

ALTERNATIVE PAYMENT AND PROGRESS REPORTING METHODS

Task # 2

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INTRODUCTION

The Federal Highway Administration's (FHWA) International Technology Scanning Program recently sponsored a scan tour to Canada and Europe investigating "construction management practices for effective project delivery, contract compliance, and quality assurance." The investigation focused on innovative practices related to the management and administration of construction contracts that have the potential for application in the United States. One of the key areas investigated by the scan team was measurement and payment for construction. The team found that a broad spectrum of methods were used, in some cases similar to practices in the U.S.; however, the trend was towards more contractor self-monitoring of progress, and greater use of contractor invoicing, and milestone and lump sum payments to streamline the reporting and payment process and create incentives aligned with project or customer goals. In light of these findings, an FHWA and AASHTO-sponsored Expert Task Group was formed to further investigate the use of alternative measurement and payment methods in the U.S., focusing on the status of use, examples, advantages and disadvantages, and impacts on traditional construction management functions.

This white paper examines the use of alternative payment strategies in the U.S., including lump sum and milestone payment, measurement by plan quantities, contractor invoicing, incentive/disincentives, alternative retainage, and contingency strategies. It contrasts these methods with the traditional payment system, summarizing how and where alternative payment methods are being applied. It provides examples from states where alternative payment strategies are being used. Additionally, to the extent that agencies have gained experience with these methods, it identifies advantages and disadvantages as perceived by state DOT's and contractors, and how these methods affect data collection, work inspection, audits, adjustment of quantities or change orders, and prompt payment. Alternative payment strategies have also been associated with advanced project controls systems incorporating cost-loaded CPM schedules, a Work Breakdown Structure (WBS) and cash flow curves to better forecast and control project payments. This paper is limited to a snapshot of the methods noted above.

TRADITIONAL PAYMENT SYSTEM

Under a traditional unit-priced, design-bid-build contract for highway construction, contractors are required submit a bid consisting of the contractor unit prices multiplied by the estimated quantities provided by the owner for each bid item in the bid tab. As the work progresses, the owner or its representative is responsible for inspecting and measuring the work, and making partial payments based on detailed take-offs of installed quantities for each unit-priced item. Additional compensation may result from variations in bid quantities, extra work, or other causes defined in the change provisions of the contract.

The traditional measurement and payment method can be cumbersome, especially on large projects where the processing of approvals, measuring of work, and calculation of quantities consumes significant time and resources. Under the traditional unit-price

approach, the owner retains the risk of quantity variations, compensating the contractor for actual quantities installed. This tends to focus more inspector attention on quantity than quality, requires more time and effort to prepare pay estimates, and does not prevent disputes that may arise over changes in the work related to pricing or variations of quantities. These factors can contribute to delayed project completion and cost growth often experienced on traditional unit-priced, low bid contracts.

The use of alternative measurement and payment methods such as lump sum and plan quantities streamlines the payment process by reducing or eliminating the need for detailed owner quantity measurement and calculation. The reduced administrative burdens on DOT staff can result in streamlining the payment process and placing greater focus on quality. The use of milestone and incentive/disincentive payment methods can also encourage a contractor to perform at a higher level in certain areas of importance to the project, be it timely delivery, limiting disruption to travelers, or technical innovation. State DOTs are transitioning to alternative payment methods, for example the use lump sum items within traditional contracts, and are experimenting with other alternative payment strategies to improve efficiency and performance. The sections that follow address the use of lump sum payment, measurement by plan quantities, milestone payments, and other incentive payment strategies used in the U.S. highway construction.

LUMP SUM PAYMENT

Lump sum payment is commonly used for design-build contracts in the U.S., but has been increasingly applied to traditional low-bid highway contracts for various bid items and more recently for contracts involving categories of work that lend themselves more to lump sum pricing.

A 35 state survey of contracting techniques for work zone traffic control conducted in 2000 by Montana DOT and FHWA indicated that a significant percentage of the states surveyed had moved to lump sum pricing or a combination of lump sum and unit prices for traffic control items.¹ Some agencies have standardized the use of lump sum payment for traffic control. For example, Washington State DOT has developed criteria, procedures, and special provisions for lump sum traffic control.² Florida³ and Alaska⁴ DOT have moved even further towards lump sum payment, developing guidelines for lump sum projects for various types or items of work.

How Implemented?

In contrast to a traditional unit-priced bid item, the DOT will not provide quantity estimates for lump sum items in the bid package. The plan sheets for a lump sum project typically will not include detailed quantity tables. The contractor is responsible for developing quantity take-offs from the plans for estimating a lump sum item or items for a project.

Furthermore, lump sum contracts for design-build or traditional projects are administered differently than unit-priced contracts. The contractor will typically develop a schedule of values for the project after the bid phase. The DOT and contractor will then agree on a

payout schedule based on the schedule of values and in some cases a cost-loaded CPM schedule. Under a lump sum contract the contractor will prepare and submit monthly pay estimates based on progress as a percentage of the lump sum prices, not based on detailed measurements of actual quantities by the DOT. Thus, DOT construction personnel are no longer responsible for measuring and documenting quantities, and preparing invoices; instead, inspectors can focus more on ensuring that the work meets the quality requirements for the contract.

Adjustments to a lump sum contract can result from an owner-dictated scope change, or adjustments to material quantities or deficiencies based on a pre-determined unit price. In some cases the owner, for example Florida DOT, may include a contingency price for a lump sum contract that provides a vehicle to reimburse the contractor for additional work not covered in the contract.⁴

Certain projects lend themselves more readily to the use of lump sum contracting. Florida³ and Alaska⁴ DOT's Lump Sum Project Guidelines recommend that lump sum contracts are best applied to relatively simple projects with a well-defined scope, a low risk of unforeseen conditions, and not likely to change in scope or provide less than the required quantities. Some examples of projects that fit these criteria are bridge painting, fencing or guardrail installation, intersection improvements where utilities are known, landscaping, lighting, minor road widening, simple milling or resurfacing, signage, traffic signals, and sidewalks. Florida and Alaska DOT also identify projects that will not make good candidates for lump sum contracts. These include urban construction, major rehabilitation or repair, subsurface earthwork, concrete pavement repairs, and similar projects where quantities are unknown or difficult to estimate, or may change significantly during construction.³

<p>BEST LUMP SUM PROJECTS</p> <ul style="list-style-type: none"> • Well-defined Scope • Low Risk of unforeseen conditions • Project scope unlikely to change during all phases <p>NOT GOOD CANDIDATES FOR LUMP SUM PROJECTS</p> <ul style="list-style-type: none"> • Urban Reconstruction • Major Rehab or Repair • Subsurface Earthwork • Concrete pavement repairs

To further gauge the use of lump sum payment practices within the U.S. highway industry, Figure 1 summarizes the use of lump sum bid items among 14 state DOTs based on a review of their current specifications. Several items, especially those with a higher

Figure 1. State DOTs Using Lump Sum Payment

	Mobilization	Structural Steel	Concrete Structures	Cleaning/Painting Steel	Demolition/Removal of Str.	Maintenance of Traffic	Landscaping & Maintenance	Cleaning & Grubbing	Lighting	Traffic Signals	Temporary Structures/Falsework	Structural Excavation	Signage	Surveying	Pavements/Curbs/Paths	Reinforcement Steel	Piles/Test Piles	Irrigation Systems	Portland Cement	Timber Structures	Railings/Guardrails/Fencing	Pavement Markings	Bridge Drainage System	
Arizona		X	X		X	X		X				X				X								
California	X			X			X	X										X						
Colorado	X				X		X	X	X					X										
Florida	X	X		X		X		X	X		X												X	X
Indiana		X	X	X	X	X	X	X			X	X			X									
Iowa	X			X	X	X				X				X										X
Maryland	X	X	X	X	X	X	X	X				X	X			X			X	X	X			
Michigan	X					X	X																	
Minnesota	X			X	X		X	X	X			X												
N. Carolina	X	X		X	X	X		X	X		X	X		X	X									
Pennsylvania	X		X		X	X		X	X	X	X		X	X			X							
Texas	X			X	X	X					X							X						
Washington	X	X	X	X	X	X	X	X		X		X	X	X				X						
Wisconsin				X		X			X		X	X										X		
Total	12	6	5	10	10	11	10	10	6	6	6	7	4	5	2	2	1	2	1	1	2	1	2	

frequency of use, maintenance of traffic, paint, lighting, and landscaping fit with the types of projects that are considered good candidates for lump sum projects. However, some other items using lump sum, for example demolition, excavation, and piles might be considered less than ideal candidates based on the difficulty in estimating quantities and the potential for significant variations in quantities. Closer inspection of the specifications, particularly excavation, indicates that some DOTs provide a mix of lump sum or unit price or provide an option to use one or the other. Thus, it appears that the project delivery method, specific conditions, and complexity of the project will determine when and to what extent lump sum items are used.

Advantages

There are perceived advantages to the use of lump sum contracting for the DOT and the contractor. From the DOT perspective, lump sum payment reduces the cost and time of design and contract administration to calculate, measure, and verify quantities. During design development, the plans for lump sum contracts will not include detailed computations or quantity take-offs resulting in less design effort. In the case of traffic control, the DOT will transfer responsibility to the contractor for developing a detailed traffic control plans and estimating quantities as a basis for a lump sum bid.

During the construction phase, lump sum shifts the responsibility for estimating progress and invoicing to the contractor, creating a more streamlined payment process. The paperwork required from field inspectors to measure quantities and prepare an invoice is reduced or eliminated, freeing up DOT staff to concentrate on monitoring the quality of the work.

With lump sum contracting, the contractor will use an agreed schedule of values to determine the percent complete for the item and generate an invoice for payment. DOT will make regularly scheduled progress payments based on the percent complete for the item with the expectation that at the completion of the project, the work will be completed for the lump sum price submitted by the contractor. Fewer DOT inspection staff are needed to administer the work and there is less likelihood that the DOT will incur changes due to quantity variations.

TRADITIONAL UNIT-PRICED CONTRACT ADMINISTRATION

- ✓ If the work, for example Clearing and Grubbing, is administered under a traditional unit-priced pay item, the DOT inspector would be responsible for daily monitoring and measuring the quantity of cleared area, recording the data, and inputting data into the DOT financial management system (Field Manager or a similar system). The DOT would generate the monthly or periodic payment estimates for that item and then pay the contractor.

Lump sum bidding can further streamline unit items into bundled items reducing the administrative burden. For example, under lump sum traffic control the contractor would submit a single lump sum bid for developing, implementing, and maintaining traffic control for a project. Under traditional unit-priced traffic control, many traffic control items are typically priced and tracked separately.

Lump sum contracts create built-in incentives for contractors to control costs and work more efficiently. Lump sum contracts are more performance-oriented, providing

flexibility in contractor means and methods, which can lead to monetary savings or better ability to manage resources.

For lump sum projects the contractor often has responsibility for invoicing. Because requirements for detailed quantity measurements by the DOT are eliminated, payments can be processed more quickly and efficiently leading to improved coordination and cooperation among all the project parties.

Disadvantages

Lump Sum bids involve inherently greater risk/reward than unit-priced bids. The contractor assumes the risk for quantity overruns. This perceived risk might cause the contractor to add more contingency to bid prices, particularly if there is uncertainty in the estimated quantities for the lump sum items.

A potential DOT risk is that it will pay the lump sum price when total quantities under run estimated amounts. Other perceived DOT concerns include the potential for front-end loading particularly when quantities are difficult to estimate, and less control by the DOT over quality and safety when the contractor’s primary focus is on cost and schedule in a lump sum environment.

While some DOTs have reported that lump sum contracts reduce the number of change orders related to quantity variations, owner-directed extra work, unforeseen conditions, or other unanticipated events may arise on any project that must be resolved through the normal change order process. Florida DOT has developed internal guidelines for contract modifications on lump sum projects.⁴ These guidelines require that the contractor submit a detailed estimate for the additional work and caution that the Engineer should not rely on the contractor’s schedule of values but develop an independent estimate based on historical data or statewide averages, and conduct an entitlement analysis before issuing a contract modification as noted in Figure 2.

Fig 2. Example of a Lump Sum Change Order Analysis [FDOT “Lump Sum Project Guidelines” 2005]

Reason: Plan revisions issued to fit actual field conditions
 Description: Add sidewalk, drainpipe, mitered end section, and construct a turnout to fit existing field conditions.

CONTRACTOR'S ESTIMATE:				
Item	Quantity	Units	Unit Price (\$)	Extension (\$)
QC technician	8	HR	49.50	396.00
BG 01 Driveways	59	SY	23.10	1,362.90
6" Concrete	59	SY	23.10	1,362.90
4" Concrete	312	SY	17.60	5,491.20
Grading for driveways	118	SY	6.79	801.22
Grading for sidewalks	312	SY	1.74	542.88
Pipe Work	1	LS	5,687.00	5,687.00
				<u>\$15,644.10</u>
			Bond 1.5%	\$234.66
			Total Change Order	\$15,878.76
ENGINEER'S ESTIMATE (Based on previous work on this project and Statewide Averages):				
Item	Quantity	Unit Price (\$)	Extension (\$)	Reference
QC technician	8 Hr	49.50	396.00	Contract Unit Price
BG 01 Driveways	59 SY	23.10	1,362.90	Contract Unit Price
6" Concrete	59 SY	23.10	1,362.90	Contract Unit Price
4" Concrete	312 SY	17.60	5,491.20	Contract Unit Price
15" M.E.S.	4 Ea.	657.50	2,630.00	Statewide Average
18" M.E.S.	2 Ea.	724.62	1,529.24	Statewide Average
18" C.M.P.	32 LF	48.98	1,567.37	Statewide Average
Grading for driveways	118	6.79	801.22	Contract Unit Price
Grading for sidewalks	312	1.74	<u>542.88</u>	Contract Unit Price
				<u>\$15,683.71</u>

A recent paper analyzing alternative contracting methods for environmental remediation projects validates the findings for highway construction. Environmental projects use both unit price and lump sum contracts. Unit pricing is more commonly used than lump sum but takes more design effort to develop quantities, requires substantial project oversight by the owner to verify quantities and direct the work, and provides little incentive to minimize waste, as “more tons equal more money.” Lump sum, while not used as frequently, results in lower overall cost, requires less effort for owner oversight, and creates an incentive for production efficiency and waste minimization.⁵

Practitioners have identified best practices for successful lump sum projects. These include:

BEST PRACTICES FOR LUMP SUM PROJECTS

- Choose projects or items that have less likelihood for unknowns or variability, and that will benefit with greater contractor control over the performance of the work.
- Carefully define scope of work or performance criteria. Well prepared lump sum documents should include items like sections and details for typical work and unique conditions, plans with accurate existing conditions, and notes to describe work that can not be accurately depicted in plan form. The work should be identified as lump sum before the design of the project so that the bid documents can be prepared accordingly.
- The DOT project engineer should do a preliminary estimate for the project (or the lump sum items in the project) and for the contingency fund. This can be accomplished using normal estimating techniques or by using historical data for similar projects.
- Conduct pre-bid meetings to answer contractors’ questions and clear up any ambiguous documentation. The more informed the contractors are in preparing their bids, the more accurate the bids will be, and the more successful the use of lump sum payments will be.
- Develop guidelines for development and administration of lump sum projects.

Source: Florida DOT - “Lump Sum Project Guidelines”

PAYMENT BY PLAN QUANTITIES

Payment by plan quantities is an alternative method where payment is based on measurement derived from plans and schedule of values instead of field measurement. Its purpose is to streamline contract administration by eliminating field measuring and time spent resolving minor quantity variations. Typically, the standard specifications governing measurement and payment are revised to allow payment based on plan quantities. During the project, the DOT or its representative will estimate progress and make partial payments without field measurement. The expectation is that the DOT will pay based on the quantities shown on the plans rather than based on actual quantities unless specified exceptions occur. These exceptions could be when a plan quantity bid

item is eliminated or partially eliminated by contract revision, or when specified quantity or cost thresholds are exceeded.

Figure 2 shows some applications of plan quantity payments for the same 14 sample states. The most frequent uses are for excavation and backfill, concrete and asphalt, and structural and reinforcing steel.

Fig. 2 State DOTs Using Payment by Plan Quantity													
	Concrete	Excavation/ Backfill	Structural/ Reinforcing Steel	Asphalt	Retaining Walls	Pipe Culverts/Storm Sewers	Fencing	Guardrails	Timber Structure	Sound Barriers	Traffic Management & Signals	Demolition	Manhole & Inlet Covers
Arizona													
California													
Colorado	X	X	X										
Florida	X	X	X	X	X	X	X	X	X	X			
Indiana			X										
Iowa	X		X			X		X					
Maryland													
Michigan	X	X	X										
Minnesota		X											
North Carolina	X										X		
Pennsylvania		X											
Texas	X	X	X		X	X		X			X	X	
Washington													
Wisconsin	X		X	X		X						X	X
Total	7	6	7	2	2	4	1	3	1	1	2	2	1

DOTs have developed guidance for selecting plan quantity bid items. Wisconsin DOT (WisDOT) guidelines recommend that payment based on plan quantities be used for bid items that can be estimated accurately, are not expected to vary significantly, and can be easily measured after placement. It does not recommend using plan quantities for items that are measured by volume or weight, traditionally vary beyond spec thresholds, or involve repair or rehabilitation work.⁶ Examples concrete driveways or patching of curbs, gutters, and sidewalks, because it is difficult to estimate the amount of material needed for these applications.⁷

Like the lump sum payment mechanism, plan quantity payments can save DOT staff significant administrative effort. Field measurement and computation is reduced, and change orders for small quantity variations are eliminated completely. Inspection and materials testing are still conducted to ensure the quality of the work product.

Plan quantity payments do not eliminate change orders that result from scope changes, including deductive changes, or variations of quantity that exceed a designated threshold. If the contractor requires additional labor, equipment, or materials during the normal course of the project, WisDOT has developed an

approach for variations within a threshold level established in the specification. For example if the variation is within \$5000 or 5% of the original bid, the contractor will bear the cost or an adjustment will be made without a change order. If the adjustment exceeds this threshold, the contractor will be compensated for the additional work. Like lump

<p>PLAN QUANTITIES ELIMINATES CHANGE ORDERS FOR MINOR VARIATIONS UNLESS:</p> <ul style="list-style-type: none"> • Variation is over threshold level • Owner expands scope of the project • Contractor incurs cancellation fees or lost labor from a scope change <p>Source: Wisconsin DOT</p>

sum, contractors have flexibility choosing means and methods, but they may bear the risk for small quantity variations.

Change orders for plan quantity items can be handled in a variety of ways. When the variation of quantities is greater than the threshold level, WisDOT can choose to recalculate the entire scope of that item and use this new value for payment, or measure only that which is over the threshold, paying the original amount plus the additional amount. This distinction is important when the item in question is subject to economies of scale or bulk pricing. When a contract is revised to deduct scope or change the original plan quantity, the DOT will measure and pay for the quantity affected by the revision. The contractor should also be refunded for cancellation and restocking fees as well as payment for any prep work that was done in anticipation of the cancelled work. In any case, to support a change order, the contractor must provide the engineer with a work log and measurement data.⁶

When preparing bid documents for a job that will use payment by plan quantity, the engineer or design consultant preparing the plans must take care that any quantity tables or schedules containing notes regarding plan quantities are coordinated with the plans.

INCENTIVE/DISINCENTIVE PAYMENT STRATEGIES

Incentive and disincentive (I/D) provisions provide incentive payments to contractors for exceeding project performance goals, or impose disincentive payments for failure to meet the goals. I/Ds for time and quality have been successfully implemented by DOTs for more than 20 years to improve performance and have been mainstreamed as part of DOT contract administration practices in the United States. The FHWA and DOTs have assessed the effectiveness of I/D provisions and developed guidance for their use. Given this background, this section addresses the evolution of I/Ds to various other incentive strategies designed to improve performance and minimize impacts to highway users. These include milestone payments, lane rental, active management payment method, award fees, no excuse incentive clauses, and contingency payments. This section also addresses alternative retainage as a strategy to improve working relationships and encourage performance. As a general rule, the DOT must decide what the project goals are, and how best to achieve those goals through a particular incentive strategy.

Milestone Payments/Incentives

Milestone payments or incentives are given to a contractor for completing a pre-determined milestone, on or ahead of schedule. Likewise, a disincentive can be incurred per day for failure to hit the target completion date. Payment can be made in conjunction with a lump sum contract, where total payment for lump sum items tied to the milestone plus a milestone incentive will be paid for completion of the items on or before a specified milestone completion date. Alternatively, DOT can issue partial payments on a standard schedule and pay the milestone incentive if the contractor finishes early. As in the case of early completion I/Ds, milestone incentives are best applied to projects with high traffic volumes where phases of construction cause significant impacts to traffic flow. Interim milestones are applied to open-to-traffic dates for these traffic sensitive

construction phases. High-density, multi-phased rehabilitation projects where construction requires closure or lengthy detours are excellent candidates.

The obvious advantage of using early completion incentives is that it encourages contractors to finish work ahead of schedule minimizing impacts to the traveling public. However, the sense of urgency created by the strategy may lead to rushed work or lack of attention to quality.⁸ Early completion milestone incentives also necessitate accelerated and more frequent inspection, tighter record keeping, and extended hours for DOT staff.

While contractors benefit from the chance to earn incentive payments for early completion, there are disadvantages, as well. The pressure to complete these projects early can challenge contractors and DOT staff to balance manpower and resources on other projects. On projects where a lump sum payment is made when a milestone is completed, some contractors find it difficult to carry the financial burden between payments. These issues are exacerbated for smaller firms with fewer resources.⁹

✓ Early completion and milestone incentive projects require additional DOT inspection and reporting to monitor contractors' progress. Milestone payments also place increased pressure on contractors to balance resources and carry financial burden between milestone payments.
Source: Burkett

Before bid letting, the DOT must consider several factors in determining whether to use an early completion or time-based milestone incentive for a project. The DOT must determine whether it is advantageous to accelerate the schedule, and whether the milestone I/D amount, based on road user and construction engineering costs, is sufficient to cover the contractor's cost of accelerating the schedule to meet or beat the milestone. In response to DOT observations that contractors often beat milestone dates and earn the maximum incentive amount, the DOT must also carefully evaluate the milestone time based on normal production and then set milestones based on a more aggressive production schedule using a CPM schedule analysis. The DOT may also consider a special prequalification process to ensure that the bidders have the necessary resources and experience to meet a more aggressive milestone schedule.

✓ The DOT must carefully evaluate the project to determine whether a milestone incentive is appropriate, whether the contractor is capable of performing, and whether the project is relatively free of complications that would jeopardize an early completion, yet still allow the contractor to earn an incentive.

When milestone or early completion incentive payments are considered for use, the DOT must evaluate whether there is a potential for delay caused by circumstances beyond the control of the contractor that may still allow a contractor to earn an incentive based on beating an extended completion date. If there are complications related to third parties, environmental issues, or other unknowns that cannot be resolved prior to bid, an early completion or milestone incentive may not be in the best interest of the DOT. Lastly, during the project, the DOT must expedite the normal submittal turnaround and change order process to avoid any claims that the DOT delayed the project.⁸ The DOT must also

closely monitor progress by requiring that the contractor maintain and submit a regularly updated CPM schedule to assess progress against the milestone completion.

No Excuse Incentive Provision

No excuse incentive provisions give a contractor an incentive payment to complete the contract work on time. The contractor is given a “drop-dead date” for completion of a phase of work or the entire project. If the work is completed on or in advance of this date, the contractor will receive the full incentive. There are no excuses, for utilities, change orders, weather, or any other cause, short of a natural disaster, for not meeting the completion date. On the other hand, no disincentives are assessed, aside from liquidated damages, for not meeting the completion date. Florida DOT developed this approach, coined the term “No Excuse Bonus” to describe it, and has used it to a greater extent than other DOTs. From the FHWA’s perspective, the term incentive is preferred. The term bonus implies something paid in addition to what is expected. Other states are proceeding with similar versions of a “no excuse incentive” (NEI) clause. As in the case of an I/D provision, the incentive amount is based on road user costs and other costs reflecting the value to the DOT and the public for finishing the project by a certain date.¹⁰

A no excuse incentive provision might be applied where it is extremely beneficial to finish a project by a certain date but not necessarily beneficial to finish early. One example might be the sequencing of multiple construction contracts within a larger project or program. If the preceding contractor finishes early, it may not be practicable to accelerate the start date or traffic phasing of the follow-on contractors, but finishing late would cause collateral impacts to succeeding contractors and the overall project completion. Another example could involve the opening of a bridge or a roadway to accommodate holiday traffic or a major event. Finishing early would provide some benefit, but finishing late would cause severe impacts to the traveling public.

EXAMPLES OF NO EXCUSE INCENTIVES

- ✓ Iowa DOT is using an NEI clause that will provide for a \$250,000 incentive for early completion on an I-35 reconstruction project. The NEI provision simply states that “any delays due to weather, change orders, overruns of quantities, utility delays, or any other delays will not be considered as justification to modify the calendar date.”

- ✓ Virginia DOT is using an NEI provision on a \$100 million contract that is the first phase of the massive Springfield interchange project. An NEI provision will provide for a \$10 million incentive for the completion of critical work by August 18, 2001 or a \$5 million incentive for completion by November 17, 2001. A noteworthy provision in VDOT’s clause requires the contractor to sign a statement releasing the state from any and all claims, causes, issues, demands, disputes and matters of controversy of any nature or kind.

Source: AASHTO Primer

Lane Rental

Lane rental was first used in highway construction contracting in the United Kingdom (U.K.) in 1984. It has been adopted for use in the U.S. since 1990. At least nine highway agencies have experimented with or implemented lane rental including New York, Arizona, North Carolina, Colorado, Indiana, Maine, Oklahoma, Oregon, and Washington. In 1995 the FHWA removed restrictions to the use of lane rental and it was raised from an experimental procedure to operational. The goal of lane rental is to encourage contractors to limit road closures and interruption to drivers during construction. A daily rental charge is assigned the closure of a lane of traffic, with variations for the type of lane (turn lane, shoulder, ramp, through lane) and time of day (day work, rush hour, night work).¹¹

Variable intervals and rates can be assigned; a lane may be rented for 15-minute intervals, one-day intervals, or whatever is appropriate for the project. In Washington, contractors provide a separate lane rental bid, similar to an A+B bid for time, which estimates how many lane closures will be needed through the course of a project. The lane rental bid is added to proposed price. As such, the bidder with the lowest price may not be awarded the contract. The award is made to the bidder with the lowest combined price of proposed bid and proposed lane closure costs. In this way, contractors are encouraged to be innovative in their scheduling and manpower allocations to limit the disruption to travelers. If during the course of construction, the contractor exceeds the estimated number of lane closures, it will pay a fee at the rate established by WSDOT. If a contract incurs liquidated damages, the lane closures are tracked, but no fee is assessed. The project engineer approves and keeps record of all lane closures¹²

Lane rental is most successful when potential third party conflicts related to lane closures are resolved before the work begins. These conflicts can involve utilities, railways, environmental concerns, hazardous materials, public relations issues, and similar complications.¹³ The clearer the policy for handling these interruptions, the less likely that change orders will complicate the job

✓ WSDOT uses the following formula to choose the lowest bid:

$$A + (B \times \text{Lane rental cost})$$

Where:

A = bid amount for all work to be performed under the contract

B = total number of lane rental units needed to complete the work (units normalize day vs. night rentals, shoulder vs. through lane rentals, etc.)

Source: Washington State DOT

EXAMPLES OF LANE RENTAL FEES

- Denver, CO interchange ramp closure
 - \$2,850/lane/day
- Portland, ME hot bituminous overlay and deck wearing surface replacement
 - \$0-\$2000/lane/hour
- Oklahoma City, OK I-35/I-40E interchange reconstruction
 - \$5,000/lane/day
- Portland, OR Sunset Highway reconstruction
 - \$0-\$21,000/lane/15 minutes

Source: "Briefing – FHWA Initiatives to Encourage Quality."

later. Lane rental is also more successful when applied to smaller, shorter jobs, because it is difficult to estimate the required lane closures on a job that is large, complex or runs for a long time.¹²

Lane rental can increase the cost of a project, as contractors may need to apply more resources or work more quickly to lane rental jobs and require additional bond coverage. By requiring contractors to submit separate bids for project costs and lane rental costs, WSDOT is able to choose the contractor who has best balanced these factors. As long as the lane rental charge has been set at an appropriate level, this should provide the most affordable project in terms of both dollars and public impact.¹²

Active Management Payment Mechanisms

Similar to lane rental, the active management payment mechanism (AMPM) was first developed and implemented in the U.K. Arizona DOT recently used AMPM on the SR-68 reconstruction project affecting 13 miles of high volume roadway. The contractor was responsible for managing traffic to minimize delay to highway users. The contractor was also responsible for setting up and maintaining the tracking system for this project to determine incentive/disincentive earnings. Four camera stations were set up at the entrances and exits to the work zone with lighting that illuminated the license plates of the passing cars. The cameras took time-logged pictures of the cars, and imaging software attempted to match license plates on the cars entering and leaving the zone, a process, which matched about 11% of the plates. The contractor included the price for this equipment, along with a high-speed data connection, in the initial project bid.¹⁴

ADOT's goal was to limit travel time through the work area to 27 minutes. \$400,000 was allocated to a travel time fund, and each time travel time exceeded this limit for three consecutive ten minute intervals, the contractor was assessed a \$21.50 per minute fine drawn against the fund. At the completion of the project, the contractor kept the remaining money from the account.¹⁴

ADOT considered this program a success because it reduced the number of flagging stations on the road and encouraged the contractor to schedule work at the times least disruptive to motorists. However, the program was not completely without issues. Some motorists indicated that the cameras and lighting were a distraction, so they were

moved to less conspicuous locations. Others felt that having their license plates tracked was an invasion of privacy. ADOT invested in a campaign to help drivers understand the purpose of the cameras and monitoring, and this seemed to alleviate public concern. The final amount to be paid to the contractor is still under question because travel time was affected by factors out of the contractor's control. After September 11, a major road nearby was closed to truck traffic for security reasons. The truck traffic was diverted to SR-68, and obviously this made it more difficult to maintain the 27-minute travel time

✓ Arizona DOT found that public outreach was required for the SR-68 project. Commuters were distracted by the cameras and expressed concerns about privacy. ADOT was able to communicate that the AMPM program was used to make traveling SR-68 quicker and more efficient during construction.
Source: Arizona DOT

limit.¹⁴ This illustrates that is important to determine how delays beyond the contractor's control will affect incentive payments.

Award Fees

Award fees provide additional incentive payments to contractors for demonstrating superior performance in areas deemed important by the DOT. In preparation for the 2002 Olympics, Utah tackled the task of rehabilitating I-15, a major highway carrying some 340,000 motorists each day. The project included 16 miles of interstate with additional lanes to be added, construction or repair to 130 bridges, and reconstruction of seven urban interchanges and three major junction points. The total budget for the project included a \$50 million award fee, payable to the design-builder at six-month intervals for the life of the project. The design-builder was evaluated monthly by a team of 60 to 100, including UDOT and UTA staff, political leaders, and consultants. The design-builder was given a score for performance in the following areas: construction quality, timely performance, maintenance of traffic, and community relations. The project was successfully completed before the Olympic games, leaving Utah with a vastly improved roadway.¹⁵

Award fees can be applied to projects of all sizes and levels of complexity. They have been used for large design-build projects but can be applied to traditional design-bid-build projects. When an owner can justify that additional budgeted amounts will buy improved performance, whether it be minimizing road closures, timely performance, or work quality, and the improved performance is worth the cost, the use of award fees should be considered. Although data collection and monitoring are greatly increased, the benefits of providing award fees may be justified for some projects.

✓ I-15 project manager, David Downs, found the monthly contractor performance review to be very rigorous. Documentation passed through 60 to 100 hands before a recommendation for the award fee amount was agreed upon. Any disputes between contractor and review board had to be mediated and resolved. The process required efforts on a daily, not monthly, basis.

Alternative Retainage

Under a traditional retainage system, a contractor will submit a request for payment, and upon approval, the owner will release payment less a percentage (usually 5-10%) withheld for retainage. At the completion of the project, the accrued retainage is released to the contractor. This system gives the owner assurance that the project will be brought to timely completion and closed out. Most often, a contractor will pass on the risk of retainage to sub-contractors by withholding a portion of pay until the balance of retainage is released from the owner. For a subcontractor working on a small portion of large project, this can mean waiting months or even years before receiving full payment.¹⁶

Alternative retainage can mitigate financial risk for both contractors and subcontractors. There are a variety of forms of alternative retainage. The percent of retainage can be reduced at some point during the project, provided that the contractor is performing according to schedule or only retained if the contractor fails to perform. Portions of the retainage can be released during the project, either at regular intervals or upon completion

of a milestone.¹⁶ The Maryland State Highway Administration requires 5% withheld retainage, but offers contractors the option to hold the funds in an interest-bearing account and keep the payment plus interest when the project is complete provided that the procedure does not conflict with any federal grant or regulation affecting the contract. This approach does not lessen the burden of retainage during the contract, but allows for recovery of interest on retained funds at completion.

New Jersey DOT withholds 5% of the periodic progress payments from the initial progress payment to 50% of contract value. In lieu of retainage, New Jersey allows the contractor to deposit negotiable bonds into an escrow account to secure release of retainage. The escrow agreement will be entered into between the contractor, the state, and a local bank designated as authorized depository of the state. The bonds must have a Moody's rating of "B A A" or a Standard and Poors rating of "B B B," and must have a market value equivalent to the retainage required by the contract.¹⁷

Ohio DOT, U.S. DOT Federal Lands Highways, Florida DOT and agencies outside the transportation arena, for example the United States Army Corps of Engineers (USACE), do not withhold retainage unless a contractor fails to perform according to contract requirements. The Federal Lands FP-96 does not specify how much or when to retain. It states that adjustments will be made for (1) Failure to maintain acceptable progress, (2) violations of labor provisions, (3) completion of incomplete work, (4) cost of corrective work, or (5) Liquidated Damages for failure to complete on time.¹⁸ Florida DOT only retains when the percent of allowable contract time exceeds 75% and the allowable contract time exceeds the percent of contact amount earned by more than 15%.¹⁹

Some agencies withhold higher amounts for non-compliance with specific contract requirements. For example, the Bay Area Transit Authority (BART) may increase retainage from 5% to 10% for failure to comply with a specific requirement such as failure to meet DBE goals.¹⁹ Agencies also are moving to protect subcontractor interests by stipulating that a contractor may not withhold from its subcontractor invoices more than the percentage retained from the contractor invoice by the owner. In most cases agencies will specify that Liquidated Damages are separate from retainage.

These alternative retainage systems continue to encourage the contractor and its subs to perform work in a timely manner, but lessen the cash flow burden on contractors and their subs, and make working with DOT's more desirable.

Contingency Fund Management

Risk is an inherent part of construction, particularly for major transportation projects with a greater numbers of risk factors and higher degree of uncertainty. Risks caused by design uncertainties, environmental mitigation, right-of-way issues, and utilities or other third parties could result in unrealistic estimates, cost overruns, and scope and schedule creep. The purpose of a contingency fund management is to identify potential project risks that may cause cost and time growth, estimate these risks, create a contingency fund, and use management strategies to minimize cost and time impacts. The Federal

Highway Administration has developed guidance for estimating costs, assessing risk, and managing contingency funds for major projects. This guidance includes setting up contingency funds for major cost items, for example construction contingencies, design contingencies (based on different levels of design completion), and management contingencies for third parties, environmental, right-of-way and other unanticipated changes during construction. Contingency fund management may include periodic risk analysis to refine contract contingencies, continual contingency tracking, a drawdown plan that includes contingency forecasting, and strategies to mitigate risk impacts.¹⁹

One effective contract management strategy implemented by transportation agencies is to provide incentives to the contractor for managing contingencies to minimize cost and time impacts. When a contractor is given a share in the unused contingency fund, it provides a strong motivator to control cost and schedule growth. For example, when a contractor submits a change order, the amount will be deducted from the contingency fund. At the completion of the project, the contractor will receive a share of the remaining funds as a motivator to keep the cost of changes to a minimum. Contingency funds have also been set up to create incentives for timely completion or quality. Contingency incentives are especially applicable for major or mega-projects, particularly using design-build delivery, because early estimates have greater uncertainty, there is a higher potential for cost and time growth, and the level of risk often yields fewer proposals to affirm the accuracy of the owner's estimate.

To stimulate competition, manage risks, and incentivize the contractor to control cost and time growth, transportation owners are implementing shared-risk contingency funds. Recent examples include the \$330 Million Atlantic City-Brigantine Connector Project, a four-lane design-build connector highway and tunnel project in New Jersey. The project capped construction costs at \$190 Million and included a \$28 Million contingency fund, 80% of which reverted to contractor in the event of early completion.²⁰ The \$750 Million Hiawatha Light Rail Transit Project, a 12-mile design-build light rail project connecting downtown Minneapolis with the airport and Mall of America, established a \$5.5 Million shared-risk contingency fund based on 19 risk items. At the end of the project, the contractor was eligible to keep 91% of the unused contingency amount. In the event that any of the 19 risk items are realized, the contractor could choose to bill against the contingency fund or decide to not charge against the fund and absorb the cost to maximize its share in the contingency fund at the end of the project. As explained by the Hiawatha project manager the advantage of a shared-risk contingency is that "The contractor has been very diligent in working through the risk items, identifying work-arounds or creative solutions to maintain schedule and minimize cost."²¹

The use of contingency funds has been a risk management strategy employed by transportation owners and endorsed by FHWA for large, complex construction projects or programs. The use of shared-risk contingency funds takes this approach a step further, incentivizing the contractor to find innovative ways to manage risks and share in the savings.

CONCLUSIONS AND FUTURE ACTION

In today's contracting environment, construction owners are increasingly challenging themselves and contractors to expedite project delivery, without sacrificing the quality of construction. Alternative payment methods can be an effective technique in aligning payment approaches with project and customer goals. When properly applied, alternative payment strategies can be used to streamline the payment process, encourage efficient use of resources, manage risk, and meet critical performance goals.

Many state departments of transportation have successfully incorporated the alternative payment mechanisms described in this paper. Payment strategies can be used to align the goals of client and contractor, to speed a project to completion, to allocate risk, and to reduce the red tape and administrative burden of traditional payment practices. Alternative payments can be used in design-build jobs and design-bid-build jobs, and for large or small projects.

Using alternative payments requires planning in the pre-bid stage. DOT's must decide what type of payment strategy will best serve the goals of the project. If incentives are used, the amount must be determined. Specifications must be clearly written so that contractors understand how measurement and payment occur, and pre-bid meetings may take place to give further clarification. If lump sum or plan quantity is used, documents must be prepared to reflect this.

The effects of alternative payment methods during construction phase of a job vary depending on what type of mechanism is used. Lump sum payment and measurement by plan quantity decrease or eliminate field measuring and minor change orders but should be used for appropriate projects. Incentive strategies speed the project, reduce cost growth, or improve other aspects of performance, but they may create additional administrative burdens or shift more risk to the contractor. DOT's must take these factors into consideration when deciding to use alternative payment methods.

In general, DOTs and transportation owners discussed in this report have concluded that the advantages of using alternative payment methods clearly outweighed the disadvantages and the trend among highway agencies in the United States is towards greater use of alternative payment for selected projects. This paper presents a snapshot of alternative payment methods used primarily on more traditional highway projects. It does not address the use of more advanced project controls systems basing payment on cost-loaded Critical Path Method schedules, and using a Work Breakdown Structure (WBS) and cash flow curves typically used for larger, more complex transportation projects. Future action items for the Construction Management ETG to consider would be to further assess the advantages/disadvantages of implementing alternative payment methods, develop additional case studies, and provide more formal guidance on project selection and implementation. It also should address the use of more advanced project control systems for managing payments and forecasting costs-to-budget.

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