

Special Experimental Project No. 14 (SEP-14)
Alternative Contracting Program Proposal (Work Plan)
Submitted by
Montana Department of Transportation (MDT)

Introduction

The Montana Department of Transportation (MDT) submits this pavement alternate bidding work plan for review and approval as a programmatic procedure under the provisions of Special Experimental Project No. 14 (SEP-14). This will be applied to future projects in coordination with the FHWA Montana Division. Use of alternate pavement designs and bids are being considered using a Life Cycle Cost Analysis (LCCA) model. Recent unit cost increases in HMA bid prices has created a more competitive environment between Hot Mix Asphalt (HMA) and Portland Cement Concrete Pavement (PCCP) when considering an LCCA adjustment. In this proposal, MDT would assume long-term risks associated with the pavement designs, while contractors compete on the basis of the initial pavement costs adjusted by a life cycle equivalency factor.

Purpose

This work plan identifies the use of alternate asphalt and concrete pavement sections on select future reconstruction and/or major rehabilitation projects. MDT will select projects to use alternative pavement sections based on cost and engineering analysis. The cost analysis will be used to select projects where PCCP is cost competitive with HMA pavements. The engineering analysis will be done after the cost analysis, and will consider PCCP pavement issues, such as differential roadbed settlement and traffic control. The selection of these projects will be coordinated with the FHWA Montana Division. Bid cost comparisons including a life cycle cost analysis (LCCA) will allow multiple surfacing alternatives to be compared on a life cycle equivalency basis. Using LCCA, bids having unequal service lives and maintenance costs can be compared on a cost per unit time basis. The proposed specification utilizing the alternate pavement bidding with bid adjustment approach (**ATTACHMENT 1**) is considered experimental and uses the following elements in determining the most responsive bidder:

- Contractor's bid for construction
- Valuation for future rehabilitation costs based on LCCA
- Life cycle equivalency factor

The Life cycle equivalency factor (LCEF) is the present worth of the additional future rehabilitation and maintenance costs associated with the HMA alternative. This amount, or a component, will be added to total cost on bid proposals using the HMA alternate. MDT will accept the lowest responsible bid of the HMA + LCEF or PCCP alternates. Inclusion of the LCEF provides the benefit of documenting future rehabilitation strategies and anticipated pavement performance. The LCEF amount will be determined prior to the bid and included in the bid documents. The procedure used

by MDT for LCCA is described in **ATTACHMENT 2**. The basis for the methodology used to conduct LCCA follows an interim technical bulletin published by the Federal Highway Administration as publication number FHWA-SA-98-079, Life Cycle Cost Analysis in Pavement Design.

The experimental bidding method outlined in this work plan intends to capitalize on the cost competitive market emerging between hot mix asphalt (HMA) and Portland cement concrete pavement (PCCP). Due to oil price volatility and cost escalation HMA prices have been difficult to estimate. These increased prices have created a situation where PCCP is more cost competitive. In addition, increasing demands on limited highway funds necessitates methods to maximize use of highway tax dollars.

As PCCP alternate surfacing projects are bid, MDT anticipates greater investment in PCCP surfacing capabilities within the contracting community which has the potential to lower bid prices

Scope

This work plan includes a request to authorize use of the outlined procedures on a programmatic basis to include future reconstruction and major rehabilitation projects. These projects will be coordinated with the FHWA Montana Division prior to final selection. Additional value engineering proposals related to pavement type changes will not be accepted for these projects.

Schedule

MDT is requesting to apply the outlined alternate pavement bidding process to reconstruction and major rehabilitation projects between FY2010 through FY2015.

Evaluation / Reporting

During the evaluation period, between FY2010 through FY2015, MDT will develop project specific reports that assess various aspects of the alternate pavement bid projects. These areas include, but are not limited to, the following:

- Cost comparison between unit bid prices to engineer's estimates and to previous bid prices for similarly sized projects
- Evaluate number of bidders to determine level of competition
- Document individual project information
- Life Cycle Cost procedures and calculations used for project
- Evaluate whether any irregularities occurred within the bidding process
- Document bid results from contractors

This report will be submitted to FHWA Montana Division at the conclusion of construction for each project. By September 30 of each year during the study period, MDT will consolidate the individual project reports and develop an annual summary. This report will consolidate information from the individual project reports; analyze the performance of the experimental bidding technique; summarize contractors and

individual MDT comments and concerns; note any problems with the experimental bid process; and provide recommendation whether future use will be continued...

Archived

Attachment 1

Proposed Specification Language*

1. PAVEMENT OPTIONS [102] (Added ##-##-##)

A. Optional Mainline Pavements. Construct the mainline surfacing using either Portland cement concrete pavement (PCCP) or asphalt plant mix surfacing (PMS) in accordance with the contract.

B. Bid Preparation. Separate surfacing options designating the associated bid items, descriptions, and quantities are included as part of the contract. Only bid one of the two options. The bid total electronically printed on the last page of the Schedule of Items will reflect the total of the base bid items plus the total of the chosen option.

C. Low Bid Determination. The Department will add \$ 0.00 to the total bid when the PMS option is selected by the bidder. This value is to factor in the life cycle maintenance cost analysis of the roadway and will be used to determine the low bid. This value does not represent an additional payment to be made to the successful bidder.

**Special Provision Language modeled after the Missouri Department of Transportation's specifications.*

Attachment 2

Bidders may submit bids using one of the two pavement options under consideration for this project. Each bidder must choose its preferred pavement option and submit only one bid. The submission of more than one bid proposal for the same work from an individual firm or corporation under the same name or from an affiliated company will result in the rejection of the bids from those bidders.

The basis for the added dollar value is the Department's estimated cost difference for the future rehabilitation needs of the two pavement options over the 40-year anticipated performance for each pavement option (Life Cycle Cost Equivalency Factor). The life cycle cost equivalency factor is using the following example as a guide:

Archived

LCCA Example

40-YEAR LIFE CYCLE COST ANALYSIS Rural High Volume 5-lane Highway

ALL COSTS PER MILE

Discount Rate = 2.8%

Rural 5-lane PCCP Section - June 2008 Project Costs				
	Cost (\$)	Type of Maintenance	Year of Maintenance	Present Worth
Initial Construction	\$1,695,000		0	\$1,695,000
Maintenance #1	\$595,000	Mill & Fill (shoulders), Chip Seal, Concrete Rehab	20	\$342,495
Salvage Value			40	\$0
Total Cost				\$2,037,495

Rural 5-lane PMS Section - June 2008 Project Costs				
	Cost (\$)	Type of Maintenance	Year of Maintenance	Present Worth
Initial Construction	\$1,564,000		0	\$1,564,000
Maintenance #1	\$72,000	Chip Seal	7	\$59,345
Maintenance #2	\$520,000	Overlay, Chip Seal	12	\$373,324
Maintenance #3	\$780,000	Mill & Fill, Chip Seal	19	\$461,557
Maintenance #4	\$72,000	Chip Seal	26	\$35,117
Maintenance #6	\$1,309,000	PMS Rehabilitation	30	\$571,671
Maintenance #7	\$72,000	Chip Seal	37	\$25,917
Salvage value (20 years remaining on Year 30 Rehabilitation)	-\$1,042,667		40	-\$345,478
Total Cost	\$3,346,333			\$2,745,453

Life-Cycle Cost Analysis (LCCA) is a process for evaluating the total economic cost of a pavement by analyzing initial costs and discounted future maintenance costs over a pre-determined analysis period. The initial construction costs will be determined from the Engineer's estimate. The following LCCA procedure will be used to determine the discounted future maintenance costs for each pavement alternative.

The LCCA analysis period is 40 years. A 40-year LCCA corresponds with the PCCP structural design life. The future maintenance schedules have been developed based on historical performance. The future maintenance schedule for interstate and other heavy traffic routes is as follows:

Flexible Pavement Alternative

Year 7: chip seal (full width of mainline and shoulders);

Year 12: 0.2' overlay with chip seal (full width of mainline and shoulders)

Year 21: 0.2' mill and fill with chip seal (full width of mainline and shoulders).

Year 26: chip seal (full width of mainline and shoulders)

Year 30: major pavement rehabilitation (full width of mainline and shoulders)

Year 37: chip seal (full width of mainline and shoulders)

Year 40: Salvage value of remaining 20 years of pavement life remaining from major rehabilitation completed in year 30

Rigid Pavement Alternative

Year 20: Concrete Rehab(Diamond grinding (mainline plus one foot of shoulder), full depth repair 2% of mainline surface area, reseal joints) and mill and fill and chip seal shoulders

Year 40: End of pavement life cycle, no salvage value

To account for the time-value of money, all future maintenance work is discounted using the real discount rate for 30-year treasury notes and bonds (currently 2.8% annually). This rate is published by the White House Office of Management and Budget in OMB Circular No. A-94 Appendix C (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).

The discounted future maintenance costs are then added to the initial construction costs and the net present value of the alternatives are compared. The LCCA equivalency factor is the difference between the rigid and flexible alternatives.

The formula for applying the discount rate is as follows:

$$(P/F, i\%, n) = (1 / (1 + i)^n) \times \text{Present Construction Cost}$$

where:

(P/F, i%, n) = discount factor

i = discount rate (2.8% from OMB Circular A-94 Appendix C)

n = year costs occur

Initial construction costs will include pavement material costs only based on the assumption that all other project costs will be equal. The initial construction costs will be calculated based on quantities and bid item prices found in the engineer's estimate.

Future maintenance work costs will be calculated using Plan quantities and average annual cost per square yard for each treatment type (i.e., chip seal, overlay, etc.) The cost per square yard is published annually by MDT's Pavement Analysis Section. Procedures used to calculate cost per square yard can be found at http://app.mt.gov/pvms/docs/2008_pavement_condition_report.pdf.