was followed by an open discussion period. Time limits were set for this discussion and were expected to last no longer than a half-hour unless a majority of members representing each industry requested a time extension.

During the discussion period the facilitator recognized individuals who wished to speak. The facilitator called on the individuals in the order recognized and gave them the floor to present their thoughts on the issue being discussed.

During the discussion period, an area was made available for small groups to meet to discuss issues and to prioritize possible alternatives to the original issues, which was then presented to the entire group.

Following the discussion period and when it appeared that there may be a consensus, or near consensus, a statement of the issue was drafted and a poll was taken of all group members. Each member was given the opportunity to express their view of the issue statement in one of five categories. The categories were as follows:

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

The poll was tallied and posted for all group members to see the overall distribution of the results.

Anyone indicating a (disagree or strongly disagree) was asked to explain their reasons and to offer alternative issue statements which were followed by more open discussions and another poll.

If a consensus cannot be achieved on any issue statement, the facilitator was to decide the point at which further discussion and polling would be fruitless and move on to the next issue.

“Consensus” was determined to have been reached if there were no “disagree or strongly disagree” indications and at least half of the participants “agree or strongly agree” to the issue statement.

The issues presented to the group were divided into three categories:

- Issues directly related to the preparation of a Bid Package
- Issues related to specific aspects of Pavement Design
- Performance Warranties

The guidelines for the workshop required that issues related to the Preparation of a Bid Package be addressed first and that the remaining issues be discussed within the remaining timeframe of the workshop.

The issues presented to the group were as follows:

### **Issues Related to the Preparation of a Bid Package**

1. Both pavement types should be bid on an area basis
  - Cores should be taken from both pavement types to insure the depth of the material placed
  - Strength requirements, incentives and penalties should be equivalent for both pavement types
  - QC/QA for both pavement types should be incidental to the pavements
  - Tack Coats required for asphalt pavement should be incidental to the pavement
2. Both pavement types should be placed using Line and Grade
3. Access to driving on prepared base material should be the same for both pavement types
4. Specification tolerances and requirements for control of thickness of layers should be the same for both pavement types
5. Warranties for Materials and Workmanship should be included in an Alternate Bidding Process
6. Extraordinary Pavement Performance Incentives for pavements which exhibit extraordinary performance beyond the initial warranty period should be included in an Alternate Bidding Process
7. Contractor's actual bid prices should be used to determine initial costs of pavement alternatives in the Life-Cycle Cost Analysis. All initial project costs should be included in the LCC analysis to eliminate unbalanced bids
8. Initial pavement acceptance should be equivalent for both pavement types

### **Issues related to Performance Warranty**

9. Performance Warranty
10. Ride Quality as it pertains to Performance Warranty

### **Issues related to Pavement Design**

11. Requirements for equal depth of frost protection for both pavement types
12. Credit adjustment to be applied to the concrete bid for 4-inch aggregate separator to replace geotextile separator
13. Equivalent drainage requirements for both pavement types
14. Equal strength design of shoulders for both pavement types

During the joint workshop the group determined that issues 9, 10, 11 and 13 were issues that required further discussions between MDOT and the two paving industries and would not be address at the workshop.

A consensus was reached on all the remaining issues and the group determined that all those issues should be incorporated into an Alternate Bidding Process.

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## **CHAPTER 3 DEVELOPMENT OF A FINAL ALTERNATE BIDDING PROCESS**

### **3.1 Introduction**

Following the joint workshop and the consensus on the issues presented at that workshop, it was determined that Alternate Bidding of Pavements was achievable and should be used on the M-6 South Beltline projects. Meetings were held between MDOT and the PB Team representatives to discuss how to incorporate the issues into a bidding package.

It was determined that the best approach to providing for alternate pavement bidding was to bid the pavement portion of the M-6 projects separately and to provide for all other work on the projects through separate construction projects that would be bid by conventional MDOT procedures.

Three separate projects would be prepared for the work on the M-6 projects.

1. Earthwork and Drainage
2. Paving
3. A third contract to include elements such as GuardRail, Signs, Pavement Markings and some final slope restoration

This approach would allow the Paving Contract to be bid in a fair and competitive environment and allow for the easiest evaluation of the bids and a simple comparison of the bid prices submitted.

Project Specific Special Provisions would be developed to incorporate the issues discussed at the joint workshop into a bidding package for the paving contract. In addition, the PB Team would provide guidance to the consultants preparing the construction plans for the Earthwork and Drainage and the Paving Contracts.

### **3.2 Incorporating Alternate Pavement Bidding into Earthwork and Drainage Contract**

At the time the decision was made to use Alternate Bidding of Pavements on the M-6 Corridor Project, design work on the earthwork and drainage portion of the project had already begun. The design was based on a Rigid Pavement Section and Plan Grade and Top of Clay Grades had already been set. PB was asked to provide guidance to the designers with respect to incorporating alternate bidding of pavements into the design.

A meeting was held on August 26, 1999 with representatives of MDOT, PB, Alfred Benesch & Co. and Parsons Transportation Group. At the meeting, the representatives of Alfred Benesch & Co. and Parsons Transportation Group were informed that the design and construction work would be divided into three separate contracts.

- Earthwork and Drainage Contract
- Paving Contract

A third contract to include elements such as GuardRail, Signs, Pavement Marking and some final slope restoration.

The designers were given a Flexible Pavement Section which is equivalent to the Rigid Pavement Section they were currently using for their designs. The designers were told that the overall total difference in thickness for the two pavement sections was approximately 4-inches. The two pavement designs are described in Tables 1A and 1B below.

Because the pavement section would not be known until bids for the pavement contracts are accepted and approved, some adjustments were needed to the typical Design Criteria used for the preparation of the Earthwork and Drainage Construction Plans. To accommodate either pavement section and to insure proper drainage and pipe cover, the designers were instructed to maintain the existing Plan Grade and the Top of Clay Grade based on the Rigid Pavement Section but to design ditches and pipe elevations based on the Flexible Pavement Section. This would insure that the roadway grade would match the grade on mainline bridges, that vertical clearance would be maintained on all bridges over M-6, that minimum cover would be maintained over pipes and that additional subbase material would not be required no matter which pavement section was selected.

The Grading and Drainage Contract would include the installation of all drainage except Open Graded Underdrains and/or Subbase Underdrains. These drainage elements would be included as part of the Paving Contract. The Grading and Drainage Contract would also include all permanent slope restoration on sideslopes and temporary restoration on top of Clay Grade in the form of temporary seeding and a mulch blanket. It was further discussed that the construction of bridge approach slabs should be included in the Grading and Drainage Contract.

As scheduled, the grading and drainage work for the first 6-mile section of M-6 was let in January 2000 with expected completion during the 2001 construction season. The paving contract, for this section of roadway, was let in December 2000. The grading contractor and the paving contractor are coordinating their work operations in order that all paving will be completed by the end of the 2001 construction season.

**Table 1A. I-196 to Ivanrest, and Kalamazoo to I-96**

<b>RIGID ALTERNATE</b>			<b>FLEXIBLE ALTERNATE</b>		
<b>Layer Thickness, millimeters</b>	<b>Layer Thickness, inches</b>	<b>Layer Description</b>	<b>Layer Thickness, millimeters</b>	<b>Layer Thickness, inches</b>	<b>Layer Description</b>
260	10.25	Jointed Plain Conc. Pavement (4.5-m Joint Spacing)	38	1.5	Bituminous Mix 4E30 Top Course
100	4	Open Graded Drainage Course	57	2.25	Bituminous Mix 3E30 Leveling Course
100	4	Aggregate Separator (21AA)	175	6.9	Bituminous Mix 2E30 Base Course
300	11.75	Sand Subbase	150	5.9	Aggregate Base Course (21AA)
			450	17.75	Sand Subbase
(100)	(4)	Open Graded Underdrains	(100)	(4)	Subbase Underdrains
760	30	Total Thickness	870	34.25	Total Thickness

*Table 1B. Ivanrest to Kalamazoo*

<b>RIGID ALTERNATE</b>			<b>FLEXIBLE ALTERNATE</b>		
Layer Thickness, millimeters	Layer Thickness, inches	Layer Description	Layer Thickness, millimeters	Layer Thickness, inches	Layer Description
280	11	Jointed Plain Conc. Pavement (4.5-m Joint Spacing)	38	1.5	Bituminous Mix 4E30 Top Course
100	4	Open Graded Drainage Course	57	2.25	Bituminous Mix 3E30 Leveling Course
100	4	Aggregate Separator (21AA)	200	7.9	Bituminous Mix 2E30 Base Course
300	11.75	Sand Subbase	150	5.9	Aggregate Base Course (21AA)
			450	17.75	Sand Subbase
(100)	(4)	Open Graded Underdrains	(100)	(4)	Subbase Underdrains
780	30.75	Total Thickness	895	35.25	Total Thickness

### **3.3 Incorporating Alternate Pavement Bidding into the Paving Contract**

The design firm CH2Mhill was selected to prepare the construction plans for the first paving contract on the M-6 South Beltline Corridor. Representatives of MDOT and the PB Team met with the designer to discuss how to incorporate alternate bidding into their design package.

The following elements of work that were to be included in the paving contract and specific design criteria to be used in developing the plans and specifications were discussed with the designers.

#### **Work to be included in the Paving Project:**

In an effort to level the playing field and to allow for fair and equitable bidding the Paving Project will only involve the final preparation of the subgrade surface and the paving of the roadway. The specific work elements will include:

- Removing mulch and temporary grass from the top of the subgrade surface. This work will be the same for either pavement type.
- Trimming of subgrade to final grade. The amount of work involved with this will be different for each pavement type because of the overall thickness difference in the two pavements. The additional subgrade trimming required for the Flexible Pavement Section will be set up as a Budget Item in the Bid.
- Placing all Pavement Layers from Sand Subbase to Top Course of pavement. Also included in this work will be the installation of either Open Graded Underdrains (for Rigid Pavement) or Subbase Underdrains (for Flexible Pavement).
- Final sideslope restoration as required due to contractor's paving operations.

#### **Design Criteria for Paving Project:**

- Since it will be up to the bidders to select a pavement type, two sets of Typical Sections will have to be included in the Paving Construction Plans. One set of Typical Sections for the Flexible Pavement option and one set for the Rigid Pavement option. These Typical Sections will show all geometry, grading points and elevations relative to Plan Grade. All final sideslopes, ditches and grading to catch points should be shown as existing since this work was performed under the Grading and Drainage Project.
- Both pavement types will be measured on a Square Meter basis. This will be addressed by a Special Provision that will be provided to the designers for inclusion in their Plans.
- Profile sheets should show Top of Clay Grades (this is the existing ground condition as a result of the work performed under the Grading and Drainage Project) and the Plan Grade or Profile Grades for the ultimate Top of Pavement. Profile sheets should also show pipes as existing in place.
- Since some amount of earthwork will be involved with the Paving Project, Erosion and Sedimentation Control should be shown on the Plans. This may be items, which were shown on the Grading and Drainage Plans with provisions for maintaining these items during the Paving Contract.

- A number of other provisions dealing with how pavements are constructed and how and criteria for acceptance will be dealt with through Special Provisions, which will be provided to the designers.

### **3.3.1 Developing Project Specific Special Provisions**

In addition to the design elements that were to be incorporated into the design plans for the paving contract, a number of Project Specific Special Provisions had to be developed to incorporate Alternate Bidding of Pavements into the contract.

A number of the project special provisions were developed by MDOT, CH2Mhill and PB. The following special provisions were developed to address the issues in an alternate bid contract.

#### **SHOULDER CORRUGATIONS ON M-6**

This provided for shoulder corrugations on either pavement type. The work is not paid for separately but all elements of the work shall be included in other items of work.

#### **ROADWAY GRADING, SPECIAL**

This provided for the removal and disposal of approximately 110 mm of existing subgrade material to facilitate the placement of bituminous pavement. The work is not paid for separately but all elements of the work shall be included in other items of work.

#### **AGGREGATE BASE – MODIFIED, 100 mm**

This provided for the placement of an aggregate base course in lieu of a geotextile separator under concrete pavement. This work is paid for under item Aggregate Base – Modified, 100mm.

#### **PREPARATION AND PRESERVATION OF THE GRADE ON M-6**

This provides for the work required to prepare, preserve and maintain the existing grade prior to removing or placing subgrade or any base materials. The work is not paid for separately but all elements of the work shall be included in other items of work.

#### **REMOVAL OF TEMPORARY DRAINAGE**

This provides for the work of removing temporary drainage items left in place as part of the Grading and Drainage project. The work is paid for as a Lump Sum item.

The following Special Provisions were developed by MDOT and PB and were provided to CH2Mhill for incorporation into their Plans.

#### **DOCUMENTATION OF BITUMINOUS CONSTRUCTION ITEMS ON M-6**

This Special Provision was prepared by revising the Frequently Used Special Provision (FUSP) 502D. All references to documenting average daily yield were deleted.

### **ACCEPTANCE OF THE AS-BUILT SUBGRADE AND SUBGRADE SURFACE**

This Special Provision outlines the steps for the acceptance of the subgrade by the paving contractor. Once the subgrade has been accepted by the paving contractor it will become his responsibility to maintain the subgrade in an acceptable manner.

### **MODIFICATIONS TO SECTION 502 OF THE 1996 STANDARD SPECIFICATIONS ON M-6**

This Special Provision changed the method of measurement for bituminous mixtures from tons to square meters.

### **FURNISHING AND PLACING MARSHALL BITUMINOUS MIXTURE ON M-6 (WITH SAMPLING FROM THE TRANSPORT TRUCK)**

This Special Provision was prepared by revising the FUSP 501J. Pavement Unit was defined for the purpose of testing and price adjustments; Lot size was changed to reflect a square meter unit; a Section was added to define how cores would be taken to verify pavement thickness and the associated price adjustments for deficient total thickness; Measurement and Payment Section was revised to identify how Bituminous Quality Assurance Testing would be measured and paid for; Bituminous Quality Initiative was deleted as a payment item.

### **FURNISHING PORTLAND CEMENT CONCRETE (QUALITY ASSURANCE) ON M-6**

This Special Provision was prepared by revising the FUSP 605A. Positive pay adjustments for QA were deleted; Critical Concrete QA items were identified along with Base Prices; Measurement and Payment Section was revised to reflect the budgeted payment item for QA; Concrete Quality Initiative was deleted as a payment item.

### **SUPERPAVE BITUMINOUS MIXTURES (METRIC) ON M-6**

This Special Provision was prepared by revising the FUSP 501F. Method of Measurement and Payment Sections were revised to reflect the bituminous mixtures being measured by square meters.

### **FURNISHING AND PLACING SUPERPAVE BITUMINOUS MIXTURE ON M-6 (WITH SAMPLING BEHIND THE PAVER)**

This Special Provision was prepared by revising the FUSP 501I. Sampling was defined as being from behind the paver; Pavement Unit was defined for the purpose of testing and price adjustments; Lot size was changed to reflect a square meter unit; a Section was added to define how cores would be taken to verify pavement thickness and the associated price adjustments for deficient total thickness; Measurement and Payment Section was revised to identify how Bituminous Quality Assurance Testing would be measured and paid for; Bituminous Quality Initiative was deleted as a payment item.

#### **DETERMINATION OF PAVEMENT THICKNESS ON M-6 BY THE CORING METHOD**

This Special Provision was developed to replace Michigan Testing Method 201-97. This SP provided for coring of both concrete and asphalt pavement; identified how cores would be measured and identified and how they would be recorded.

#### **PAVEMENT ACCEPTANCE FOR JOINTED PLAIN CONCRETE PAVEMENT ON M-6**

This was an old Special Provision that was developed in 1998 and has been used on previous contracts.

#### **PAVEMENT ACCEPTANCE FOR NEW SUPERPAVE BITUMINOUS PAVEMENT ON M-6**

This Special Provision was developed for this project and was intended to make pavement acceptance equivalent for both pavement types.

#### **NEW JOINTED PLAIN CONCRETE PAVEMENT WARRANTY ON M-6**

This Special Provision was developed by MDOT working with both paving industries. It defines the acceptance of the pavement and the criteria for determining the condition of the pavement for the initial 5-year warranty period and the remediation required.

#### **NEW SUPERPAVE BITUMINOUS PAVEMENT WARRANTY ON M-6**

This Special Provision was developed by MDOT working with both paving industries. It defines the acceptance of the pavement and the criteria for determining the condition of the pavement for the initial 5-year warranty period and the remediation required.

#### **EXTRAORDINARY PERFORMANCE INCENTIVE FOR JOINTED PLAIN CONCRETE PAVEMENT ON M-6**

This Special Provision was developed by MDOT working with both paving industries. It defines the criteria for incentives for concrete pavement which exhibits extraordinary performance for three years following the initial warranty period.

#### **EXTRAORDINARY PERFORMANCE INCENTIVE FOR SUPERPAVE BITUMINOUS PAVEMENT ON M-6**

This Special Provision was developed by MDOT working with both paving industries. It defines the criteria for incentives for superpave bituminous pavement which exhibits extraordinary performance for three years following the initial warranty period.

#### **DETERMINING LIFE CYCLE COST OF PAVEMENT ALTERNATES ON M-6**

This Special Provision identified the method of determining the life-cycle cost for the pavements. It identified all factors used in the computation including the maintenance strategies and costs for each pavement type and the adjustments to the initial costs for each pavement. An Initial Cost Credit for the project cost difference between a geotextile separator and an aggregate separator was identified for the concrete pavement alternate and an Initial Cost Credit for the project cost to undercut the existing subgrade by 110mm for the bituminous pavement alternate.

As each of the Special Provisions prepared by MDOT, CH2Mhill and the PB Team were developed, several draft versions were sent to both paving industries for their review and comment. All comments were reviewed and addressed before the Special Provisions were finalized and incorporated into the bid documents.

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## **CHAPTER 4 EVALUATION OF THE ALTERNATE BID PROCESS**

### **4.1 Preparing the Bid Package**

Several meetings were held between the representatives of the project designer, MDOT and the PB Team to insure the completeness of the plans and specifications and the coordination between the two. Since separate quantity calculations were required for each of the two pavement alternatives, these calculations were rigorously scrutinized to insure their correctness, completeness and equivalence.

The group worked together to insure that the designers understood the implications of the Project Specific Special Provisions and how they affected the Construction Plans and Quantities.

The Engineers Estimate was prepared by MDOT personnel using the quantities developed by the project designers and applying historic unit prices for the individual items of work.

Following the completion of the Bid Package, the project was advertised and the Bid Package was made available to perspective bidders. A Pre-Bid meeting was held to insure that the bidders understood the implications of the Special Provisions and how they were to prepare their bids. Bidders were given the opportunity to ask questions and to raise any issues pertaining to the Plans and Specifications.

### **4.2 Pre-Bid Meeting**

A mandatory Pre-Bid Meeting was held on November 9, 2000. The meeting minutes from that meeting are attached as appendix A. At the meeting a number of issues were raised by potential bidders following their review of the bid documents. As a result of the discussions it was determined that an addendum would be issued to address the issues discussed. The major issues that were addressed by the addendum are as follows:

#### **SUBGRADE ELEVATION**

It was determined that the Grading and Drainage Contract would not be completed prior to the letting of the Paving Contract. This allowed final grading of the subgrade to the required elevation for whichever pavement type was selected for the Paving Contract. This required modifications to the Special Provision ACCEPTANCE OF THE AS-BUILT SUBGRADE AND SUBGRADE SURFACE ON M-6. In addition, the Notice to Bidders was modified to state that MDOT would provide the awarded paving contractor with a finished subgrade at the proper elevation.

#### **AGGREGATE SEPARATOR FOR CONCRETE PAVEMENT DESIGN**

It was determined that the Contractor's would have the option of using either an aggregate separator or a geotextile separator for the concrete pavement design. This language was added to the Special Provision AGGREGATE BASE – MODIFIED.

**LIFE – CYCLE COSTS**

As a result of the final subgrade being provided to the paving contractor at the proper elevation and the option for either aggregate separator or geotextile separator for the concrete pavement design, the cost credits for these two items were eliminated from the Special Provision DETERMINING LIFE CYCLE COST OF PAVEMENT ALTERNATES ON M-6. Language was also added to the life cycle cost special provision which stated that the low bid would be determined based upon which bid had the lowest life-cycle cost and that any errors occurring in bids as a result of applying the formulas for life-cycle cost would be corrected by the Department and would not result in a rejection of the bid.

**AGGREGATE BASE UNDER SHOULDERS**

A note on the plans was revised to eliminate a conflict with the typical sections. The revised note defined the pay limits for Aggregate Base – Modified, 100mm and Open Graded Drainage Course, 100mm under freeway shoulders.

**PLAN CHANGES FOLLOWING AWARD**

To ensure a level playing field and to provide a fair and competitive bidding environment, the provisions for Value Engineering were eliminated from the paving contract. All potential bidders were made aware of this prior to and at the Pre-Bid Meeting.

**4.3 Opening the Bids**

Bids for the project were opened on December 1, 2000. The results are as follows:

**7.5 KM (6 Miles) OF PAVEMENT CONSTRUCTION ON M-6 FROM WEST OF PATTERSON AVE. EAST TO WEST OF THE CSX RAILROAD**

**CONTROL SECTION – 41064  
JOB NUMBER – 53508A**

Engineers Estimate -	\$10,428,690.75	Asphalt Alternate (Initial Cost Only)
	\$18,182.80 / ln-km/yr	Asphalt Alternate (Life Cycle Cost)
	\$11,486,689.16	Concrete Alternate (Initial Cost Only)
	\$19,421.20 / ln-km/yr	Concrete Alternate (Life Cycle Cost)

**BIDDERS:**

The following bid prices reflect the initial construction costs adjusted by the life-cycle cost procedure.

<b><u>Bidder</u></b>	<b><u>Total Bid</u></b> (initial cost)	<b><u>Life Cycle Cost</u></b> (per lane-kilometer per year)
Thompson McCully Company (Asphalt Alternate)	\$7,467,542.31	\$13,572.79
Ajax Paving Industries, Inc. (Concrete Alternate)	\$7,984,164.78	\$14,071.76
Interstate Highway Construction, Inc. (Concrete Alternate)	\$9,502,934.88	\$16,391.39
Klett Construction Company (Asphalt Alternate)	\$9,878,329.74	\$17,332.33
Rieth-Riley Construction Company (Asphalt Alternate)	\$9,915,229.17	\$17,389.88
John Carlo, Inc. (Asphalt Alternate)	\$11,002,477.20	\$18,681.65

**4.4 Life-Cycle Cost**

As has already been stated, the pavement contract was awarded to the bidder with the lowest life-cycle cost as described in the Special Provision DETERMINING LIFE CYCLE COST OF PAVEMENT ALTERNATES ON M-6. This is in accordance with the Michigan Public Act No.79 of 1997 which requires the Department to award paving contracts utilizing materials having the lowest life-cycle cost for projects where the total paving costs exceed \$1,000,000.

In an effort to maintain a level playing field and to provide a fair and competitive environment for all bidders, MDOT prepared the life-cycle cost special provision in conjunction with and with input from both paving industries. One of the most crucial elements in determining life-cycle cost is the required future maintenance costs associated with a pavement design. These costs are particular to the type of pavement. It has already been determined and accepted that the two MDOT pavement designs are equivalent. The two pavement preservation strategies were developed by MDOT using

historical data gathered on existing pavements and input into their Pavement Management System. This practice is very similar to those implemented by other State highway agencies. This ensures that the average service life of the standard pavement design strategies and rehabilitation alternatives represent the use of local materials, typical construction practices and specifications, and environmental conditions that are encountered in Michigan. Inherent in the preservation strategies is the determination of the initial service lives of the different pavement designs. These service lives have also been developed through historical data on existing pavements. Associated with the future maintenance costs are the user delay costs which can be expected as a result of the maintenance operations. MDOT, in conjunction with the University of Michigan, has developed a computer model to determine these user delay costs.

An enormous amount of background work was required to develop the pavement preservation strategies, pavement service lives and the associated user delay costs but, through the partnering efforts of MDOT and the two paving industries agreement has been reached by all parties.

MDOT uses the equivalent uniform annual cost (EUAC) method to calculate the life cycle costs on a per annum basis utilizing an interest rate as determined by the Federal Government's Office of Management and Budget. Both industries support the EUAC method and the interest rate.

To determine the life-cycle cost of a particular bid, the total bid (initial cost) and the expected future maintenance costs, represented as a present value by the use of accepted economics equations, are multiplied by the EUAC factor. The life-cycle cost of each bid can then be compared to determine the lowest life-cycle cost.

#### **4.5 Evaluating the Bids**

The bids were evaluated by MDOT personnel and the project was awarded to the bidder that submitted the bid with the lowest life cycle cost, Thompson McCully Co.

It was noted that the bids fell into three separate groupings. The two low bids, which represented each of the two pavement types, were 25% and 26% respectively below the engineers estimate and within 3.5% of each other. The second grouping of the next three lowest bids, two representing asphalt pavement and one representing concrete pavement, were 14%, 4.7% and 4.4% respectively below the engineers estimate.

The fact that each of these groupings contained bids from each of the pavement types seems to indicate that a competitive bidding environment was achieved.

On the face of the bid evaluation it appears that MDOT realized a savings of nearly three million dollars over the engineers estimate. However, an independent evaluation of the project bid tabulation by representatives of the PB Team indicates lower than expected unit prices from the two low bidders. Since this is the first project bid using Alternate

Bidding it is impossible to predict whether these savings will be realized on future Alternate Bid projects.

The PB Team attempted to contact representatives from each of the bidders to determine if any extraordinary problems were encountered in the preparation of the bids. The individuals who responded indicated that they had not experienced problems in preparing their bids. Some inconsistencies between plans and specifications were noted, but these were addressed at the Pre-Bid meeting and an addendum was issued prior to the opening of bids. The individuals who responded are listed below:

Thompson McCully Company	Jim Lindstrom
Interstate Highway Construction Co.	Jeff Ardelean
Klett Construction Co.	Jim Klett
Rieth-Riley Construction Co.	Kirk Bruekink

The PB Team also attempted to contact the heads of the two paving industry associations to get their impressions of how the process worked on this project. John Becsey from the Michigan Asphalt Paving Association responded that he felt the process worked well and the bid documents reflected the process as it had been presented to both industries prior to the opening of bids. Mr. Becsey did indicate that it would be helpful, on future projects, for the potential bidders to have more time in reviewing the bidding documents prior to submitting bids. If MDOT elects to continue the alternate bidding process on future projects, as bidders become more familiar with the requirements of the alternate bidding process, this should not pose any problems.

#### **4.6 Evaluating the Alternate Bidding Process**

Due to the involvement of all parties in the development of the Alternate Bidding Process and the partnering efforts between MDOT and the paving industries the Alternate Bidding Process appears to be a viable bidding tool which can be utilized on future projects.

It should be noted that the process was applied to a project involving Paving only. This was intentionally done to simplify the application of the process and the evaluation of the bids. Additional work and cooperation between MDOT and the paving industries will be required to apply this process to more conventional construction projects which include all aspects of a typical construction project.

The following is a summary of costs incurred by the Department to both develop a framework for the alternate bidding process and to develop the final process,

## **Phase I**

This process began with meetings between MDOT and the PB Team and was followed by the public announcement indicating MDOT's intention to attempt to develop an alternate bidding process. This announcement was made to public officials and representatives of the two paving industries at a briefing held in Grand Rapids, Michigan on August 19, 1999. Following the public announcement, individual meetings were conducted between MDOT, the PB Team and representatives of the two paving industries. These meetings were held on October 19<sup>th</sup> and 20<sup>th</sup>, 1999. The information gathered at these meetings was incorporated into the White Paper on Alternate Bidding prepared by the PB Team. The next step in the process was to develop the basic framework of an alternate bidding process and to present this to both industries and to attempt to reach consensus on the issues that would have to be addressed to make the process viable. This was accomplished at a joint workshop with representatives of MDOT, the PB Team, Federal Highway Administration and the two paving industries held in Brighton, Michigan on March 15, 2000. The effort required by MDOT personnel and the PB Team to get to this point in the process are as follows:

MDOT Personnel	350 hrs	\$30,000
PB Team	1250 hrs	\$136,000
Total Phase I Cost		\$166,000

## **Phase II**

Following the basic formulation of the process and the consensus building workshop, the task of implementing an alternate bidding process was begun. This required a careful review of special provisions that would be included in the bidding documents and revising existing special provisions and developing new special provisions to facilitate the implementation of the alternate bidding process. In addition to the special provisions required for the process, significant additional effort was required in the development of the contract plans to ensure coordination with the special provisions and the intent of the alternate bidding process. The effort required by MDOT personnel, the PB Team and the project designers (CH2Mhill) are as follows:

MDOT Personnel	700 hrs	\$56,000
PB Team	740 hrs	\$80,000
CH2Mhill	3000 hrs	\$400,000
Total Phase II Cost		\$546,000

It should be noted that the effort required to develop consensus on the approach, Phase I, was likely a one-time expenditure. Phase II activities will occur on every alternate bid contract and will vary depending on the specific characteristics of the project. Future Phase II costs will likely be less, in total and as a percentage of project costs, because

many of the specifications developed can be directly transferred to future projects with minimal modifications.

While Mr. Becsey from the Michigan Asphalt Paving Association felt the alternate bid process provided a fair and level playing field for all bidders, Mr. Risser from the Michigan Concrete Paving Association expressed some concerns about the equivalency of the two pavements with reference to testing procedures and evaluation of pavement performance.

Both the PB Team and MDOT feel the process has provided a fair and level playing field for all bidders and had realized significant savings for the Department and the Michigan taxpayers. Continued fine-tuning of the process will be required to address the concerns expressed by the Michigan Concrete Pavers Association, but, it appears the current process provides the Department with a viable tool for providing competitive bids.

The project is presently under contract and has not been completed, at this time. Therefore, this report is not able to summarize any increased construction engineering (CE) costs, incurred by the department, due to the alternate bid approach. Any increased CE costs will be documented at a future date.

#### **4.7 Recommendations**

A comparison of the bid costs versus the increased preliminary engineering costs indicated that letting the first M-6 contract, as an alternate paving bid contract, resulted in a net savings to the Department and the taxpayers of over two million dollars. However, this savings may or may not reflect real long term savings if the Department implemented alternate bidding on a large portion of the annual paving construction program.

The cost effectiveness, of the alternate bid process, cannot be determined until an evaluation can be made of the long-term pavement performance and maintenance costs of alternate bid projects versus those of traditional (non-alternate bid) approach. Only after these long-term evaluations are completed can the cost effectiveness of an alternate paving bid process be accurately determined.

At this time, the Department should consider letting additional alternate paving bid contracts to ascertain whether the initial cost savings realized on the first M-6 contract can be achieved on future projects. However, it is recommended that the Department continue to work with both industries to further improve the process prior to letting any additional alternate bid projects.

Initially, alternate bid contracting appears to give the Department one more tool to maintain a competitive bidding environment in the transportation industry.

**APPENDIX A**

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**M-6 West Patterson Avenue to CSX RR  
Mandatory Pre-bid Meeting  
November 9, 2000  
Meeting Minutes**

1) The items that will be included in the addendum are as follows:

a) Eliminate the cost credits in the “Determining life cycle cost of pavement alternates on M-6” special provision (SP) on page 178 of the proposal. Also, we added language regarding determination of the low bidder that it will be based on the bid that has the lowest life cycle cost according to this special provision. Finally, if the quoted unit and lump sum prices control and errors occurring when applying the formulas, outlined in this special provision, will be corrected by the Department. A bid will not be rejected because of the bidders failure to accurately apply the life cycle cost formula.

b) Added language to the “AGGREGATE BASE - MODIFIED” Sp on page 58 of the proposal to allow an option for the separator on the concrete design. The separator for the concrete design shall be either an aggregate separator or a geotextile separator, at the Contractor’s option. If the concrete alternate gets the bid, the contractor must advise the Delivery Engineer of the separator alternate to be used at the preconstruction meeting.

c) Added new notice to bidders to indicate that the concrete and asphalt have different total thickness and therefore the two design alternate require the finished subgrade be at different elevations according to the plans. Also MDOT will provide awarded contractor with a finished subgrade at the proper elevation.

d) Added some language to the notice to bidders on page 251 of the proposal to indicate that the contractors shall submit a bid that includes prices for either the concrete or bituminous work items along with the common items listed on the plans. Also added the contractor shall calculate the life cycle cost amount according to the procedure outlined in the DETERMINING LIFE CYCLE COST OF PAVEMENT ALTERNATES ON M-6 special provision.

2) Critical Path Method (CPM) SP on page 50 of proposal is not the most current version.

MDOT will include the most updated version in the addendum.

3) There is a conflict concerning the last paragraph of page 57 and what is on page 59 of the proposal.

We deleted the last paragraph from page 57 “ACCEPTANCE OF THE AS-BUILT SUBGRADE AND SUBGRADE SURFACE”SP.

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4) In the Progress Clause, page 34 of the proposal, the access date of September 24, 2001 to EB M-6 from station 57+700 to approximately 59+200 and WB M-6 from station 57+675 to approximately station 59+300" seems late compared to access dates for the rest of the project.

There will be no change to the dates in Progress Clause.

5) Concerns regarding responsibility of restoration issues for areas near the shoulders in the guardrail, restoration, signing, and pavement marking contract.

There will be a coordination clause in the signing and pavement marking contract to cover this issue.

6) The last paragraph on page 37 of the proposal regarding the contractor shall obtain all necessary permits from local government prior to placing construction signs on M-37. Is it necessary?

No. We will delete it from MOT SP.

7) Is there a change in the subbase quantity on page 4 of the proposal.

No.

8) The note on bottom right of sheet 31 need some clarification.

The note will be changed to read

“ UNDER MEDIAN (INSIDE) SHOULDERS, AGGREGATE BASE - MODIFIED, 100mm, AND OPEN-GRADED DRAINAGE COURSE, 100mm, SHALL BE PLACED AT THE SAME WIDTH AS THE PAVED SHOULDER. HOWEVER, IF THE PAVED SHOULDER WIDTH EXCEEDS 1.2m IN WIDTH (GUARDRAIL AREAS), THE CONSTRUCTION LIMITS FOR AGGREGATE BASE - MODIFIED, 100mm, SHALL BE LIMITED TO 0.9m BEYOND THE MAINLINE PAVEMENT EDGE. WHERE THE AGGREGATE BASE - MODIFIED, 100mm WIDTH VARIES FROM 1.2m TO 0.9m AND FROM 0.9m TO 1.2m, IT SHALL BE TRANSITIONED AT A RATE OF 1:2.

THE PAY LIMITS FOR AGGREGATE BASE - MODIFIED, 100mm, AND OPEN-GRADED DRAINAGE COURSE, 100mm, UNDER FREEWAY SHOULDERS SHALL BE LIMITED TO 0.9m BEYOND THE MAINLINE PAVEMENT EDGES, WITH ANY ADDITIONAL WIDTH OF EITHER ITEM TO BE INCLUDED IN THE PAY ITEM SHOULDER, FREEWAY.

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9) When will the addendum be issued.

By November 17, 2000.

10) If the paving contractor does not receive the completed subgrade by the dates in the progress clause, will the completion date be adjusted?

Yes the Delivery Engineer will determine an equitable adjustment.

Meeting was adjourned.

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