Pennsylvania Department of Transportation
Work Plan Special Experimental Project No. 14 (SEP-14)
Alternate Pavement Type Bidding
December 1, 2008, Revised December 18, 2008

Introduction

Approval by FHWA Headquarters is necessary for any non-traditional construction contracting technique which deviates from the competitive bidding provisions in 23 USC 112 and its implementing regulations 23 CFR Parts 635 and 636. Any construction contract which utilizes a method of award other than the lowest responsive bid (or force account as defined in 23 CFR 635 Subpart B) must be evaluated under Special Experimental Project No. 14 (SEP-14). These non-traditional contracting techniques may include best value, life cycle cost bidding, qualifications-based bidding or other methods where cost and other factors are considered in the award process.

The basic component of an SEP-14 proposal is a work plan which includes a brief description of the technique to be evaluated and a proposed evaluation plan. The Pennsylvania Department of Transportation (PennDOT) submits this SEP-14 work plan for review and approval of its process for Alternate Pavement Type Bidding projects. In this plan it is proposed to advertise projects with an alternate pavement type having an equivalent design life. This proposal is for consideration of Alternate Pavement Type Bidding on any and all applicable future projects and is not project specific.

Purpose

The proposed Alternate Pavement Type Bidding is being considered by PennDOT to take advantage of the cost competitive market between flexible and rigid pavements. Other states that have used alternate bidding have generally experienced increased competition and a reduction in bid prices on projects. With rising costs associated with paving materials and increasing demands on available highway funds, there is a challenge to reduce costs and actively pursue methods that have the potential to enhance the use of tax dollars, as well as motivation to determine pavement type based on low bid.

Scope

The scope of projects using this process will include the design and either construction or reconstruction of pavement. The design work includes the required surveys, geotechnical investigations, pavement design, bridge design as applicable, drainage design and roadway design. The designs will meet the current requirements of PennDOT's Design Manuals and AASHTO Standard Specifications for the Design of Highways and Bridges. Structural pavement designs will be determined using Darwin AASHTO 93 until PennDOT adopts the Mechanistic-Empirical Pavement Design Guide (MEPDG). A Life Cycle Cost Analysis (LCCA) will be performed by PennDOT in accordance with its Pavement Policy Manual (Publication 242). Construction will comply with PennDOT's Specifications (Publication 408) and special provisions. Typical sections will be provided in the Plans for rigid and flexible pavements. The contractor will be obligated to construct either the rigid pavement section or the flexible pavement section shown on the Plans.

In our efforts to promote fair competition between the bituminous and cement concrete paving industries and to realize lower construction costs through Alternate Pavement Type Bidding, the following steps are defined:

1. PennDOT will advertise and solicit bids for Alternate Pavement Type Bidding projects utilizing its normal bidding process. Prior to the bidding, the Life Cycle Cost (LCC) adjustment factor value will be provided as a present worth value that includes a discount rate. This factor will be added to the Contractors' initial bid price to account for future maintenance and rehabilitation actions including user delay so that bids are based on life cycle costs. The successful bidder will be the contractor with the least cost sum of the initial bid cost plus the LCC adjustment factor.
2. A new section of PennDOT's Pavement Policy Manual, Publication 242, has been developed to provide guidance for Alternate Pavement Type Bidding. This section is provided in Attachment 1. Also, provided in Attachment 2, are maintenance strategies for bituminous and plain cement concrete construction/reconstruction. Maintenance strategies for other treatments have been or will be defined the next edition of the Pavement Policy Manual.
3. All referenced sections of the Pavement Policy Manual have been discussed with and agreed upon by the bituminous and cement concrete paving industries.

Measurements

The success of Alternate Pavement Type Bidding will be measured by cost savings on the projects that employ this process. These savings will be determined as follows:

1. Compare the LCC estimates to the final bid.
2. Monitor increased design costs; since two alternates will need to be designed, the cost of the "second" alternate will need to be considered to determine overall savings.
3. Compare unit prices on alternate bid projects to projects with comparable quantities that are bid conventionally.

Schedule

1. Upon approval of this work plan, PennDOT will issue policy regarding Alternate Pavement Type Bidding projects.
2. PennDOT will advertise Alternate Pavement Type Bidding projects prior to the bid opening date and hold pre-bid conferences.
3. PennDOT will receive bids and determine the least cost sum of the initial bid plus the LCC adjustment factor and award the contract to the least cost sum bidder.
4. Within two years of approval of this work plan, PennDOT will provide a report of the outcomes of Alternate Pavement Type Bidding projects, as detailed below.

Reporting

PennDOT will prepare and submit a final report two years following issuance of the Alternate Bidding policy. This timeframe is proposed so that ample time is allowed for design and bidding of projects. Given current budget constraints, there may not be enough projects for a worthy analysis in a shorter timeframe. The report will include:

1. The paving industries' reaction to the alternate bid type selection process.
2. Individual bid items, quantity and cost for the work.
3. Life cycle maintenance actions and estimated costs used to develop the LCC adjustment factors.
4. An evaluation of the process.
5. Suggestions and recommendations for improving the process.

Attachment 1: Pavement Policy Manual, Publication 242, 11.7 "ALTERNATE BIDDING"

The following guidelines on Alternate Bidding have been developed to facilitate competition in the paving industry and to allow PennDOT to take advantage of fluctuating material costs without compromising sound engineering principles and practices.

It is in the best interest of PennDOT to apply Alternate Bidding whenever appropriate so that both industries are competitive and lower costs can be realized. Rather than a predetermined pavement type selection based on an LCCA and historical cost information, there is motivation to determine pavement type based on low bid.

Since Alternate Bidding requires the determination of a "C" factor, in the past PennDOT has only applied Alternate Bidding on projects for which an LCCA was performed. The "C" factor accounts for future maintenance and user delay costs and is added to the construction cost so that the low bid is based on life cycle costs. Additional requirements for Alternate Bidding are as follows:

- Both industries must be made aware of the upcoming Alternate Bidding project through a formal announcement process.
- Alternates must be "equivalent," meaning they are based on the same design life and compared over the same performance period.
- The bid package will indicate the appropriate "C" factors for each alternative, determined by PennDOT based on LCCA methodology for the project, described herein.
- Typical sections for all alternatives must meet RC standards, DM-2 and Pub. 242 requirements.
- Lane width, shoulder width, cross slope and all other geometric features unrelated to pavement type, shown on the Typical Sections must remain as per the plans.

11.7.1 Alternate Bidding for Structural Improvement Projects

As stated in Section 11.2, an LCCA is required for all structural improvement projects in excess of $3M on the Interstate System and $15M on all other facilities, regardless of Federal or State Oversight. A structural pavement design is performed for new construction, reconstruction, structural overlay of an existing pavement, etc. Alternative structural designs are performed for each pavement type and the LCCA is performed to analyze which equivalent structure is most cost effective over a prolonged performance period. It is important that all practical alternatives are considered when performing an LCCA for these projects, from major rehabilitation with either a bituminous or concrete structural overlay to total reconstruction with either pavement type.

Projects that require an LCCA should receive highest consideration for Alternate Bidding since "C" factors can be readily developed.

New construction, reconstruction projects and major rehabilitation projects that do not require an LCCA should also receive strong consideration for Alternate Bidding since they may constitute significant investment and opportunity for competition. The cost to perform an LCCA in order to determine "C" factors is significantly less than the potential savings in construction costs through Alternate Bidding.

11.7.2 "C" Factor Calculation – Structural Improvement Projects

Based on PennDOT's prescribed pavement maintenance cycles, provided in Section 12.2, a full-depth bituminous pavement, preserved with cyclic overlays/inlays, has an expected structural life of 50 years. A properly maintained concrete pavement has an expected structural life of 55 years; this includes a future application of a bituminous overlay. Since there is no annual maintenance cost, both alternates can be analyzed over a 50 year period and the LCCA can be performed based on Present Worth (PW). The term "structural life" references the point in time when the pavement can no longer be preserved and reconstruction is necessary; this is different than design life.

The "C" factor is determined by summing the PW of the future maintenance and user delay costs:

$C = (PW_{maint} + PW_{user})$

Where:
C = "C" factor
PW_{maint} = PW of future maintenance costs
PW_{user} = PW of user delay costs

11.7.3 Alternate Bidding for Pavement Preservation Projects

For pavement preservation projects, no structural analysis is performed since the intent and purpose of the program is based on extending the existing pavement life without adding any structure to the pavement. The Pavement Preservation Guidelines (PPG) in Appendix G define the criteria and nature of work which qualifies as preservation for Interstate, Expressway and non-Expressway Federal Aid projects.

Traditionally, an LCCA had not been used to compare alternatives in a preservation project since the different preservation treatments are appropriate at different stages of the life of the pavement and are not generally alternatives to each other. For example, the decision to diamond grind versus overlay is not based solely on economics, but also existing pavement condition. However, the introduction of technologies such as microsurfacing, unbonded concrete overlays and ultra-thin whitetopping provide alternatives to our approach to preservation and open the door to Alternate Bidding of preservation projects.

Pavement preservation projects may be considered for Alternate Bidding procedures without a complete LCCA. Further, Alternate Bidding may be employed to compare a 10 year preservation alternative with a 20 year alternative; the treatment with a 10 year life is repeated in year 10 so that the total analyzed life is equal. Table 11.5 lists potential alternates; these approaches may include, but are not limited to the following:

- Piloting pavement preservation strategies for extending the life of a pavement for up to 20 years.
- Alternate Bidding of a 10 year preservation alternate and a 20 year alternate.
- Best practices employed in other states regarding Alternate Bidding of pavement preservation projects.

Table 11.5 Potential Pavement Preservation Alternates

Existing Pavement Surface	Bituminous Alternate	Concrete Alternate
10 Year Cycle		
Bituminous	microsurfacing or 2 to 2.5" overlay	2" to 4" ultra-thin whitetopping (intersections and lower volume routes)
Concrete	4 to 4.5" overlay	diamond grind and CPR
20 Year Cycle		
Bituminous	2 to 2.5" overlay with mill and resurface at year 10	6.5" to 7" overlay with 1" diameter dowels
Concrete	4 to 4.5" overlay with mill and resurface at year 10	1" asphalt interlayer with a 6.5" to 7" overlay

11.7.4 "C" Factor Calculation – Pavement Preservation Projects

Since the expected life of preservation treatments is shorter than that of structural improvements, future maintenance costs are significantly reduced and a streamlined "C" factor can be determined rather than performing a complete LCCA.

"C" Factor Calculation Example:

For an existing composite pavement, based on typical current per linear mile costs, the "C" factors for Alternate Bidding of ultra-thin whitetopping versus bituminous overlay can be determined. Both alternates have a 10-year life and initial user delay costs can be discarded since they are assumed to be equivalent. The maintenance cost is based on the activities to be performed in the 5th year:

Concrete:
Clean and seal 25% of longitudinal joints, including shoulders
Clean and seal 25% of all transverse joints
Maintenance & protection of traffic
Seal coat or micro-surface shoulders (if bituminous)
For Ultra-Thin Whitetopping, cleaning and sealing joints is not applicable.

Bituminous:
Clean and seal 25% of sawed and sealed joints (if composite structure)
Crack seal 500 lineal feet per mile
Seal coat or micro-surface shoulders
Maintenance & protection of traffic

Attachment 2: Pavement Policy Manual, Publication 242, "Pavement Type Determination"

11.4.1 Bituminous Construction/Reconstruction

5 years	Clean and Seal 25% of longitudinal joints Crack Sealing 500 lineal feet per mile Seal Coat Shoulders or Microsurface Maintenance & Protection of traffic
10 years	2% Full Depth Patching Milling of Roadway Wearing Course Roadway Bituminous Inlay: 1.5" or 2.0" Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
15 years	Clean and Seal 25 % of longitudinal joints Crack Sealing 500 lineal feet per mile Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
20 years	2% Full Depth Patching Level: 0.5" Roadway and Shoulder Bituminous Inlay: 1.5" or 2.0" Type 7 Paved Shoulders Adjust guide rail and drainage structures, if necessary Maintenance and protection of traffic User Delay
25 years	Clean and Seal 25% of longitudinal joints Crack Sealing 500 lineal feet per mile Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
30 years	2% Full Depth Patching Milling of Roadway Wearing Course Roadway Bituminous Inlay: 1.5" or 2.0" Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
35 years	Clean and Seal 25% of longitudinal joints Crack Sealing 500 lineal feet per mile Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
40 years	2% Full Depth Patching 0.5" Level Roadway and Shoulder Bituminous Inlay: 1.5" or 2.0" Type 7 Paved Shoulders Maintenance & Protection of traffic
45 years	Clean and Seal 25% of longitudinal joints Crack Sealing 500 lineal feet per mile Seal Coat or Microsurfacing Shoulders Maintenance & Protection of traffic

11.4.2 New Concrete Construction, Reconstruction,

5 years	Clean and Seal 25% of all Longitudinal Joints, including Shoulders Clean and Seal 25% of all Transverse Joints Maintenance & Protection of Traffic
15 years	Concrete Patching, 2% of Total Pavement Area Diamond Grinding, 50% of Pavement Area Clean & Seal all Longitudinal Joints, including Shoulders Clean & Seal all Transverse Joints Maintenance & Protection of Traffic
25 years	Concrete Patching, 8% of Total Pavement Area Clean and Seal all Longitudinal Joints, including Shoulders Clean and Seal all Transverse Joints 60 PSY Leveling Course 4" or 4.5" Roadway and Shoulder Bituminous Overlay Saw & Seal Joints in Overlay Type 7 Paved Shoulders Adjust Guide Rail & Drainage Structures, if necessary Maintenance & Protection of Traffic
30 years	Clean & Seal 25% of Sawed & Sealed Joints Crack Sealing 500 lineal feet per mile Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
35 years	2% Partial Depth Patching Milling of Roadway Wearing Course Bituminous Inlay: 1.5" or 2.0" Saw & Seal Transverse Joints in Inlay Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
40 years	Clean and Seal 25% of longitudinal joints Crack Sealing 500 lineal feet per mile Seal Coat or Microsurface Shoulders Maintenance & Protection of traffic
45 years	2% Full Depth Patching 0.5" Level Roadway and Shoulder Bituminous Inlay: 1.5" or 2.0" Type 7 Paved Shoulders Maintenance & Protection of traffic

Note: The analysis period for new construction/reconstruction is 50 years. A residual life factor will be applied to account for the remaining life of the inlay placed at year 45.