Utah Department of Transportation

Performance Audit
Traffic Control Devices and Sign Provision

Final Report

November 22, 2000
Utah Department of Transportation

Performance Audit

Traffic Control Devices and Sign Provision

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Executive Summary

A. Introduction

This Executive Summary presents the findings from a performance audit of the Utah Department of Transportation’s (UDOT) temporary traffic control activities. Specifically, the audit focused on how UDOT pays for temporary traffic control devices and the costs of providing those devices during construction. The objective of this audit is to:

- Review UDOT’s current practices and costs of temporary traffic control provision and to identify potential efficiencies and cost savings.
- Analyze Department expenditures on temporary traffic control devices.
- Determine whether the Department could realize long-term savings by purchasing and providing certain devices.

To address these objectives, this audit answers the following questions:

1. Has the change to the lump sum pricing method reduced costs for temporary traffic control?
2. Is UDOT getting reasonable prices from contractors for traffic control?
3. Would UDOT realize business benefits from providing certain temporary traffic control devices?

B. Approach

Our approach to completing this audit includes:

- Clarifying and defining the questions to be answered by the audit.
- Interviewing UDOT staff, contractors, and traffic control suppliers.
- Examining UDOT’s current and past policies, procedures, specifications, and regulations related to traffic control.
- Collecting and analyzing data from a sample of similar interstate maintenance projects to make comparisons between current and past traffic control pricing practices.
- Collecting bid price and quantity data from UDOT’s Bid Estimate System. Developing performance measures and cost models from this data.
• Conducting interviews with other state departments of transportation (DOTs) personnel to benchmark UDOT’s costs and practices.

C. Audit Findings

The following summarizes the findings of this audit of traffic control provisions at UDOT.

Issue: Has the change to the lump sum pricing method reduced costs for temporary traffic control?

The cost of traffic control using a lump sum pricing method compared to a unit cost pricing method are similar; however, there are broader business benefits to UDOT from using the lump sum method.

The change in UDOT’s construction specifications to a lump sum pricing method was made to address problems associated with the unit cost pricing method, including:

• Contractors have little incentive to be efficient.
• Contractors could receive payment for devices even though work was stopped on projects.
• UDOT engineers spent time and other resources developing traffic control plans that were not used by the contractors.
• UDOT engineers spent time and other resources tracking and monitoring device usage in order to fulfill payment requirements.

The change to lump sum pricing has shifted the costs for developing of plans from UDOT to contractors. UDOT engineers now have more time to monitor the quality of construction.

Issue: Is UDOT getting reasonable prices from contractors for traffic control?

UDOT is receiving reasonable prices from contractors for temporary traffic control devices.

• UDOT paid contractors around $4.5 million over the last four years for barrels, barricades, and vertical panels, translating to an average price per unit of between $10 and $24.
• Based on a survey of prices for new temporary traffic control devices, current costs range between $35 and $75, including shipping.
• At the aggregate level, UDOT is not paying more for traffic control.
Total traffic control bid prices represent 4.9 percent of total construction costs, much less than the average 5.9 percent for benchmark partners.

**Issue: Would UDOT realize any business benefits from providing certain temporary traffic control devices?**

**UDOT will not save money by providing temporary traffic control devices to contractors.**

- If UDOT were to supply these devices over a four-year period, the costs to the Department could exceed $7.5 million, including labor, maintenance, and warehousing.

**Exhibit E-1: Comparison of Contractor and UDOT Costs**

<table>
<thead>
<tr>
<th>Contractor-Furnished Equipment</th>
<th>UDOT-Furnished Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• $4.5 million over four years.</td>
<td>• $7.7 to $10.3 million for same devices.</td>
</tr>
<tr>
<td>• Other costs not included above:</td>
<td>• Other costs not included above:</td>
</tr>
<tr>
<td>− Mobilization costs (may include some traffic control fees).</td>
<td>− Contractor pickup and return of devices for each project.</td>
</tr>
<tr>
<td></td>
<td>− Inventory control and tracking system for traffic control devices.</td>
</tr>
<tr>
<td></td>
<td>− County and municipal governments provision of devices.</td>
</tr>
<tr>
<td></td>
<td>− Land and/or building acquisition for warehousing and storage.</td>
</tr>
</tbody>
</table>

**D. Recommendation**

**Refine Section 155 of the Construction Specification covering provision of traffic control to address the following issues:**

- **Develop a standard procedure for addressing change orders involving traffic control devices and activities.**

Examination of project files, as well as interviews with contractors reveal that UDOT does not have a standard approach to covering traffic control costs within change orders. In some cases, additional costs are determined based on the estimated duration created by the change in project scope. In other cases, costs have been set based on the unit cost pricing method.
Implementation Strategies

- Include change order methodology as an addendum to Section 155 specification.
- Apply change order methodology consistently.

- Define UDOT’s requirements for traffic control devices prior to bid.

By providing general guidelines and expressing expectations for traffic control through the bid process for each project, UDOT can increase the level of service and reduce ambiguity and misunderstandings with contractors. For example, if UDOT expects the use of variable message signs or state patrol vehicles, this should be specified. This is not required under the Manual on Uniform Traffic Control Devices (MUTCD). In addition, UDOT can specify requirements to phase lane closures to avoid undue disruption to motorists instead of letting contractors determine what is convenient.

Implementation Strategies

- Develop a list of special provisions for traffic control (such as use of State Patrol, Jersey barriers or variable message signs) that have been used based on Region experience.
- On each project, prepare a general statement of the Department’s expectations for traffic control, and which special provisions, if any, are to apply.

- Consider developing separate budgets for labor and materials under lump sum.

Other states have developed streamlined traffic control bidding processes that involve more detailed tracking of materials and labor. For example, Arizona Department of Transportation (ADOT) has separated labor and device costs by setting parameters for bids including the number and type of devices, and the labor hours allowed for the project.

Implementation Strategies

- Evaluate business benefits of developing separate budgets for labor and materials under lump sum.

- Ensure that traffic control standards and specifications are applied uniformly throughout the state.

Contractors interviewed indicated that, from their perspective, UDOT does not consistently apply engineering standards for traffic control plans and specifications throughout the state. For example, for two similar projects, UDOT ordered the contractors to use dissimilar control devices. This forced the contractors to incur higher than expected costs. In order to eliminate some
of the ambiguity caused by lump sum pricing and disputes regarding deployment of traffic control devices, contractors need to understand UDOT expectations.

Implementation Strategies

− Implement prior recommendation to define UDOT’s requirements for traffic control prior to bid.
− Specify which, if any, special provisions apply on a project by project basis.
I. Introduction and Background

This document presents findings from a performance audit of temporary traffic control costs in the State of Utah, commissioned by the Utah Department of Transportation (UDOT). The report is organized into the following sections:

- **Introduction and Background:** Presents the objectives of the audit, and some background on temporary traffic control in Utah.
- **Findings and Recommendations:** Presents the approach and findings from work completed to address the audit objectives.
- **Appendix A:** Provides additional results from traffic control analyses developed during the course of this audit.
- **Appendix B:** Provides data from a traffic control benchmarking analysis between UDOT and other state departments of transportation.

A. Audit Objectives and Questions

1. Audit Objectives

   UDOT has had consistent policy-level concern regarding the resources spent on temporary traffic control devices. The objectives of this audit are to:

   - Review UDOT’s current practices and costs of temporary traffic control provision and to identify potential efficiencies and cost savings.
   - Analyze Department expenditures on temporary traffic control devices.
   - Determine whether the Department could realize long-term savings by purchasing and providing certain devices.

2. Audit Questions

   To meet these objectives, a series of interviews were held to establish the following audit questions:

   - Has the change to the lump sum pricing method reduced costs for temporary traffic control?
   - Is UDOT receiving reasonable prices from contractors for traffic control?
   - Would UDOT realize any business benefits by providing certain temporary traffic control devices?

   The remainder of this section presents background information on traffic control devices and their use in Utah.
B. Background on UDOT’s Traffic Control Policies and Practices

Temporary traffic control is an integral part of UDOT’s construction activities. Effective temporary traffic control provides for the safety of motorists, workers, and pedestrians as they travel through work zones.

1. Specifications for Temporary Traffic Control

Construction projects managed by UDOT require some form of traffic control plans. Traffic control plans list the phases of traffic control work, provide detailed drawings showing the traffic control plan for each phase, and identify procedures for dealing with emergency vehicles. These plans detail the length of work zones, sign locations, taper lengths, device spacing, and so on. Construction firms develop these plans; UDOT completes the approval process for the plans. Once a project is underway, the traffic control activity is monitored daily by the project inspector.

Contractor’s develop traffic control plans according to the following standards:

- Metric Standard Specifications for Road and Bridge Construction, Sections 155 and 850, 1994 with revisions, Utah Department of Transportation.
- Standard Traffic Control Drawings, 745-2 series, Utah Department of Transportation.

2. Types of Traffic Control Devices

UDOT and its contractors use several types of devices and other traffic control activities to alert and direct motorists through work areas, providing a safe environment for both the motoring public and those working on the construction sites. Construction and maintenance workers place the devices in and along the roadway to act as temporary controls, informing the public of changes to normal traffic patterns. Contractors and UDOT use the following devices on construction and maintenance projects throughout the state:

- **Barrels** – Placed in tapered and un-tapered arrangements within or alongside the roadway, warning travelers of road closures, traffic pattern changes, or other obstacles ahead.
- **Barricades** – Placed across a road or ramp to indicate the way is closed to traffic. These types of devices come in several designs and sizes.
- **Channelizing devices** – Another term used for barrels, cones, tubes, and any other device used to channel traffic into temporary traffic patterns within work zones.

- **Construction signs** – Devices used for warning motorists of work zones, lane closures, temporary traffic pattern changes, etc. These signs typically state “Road Construction Ahead”, “Right Lane Closed ¼ Mile”, etc.

- **Drums** – Used as crash barriers at bridge abutments and at the ends of concrete barriers. Filled with water or sand.

- **Pre-cast concrete barriers** – Also called “Jersey barriers”. They are used in construction zones to demarcate lanes, especially between traffic flowing in opposite directions. Traffic control costs involve installing, relocating, and removing these items.

- **Stationary and portable warning arrows** – Construction signs used to indicate a warning of lane closures ahead, requiring traffic to move to the left or right of the construction equipment.

- **Temporary traffic striping** – Consists of yellow/black tape. Indicates a change in lane direction and flow patterns after removal of any existing, fixed traffic striping. Traffic control costs involve placement and removal of these items.

- **Truck-mounted attenuators** – Mounted on the rear of maintenance vehicles. These devices prevent moving vehicles from running into construction equipment and personnel working further down roadway, typically within or near an open lane or travel.

3. **UDOT’s Method for Pricing Traffic Control**

UDOT accounts for traffic control costs using two pricing methods: unit cost and lump sum. UDOT shifted to primarily using a lump sum pricing method in 1998, after piloting the method on a few projects in 1997; however, some projects are still priced using the unit cost method. In addition, some change orders to “lump sum” projects have traffic control priced on a unit cost basis. The two methods are described below.

**a. Unit cost method**

Under the unit cost method, UDOT, using several itemized cost accounts, tracked, and accounted for the price and quantity of individual labor activities and material items. Under this method:

- UDOT and contractors managed traffic control pricing and management in accordance with Section 850 of the Standard Specification for Road and Bridge Construction.
For labor items, including traffic control supervisor, flagging, or pilot cars, the unit cost was based on a per hour or per day price basis.

For material items, such as barricades, barrels, or signs, the unit cost was based on a daily or hourly per device basis, or per dimensional (meter, square meter, square meter-day, etc.) basis.

UDOT developed a preliminary traffic control plan. After contract award, the successful contractor would provide a final plan to UDOT. UDOT's preliminary plan rarely matched the plan developed and implemented by the contractor.

Contractors bid prices for labor and devices based on the quantities estimated by UDOT in the initial plan.

UDOT managed costs of traffic control by individual activity and device. Each activity and device, totaling upwards of 30, had to be accounted for individually.

UDOT managed cost reimbursement by accounting for each item’s use, based on the item’s bid unit of measure. For example, to reimburse a contractor for barrels used in a given month, UDOT personnel, on a daily basis, counted the number of barrels on the construction site, totaled them for the month, and then multiplied this sum by the contracted bid-rate and by the number of days in the month. This product equaled the total costs incurred for those devices in that month.

b. Lump sum method

Under the lump sum method, all traffic control costs are tracked within a single cost account. Under the lump sum method:

Contractors provide temporary traffic control for UDOT construction projects per Section 155 of the UDOT Construction Specifications. Complying with Section 155, contractors “provide traffic control plans and all materials, labor and equipment necessary for the implementation and maintenance of traffic control”. As part of the bid estimate, bidders provide only their estimated price for all these services.

UDOT manages all traffic control costs within a single account. Consolidating all devices and activities into one cost account simplifies management efforts, but also results in the loss of details
regarding the number and costs of individual traffic control activities.

- Contractors provide a copy of their proposed traffic control plan to UDOT after contract award for review and approval.
- Contractors follow the same specifications employed under the unit cost method for developing the traffic control plans and on site implementation.
- Reimbursement for traffic control is based on the percentage of overall work completed.

c. Reasons for the change from unit cost to lump sum traffic control accounting

Exhibit I-1 highlights the reasons that led to the change from the unit cost method to the lump sum method. In principle, the lump sum method appears to provide incentives for reduced costs and more competition.

Exhibit I-1: Pros and Cons of Unit Cost and Lump Sum Traffic Control Pricing Methods

<table>
<thead>
<tr>
<th>Unit Cost Method</th>
<th>Lump Sum Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>• There was potential financial incentive for contractors to delay project completion in order to continue being paid for traffic control devices on site.</td>
<td>• Rewards contractors for efficiency and completing projects early.</td>
</tr>
<tr>
<td>• Contractors could stop working on projects, but still receive payment for traffic control devices on site.</td>
<td>• Eliminates incentives to delay project completion in order to receive additional payment for traffic control.</td>
</tr>
<tr>
<td>• The unit rates estimated by UDOT engineers for traffic control devices may have been too high, providing incentive for contractors to cut prices elsewhere and make it up on traffic control.</td>
<td>• Relies on the competitive bidding environment to ensure reasonable rates are being paid for traffic control devices.</td>
</tr>
<tr>
<td>• Contractors often made changes to the traffic control plans produced by the Department due to site variations, causing rework of the plans.</td>
<td>• Shifts preparation of traffic control plans solely over to contractors.</td>
</tr>
<tr>
<td>• Interviewees believe that UDOT traffic control plans were frequently redone by contractors as part of their mobilization activities.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Interviews with UDOT staff and contractors.
4. Volume of Temporary Traffic Control in Utah

Exhibit I-2 illustrates that, over the last four years, UDOT has spent between at least $5.3 and $8.6 million per year on traffic control devices and activities.

Exhibit I-2:
Total Traffic Control Bid Prices, 1995 – 1999
($ Millions)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Unit Cost</td>
<td>$4.9</td>
<td>$6.3</td>
<td>$2.0</td>
<td>$1.8</td>
</tr>
<tr>
<td>- Lump Sum</td>
<td>$0.4</td>
<td>$2.3</td>
<td>$4.1</td>
<td>$6.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$5.3</strong></td>
<td><strong>$8.6</strong></td>
<td><strong>$6.1</strong></td>
<td><strong>$8.5</strong></td>
</tr>
<tr>
<td><strong>Total Contracted Bids</strong></td>
<td><strong>$151.5</strong></td>
<td><strong>$242.2</strong></td>
<td><strong>$138.2</strong></td>
<td><strong>$173.7</strong></td>
</tr>
<tr>
<td>Percent Traffic Control</td>
<td>3.5%</td>
<td>3.6%</td>
<td>4.4%</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

Source: UDOT Bid Estimate System, Dye Management Group, Inc. analysis.
Note: In then year dollars.

The exhibit shows that:

- Traffic control bid prices as a category and as a percentage of overall construction contracts has increased over the last four years.
- The ratio between traffic control and overall construction costs has increased steadily increased from 3.5 percent to nearly 5.0 percent between 1996 and 1999.

5. Use of Temporary Traffic Control in Construction and Maintenance

a. Construction projects

Generally, all temporary traffic control activities for construction projects are the responsibility of private construction contractors. A contractor’s responsibility for traffic control includes:

- Providing and installing traffic control devices before work activities start.
- Maintaining traffic control devices and ensuring their proper function during construction work.
- Replacing damaged or destroyed devices that no longer function.
- Moving devices in the work zone as necessary.
- Removing traffic control devices at the completion of the project.
UDOT provides some limited provision for temporary traffic control devices. For example:

- Region 1 has a significant stockpile of pre-cast concrete barriers available to contractors.
- Region 2 owns and provides some variable message boards. Region 2 also owns several miles of pre-cast barriers that are currently employed on the I-15 reconstruction in Salt Lake City.
- Region 4 has a stockpile of pre-cast concrete barriers and two variable message boards.

b. Maintenance projects

UDOT contracts out some maintenance projects. It is the responsibility of the private maintenance contractor to supply traffic control devices and services as they would on construction projects. For those projects completed by UDOT, the maintenance crews have their own barrels, barricades, and other signs necessary to complete their jobs. UDOT warehouses some traffic control devices for maintenance crews at central headquarters, regional headquarters, and at over 70 maintenance sheds located throughout the state. The maintenance crews receive orders for devices from the regional and central warehouse, as well as directly from the suppliers.
II. Findings and Recommendations

This section presents the findings and supporting data analysis from the audit of traffic control devices at UDOT. Each of the audit questions is addressed in turn.

A. Has the Change to the Lump Sum Pricing Method Reduced Costs for Temporary Traffic Control?

1. The cost of traffic control using a lump sum pricing method compared to a unit cost pricing method are similar; however, there are broader business benefits to UDOT from using the lump sum method.

   a. Approach

      Our methodology included:

      • Interviewing UDOT staff in engineering and procurement areas.
      • Identifying labor and material costs associated with traffic control.
        – Costs incurred by UDOT inspectors and engineers while conducting inspections and tallying device counts were not included.
      • Computing the cost ratio between traffic control costs and total project construction costs for two sets of projects (unit cost- and lump sum-based pricing).
      • Computing the cost savings of shifting traffic control planning and development from UDOT to contractors.

   b. Evidence

      Interviews with UDOT staff indicate the change in UDOT’s construction specifications to a lump sum pricing method was made to address problems associated with the unit cost pricing method, including:

      • Contractors had little incentive to be efficient.
      • Contractors could receive payment for devices even though work was stopped on projects.
      • UDOT engineers spent time and other resources developing traffic control plans that were not used by the contractors.
UDOT engineers spent time and other resources tracking and monitoring device usage in order to fulfill payment requirements.

The change to lump sum pricing has shifted the costs for plan development and monitoring from UDOT to contractors. UDOT engineers now have more time to monitor the quality of construction.

Exhibit II-1 presents the comparison in traffic control costs incurred by UDOT under the unit cost and lump sum pricing method for a set of similar interstate maintenance projects.

**Exhibit II-1:**
A Comparison of Traffic Control Costs for Two Sets of Similar Projects Let by UDOT

<table>
<thead>
<tr>
<th></th>
<th>Unit Cost Pricing</th>
<th>Lump Sum Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Projects</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Traffic Control Costs ($ millions)</td>
<td>$4.05</td>
<td>$5.43</td>
</tr>
<tr>
<td>Total Contract Costs ($ millions)</td>
<td>$110.49</td>
<td>$111.70</td>
</tr>
<tr>
<td>Traffic to Total Contract Cost Ratio</td>
<td>3.7%</td>
<td>4.9%</td>
</tr>
<tr>
<td>UDOT PE Traffic Control Costs Saved*</td>
<td></td>
<td>($0.12 - $0.18)</td>
</tr>
<tr>
<td>UDOT CE Traffic Control Costs Saved**</td>
<td></td>
<td>($0.91 - $1.36)</td>
</tr>
<tr>
<td><strong>Net Traffic Control Costs ($ millions)</strong></td>
<td><strong>$4.05</strong></td>
<td><strong>$3.89 - $4.40</strong></td>
</tr>
</tbody>
</table>

Source: UDOT Final Estimates of projects, Dye Management Group, Inc. analysis

Note(*): Estimated PE traffic control costs range from 2% to 3% of estimated PE expenditure on projects.

Note(**): Estimated CE traffic control costs range from 10% to 15% of estimated CE expenditures on projects.

The exhibit shows that for two sets of projects of similar size and scope:

- UDOT has realized no significant cost savings by shifting to a lump sum pricing method.
- Traffic control costs under lump sum pricing is a slightly higher percentage of the overall project costs. However, inclusion of savings realized during the Preliminary Engineering and Construction Engineering phases reduces the overall cost for traffic control.
B. Is UDOT Receiving Reasonable Prices From Contractors For Traffic Control?

1. UDOT is receiving reasonable prices from contractors for traffic control devices.
   
a. Approach

   Our methodology included the following:
   
   • Analyzing the bid prices and quantities for temporary traffic control devices, including barrels, barricades, drums, and vertical panels and other channelizing devices.
   
   • Comparing bid prices to actual costs for two sample sets of projects.
   
   • Interviewing UDOT staff, contractors, and suppliers of traffic control devices, to determine uses and costs for these devices.
   
   • Benchmarking practices and costs for traffic control at other state departments of transportation (DOTs).

b. Evidence

   The following data supports the finding:
   
   • UDOT paid contractors about $4.5 million over the last four years for certain devices, translating to an average price per unit of between $10 and $24.
   
   • A survey of traffic control supply firms, manufacturers, and UDOT shows that current prices for temporary control devices range between $35 and $75 each, including shipping.

   Exhibit II-2 presents the estimated total bid prices for temporary devices used on construction projects let by UDOT between 1996 and 1999.
($ thousands)

<table>
<thead>
<tr>
<th></th>
<th>1996</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>Present Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrels and Drums</td>
<td>$152.2</td>
<td>$249.2</td>
<td>$451.9</td>
<td>$442.6</td>
<td>$1,499.3</td>
</tr>
<tr>
<td>Barricades</td>
<td>$84.1</td>
<td>$233.2</td>
<td>$80.7</td>
<td>$88.9</td>
<td>$585.3</td>
</tr>
<tr>
<td>Vertical Panels**</td>
<td>$488.2</td>
<td>$722.9</td>
<td>$185.3</td>
<td>$683.5</td>
<td>$2,476.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$724.4</td>
<td>$1,205.2</td>
<td>$717.8</td>
<td>$1,215.0</td>
<td>$4,560.8</td>
</tr>
</tbody>
</table>

Source: UDOT Bid Estimate System, Dye Management Group, Inc. analysis.

Note: In then year dollars.
Note(*): Based on a rate of 7.125% per annum.
Note(**): Including other channelizing devices.

- Based on project cost and duration data, estimates indicate that contractors used between 50,000 to 75,000 devices per year throughout the state over the last four years.

Exhibit II-3 presents the estimated average prices for the devices listed above, given a range of units needed on a yearly basis.

Exhibit II-3: Average Price Per Unit

<table>
<thead>
<tr>
<th>Units</th>
<th>1996</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,000</td>
<td>$28.97</td>
<td>$48.21</td>
<td>$28.71</td>
<td>$48.60</td>
</tr>
<tr>
<td>50,000</td>
<td>$14.49</td>
<td>$24.10</td>
<td>$14.36</td>
<td>$24.30</td>
</tr>
<tr>
<td>75,000</td>
<td>$9.66</td>
<td>$16.07</td>
<td>$9.57</td>
<td>$16.20</td>
</tr>
<tr>
<td>100,000</td>
<td>$7.24</td>
<td>$12.05</td>
<td>$7.18</td>
<td>$12.15</td>
</tr>
</tbody>
</table>

Source: Dye Management Group, Inc. analysis.

- A survey of other state DOTs suggests that, at an aggregate level, UDOT is not paying more for traffic control.
  - Total traffic control bid prices make up 4.9 percent of the total construction costs, much less than the average 5.9 percent for the benchmark partners.
Exhibit II-4: Benchmark Survey of Traffic Control Costs and Methods for Five Western States
($ Millions)

<table>
<thead>
<tr>
<th>Benchmark Measure</th>
<th>Utah</th>
<th>Colorado</th>
<th>Montana</th>
<th>North Dakota</th>
<th>Oregon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of pricing</td>
<td>Unit Cost &amp;</td>
<td>Unit Cost &amp;</td>
<td>Unit Cost</td>
<td>Unit Cost</td>
<td>Unit Cost &amp;</td>
</tr>
<tr>
<td></td>
<td>Lump Sum</td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>Lump Sum</td>
</tr>
<tr>
<td>One year total traffic control bids</td>
<td>$8.5</td>
<td>$22.7</td>
<td>$8.9</td>
<td>$17.1</td>
<td>$15.7</td>
</tr>
<tr>
<td>One year total construction bid prices</td>
<td>$173.7</td>
<td>$380.0</td>
<td>$200.2</td>
<td>$220.0</td>
<td>$286.0</td>
</tr>
<tr>
<td>Ratio of traffic control bids to total value</td>
<td>4.9%</td>
<td>5.9%</td>
<td>4.4%</td>
<td>7.7%</td>
<td>5.5%</td>
</tr>
<tr>
<td>of construction contracts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: State DOTs, Dye Management Group, Inc. analysis.

C. Would UDOT Realize Any Business Benefits By Providing Certain Temporary Traffic Control Devices To Contractors?

1. UDOT will not save money by providing temporary traffic control devices to contractors.

   a. Approach

   We developed a cost model to estimate the potential expenditures incurred by UDOT if the state supplied temporary traffic control devices for construction projects. The input data for the model was established as follows:

   • Researched the costs of purchasing different control devices from national and local suppliers.
   • Estimated the costs of maintaining the devices.
   • Identified the inventory costs for keeping the unused devices in storage at UDOT facilities.
   • Determined the estimated number of temporary control devices UDOT would need to have available on a yearly basis to meet demand.
   • Interviewed UDOT staff to determine other activities and costs that are not quantifiable, but should be considered in any further analysis.
The following outline describes the analytical steps in the model:

- For an estimated number of devices, ranging between 50,000 and 75,000 units as presented above, the low and high prices per unit provide an estimate of total purchase costs.
  - Calculate the **Purchase Costs** of procuring the devices.

- Apply a **Turnover Rate** to the number of devices on hand (in use and in storage) to determine purchase costs for replacing those destroyed or no longer useful, called the **Replacement Stock**.
  - Calculate the Replacement Costs, based on the Replacement Stock.

- Apply a low and high device **Utilization Rate** (amount of time devices are being used in a year) to the number of devices on hand, to determine how many devices are in storage.
  - Calculate the **Warehousing Costs** for the number of units in storage, based on UDOT inventory cost methodology (according to UDOT, equivalent to approximately 30 percent of stock value in storage).

- Estimate the **Labor Costs**, based on five additional FTEs: one at each UDOT Regional Headquarters, and one at UDOT Headquarters. These staff would be responsible for acquisition, maintenance, and inventory tracking duties for the devices.

- Estimate the **Maintenance Costs** associated with maintaining the devices, based on 15 percent of material (device) costs on hand. Maintenance includes: repairing of damaged devices, cleaning and sanding of surfaces, and painting and applying new reflective tape.

- The sum of the **Purchase Costs**, **Replacement Costs**, **Warehousing Costs**, **Labor Costs**, and **Maintenance Costs** equals the **Total Costs** incurred by UDOT to supply the traffic control devices each year.

**b. Evidence**

Exhibit II-5 presents the results from the cost model.
**Exhibit II-5: Estimated Costs Incurred by UDOT to Supply 60,000 Traffic Control Devices**

($ Millions)

<table>
<thead>
<tr>
<th>Cost Items</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purchase Costs</strong>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Barrels &amp; Drums (15k)</td>
<td>$0.68 - $0.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Barricades (15k)</td>
<td>$0.86 - $0.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Vertical Panels* (30k)</td>
<td>$1.05 - $1.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$2.58 - $3.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Replacement Costs</strong>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Barrels</td>
<td>$0.22 - $0.32</td>
<td>$0.22 - $0.32</td>
<td>$0.22 - $0.32</td>
<td>$0.22 - $0.32</td>
</tr>
<tr>
<td>- Barricades</td>
<td>$0.43 - $0.47</td>
<td>$0.43 - $0.47</td>
<td>$0.43 - $0.47</td>
<td>$0.43 - $0.47</td>
</tr>
<tr>
<td>- Vertical Panels</td>
<td>$0.35 - $0.57</td>
<td>$0.35 - $0.57</td>
<td>$0.35 - $0.57</td>
<td>$0.35 - $0.57</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>$1.00 - $1.36</td>
<td>$1.00 - $1.36</td>
<td>$1.00 - $1.36</td>
<td>$1.00 - $1.36</td>
</tr>
<tr>
<td><strong>Warehousing Costs</strong>*</td>
<td>$0.01 - $0.02</td>
<td>$0.01 - $0.02</td>
<td>$0.01 - $0.02</td>
<td>$0.01 - $0.02</td>
</tr>
<tr>
<td><strong>Labor</strong></td>
<td>$0.30</td>
<td>$0.30</td>
<td>$0.30</td>
<td>$0.30</td>
</tr>
<tr>
<td><strong>Maintenance Costs</strong></td>
<td>$0.39 - $0.54</td>
<td>$0.39 - $0.54</td>
<td>$0.39 - $0.54</td>
<td>$0.39 - $0.54</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td>$3.27 - $4.49</td>
<td>$1.69 - $2.22</td>
<td>$1.69 - $2.22</td>
<td>$1.69 - $2.22</td>
</tr>
<tr>
<td><strong>4-Year PV</strong>*</td>
<td>$7.70 - $10.29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: UDOT, traffic control and construction firms, and Dye Management Group analysis.

Note: Numbers may not add due to rounding.

Note(*): Based on purchase prices, high and low turnover rates, and utilization rates.

Note(**): Based on a percentage of total inventory purchased.

Note(***): Based on an interest rate of 7.125% per annum.

The exhibit illustrates that to supply temporary traffic control devices, UDOT would incur approximately $7.7 to $10.3 million dollars over a five-year period. This figure is significantly more (over $2.0 million) than the costs UDOT incurred for the same devices supplied by contractors, as illustrated in Exhibit II-2, above.

Other costs that have not been estimated but would be incurred include:

- Costs incurred by contractors for mobilizing temporary devices. This includes the additional cost for the pickup and return of devices by the contractor.
- Costs incurred by UDOT to develop and implement an inventory control and tracking system of traffic control devices.
- Potential costs incurred by county and municipal governments to also begin supplying devices.
- Costs incurred by UDOT for land and buildings required to store devices.
D. Recommendation

The audit analysis does not warrant changing the manner in which temporary traffic control devices are provided for construction projects. However, based on audit analysis and interviews with stakeholders, the following recommendation is made:

**Refine Section 155 of the Construction Specification covering provision of traffic control to address the following issues:**

- **Develop a standard procedure for addressing change orders involving traffic control devices and activities.**
  
  Examination of project files, as well as interviews with contractors reveal that UDOT does not have a standard approach to covering traffic control costs within change orders. In some cases, additional costs are determined based on the estimated duration created by the change in project scope. In other cases, costs have been set based on the unit cost pricing method.

**Implementation Strategies**

- Include change order methodology as an addendum to Section 155 specification.
- Apply change order methodology consistently.

- **Define UDOT’s requirements for traffic control devices prior to bid.**
  
  By providing general guidelines and expressing expectations for traffic control through the bid process for each project, UDOT can increase the level of service and reduce ambiguity and misunderstandings with contractors. For example, if UDOT expects the use of variable message signs or state patrol vehicles, this should be specified. This is not required under the *Manual on Uniform Traffic Control Devices* (MUTCD). In addition, UDOT can specify requirements to phase lane closures to avoid undue disruption to motorists instead of letting contractors determine what is convenient.

**Implementation Strategies**

- Develop a list of special provisions for traffic control (such as use of State Patrol, Jersey barriers or variable message signs) that have been used based on Region experience.
- On each project, prepare a general statement of the Department’s expectations for traffic control, and which special provisions, if any, are to apply.
• **Consider developing separate budgets for labor and materials under lump sum.**

Other states have developed streamlined traffic control bidding processes that involve more detailed tracking of materials and labor. For example, Arizona Department of Transportation (ADOT) has separated labor and device costs by setting parameters for bids including the number and type of devices, and the labor hours allowed for the project.

*Implementation Strategies*
- Evaluate business benefits of developing separate budgets for labor and materials under lump sum.

• **Ensure that traffic control standards and specifications are applied uniformly throughout the state.**

Contractors interviewed indicated that, from their perspective, UDOT does not consistently apply engineering standards for traffic control plans and specifications throughout the state. For example, for two similar projects, UDOT ordered the contractors to use dissimilar control devices. This forced the contractors to incur higher than expected costs. In order to eliminate some of the ambiguity caused by lump sum pricing and disputes regarding deployment of traffic control devices, contractors need to understand UDOT expectations.

*Implementation Strategies*
- Implement prior recommendation to define UDOT’s requirements for traffic control prior to bid.
- Specify which, if any, special provisions apply on a project by project basis.
Appendix A
Data Analysis Supporting the Audit Findings

This appendix presents additional data and analyzes completed during the course of the performance audit. Issues analyzed include:

- Analysis of traffic control costs under unit cost and lump sum pricing.
- Issues and Findings from Interviews.

Each issue is addressed below.

A. Analysis of traffic control costs under unit cost and lump sum pricing

Exhibit A-1 outlines the difference between unit cost and lump sum accounting for traffic control of two sets of similar projects. Analysis of the bid data for a set of unit cost and lump sum projects indicate a wider range of less accurate bid estimates under the lump sum method as compared to the unit cost method.

<table>
<thead>
<tr>
<th></th>
<th>Unit Cost Basis</th>
<th>Lump Sum Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Projects</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Total Value of Engineer’s Estimates*</td>
<td>$3,636.9</td>
<td>$7,947.0</td>
</tr>
<tr>
<td>Total Value of Winning Bids*</td>
<td>$3,450.2</td>
<td>$3,966.9</td>
</tr>
<tr>
<td>Percent Difference</td>
<td>-5.1%</td>
<td>-49.9%</td>
</tr>
<tr>
<td>Normal Bid Range (+/-)*</td>
<td>$38.0</td>
<td>$180.7</td>
</tr>
</tbody>
</table>

Source: UDOT Final Estimates of projects, Dye Management Group, Inc. analysis
Note(*): In thousands of dollars.

The data indicates that:

- The range of estimated bids for traffic control on projects under the lump sum method is significantly more than under the unit cost method.

Examination of the range and standard deviation of bids indicate that those projects bid under the lump sum method had a wider range of bids for traffic control, as compared to unit cost projects. Overall, the standard deviation for lump sum projects averaged over $180 thousand, compared to only $38 thousand for unit cost projects. Individual projects show bid variations of $700
thousand to $1 million. The sample set also indicates that UDOT may have problems in estimating traffic control under the lump sum method; a couple of projects had estimates several times higher than the winning or lowest bid for traffic control.

- **Bid-estimating performance varies significantly between unit cost and lump sum projects.**

  For the set of unit cost projects, the difference between UDOT’s estimated cost for traffic control, and the total value of traffic control on the winning bids was only 5 percent. However, for the lump sum projects, the difference between UDOT and the winning bid estimates was nearly 50 percent.

These results are due to several factors, including:

- **Lack of detailed information regarding the expected or required quantities of labor and material.**

  Under the lump sum method, prospective bidders do not have a preliminary traffic control plan upon which to base their estimates. It is only after award that the successful bidder (lowest overall bidder) must present their traffic control plan to UDOT for review.

- **Lack of consistent application of traffic control standards by UDOT and contractors.**

  Contractors have indicated that UDOT has been inconsistent in applying lump sum traffic control management throughout the state. For example, in one region, UDOT did not specify the need for a particular device. On a nearly identical project elsewhere in the state, UDOT engineers insisted on using particular devices.

- **Lack of historical performance data on traffic control costs by prospective bidders.**

  Examining the effectiveness of lump sum method identified the variety of methods contractors use to complete bids. Some contractors submit detailed bids based on historical data, ensuring compliance with regulations and safety of their site. Others merely present rough estimates, since they do not manage their costs closely. These firms shift funds from one area of their budget to another to cover costs, if necessary.

- **Traffic control costs may not be fully accounted.**

  Examination of several projects revealed that costs are not accounted for consistently in accordance with the specifications (i.e., cost items were listed under "traffic control" on some projects and under "other activities" on other projects). Also, UDOT engineering staff believe that traffic control costs may
be lumped in with other activities, such as placing flagging costs in with the asphalt overlay activity costs, thus masking the true cost of traffic control.

- **Lack of a detailed traffic control plan on which to base an estimate of labor and material requirements.**

Without a detailed traffic control plan, UDOT engineers do not have adequate information to make an accurate estimate of costs. Consequently, they may make rough estimates.

Exhibits A-2 and A-3 present the detailed bid data for the sample population of projects examined by unit cost and lump sum, respectively.

**Exhibit A-2:**

**Variation of Unit Cost Traffic Control Bid Prices**

($ in thousands)

<table>
<thead>
<tr>
<th>Project</th>
<th>Engineer’s Estimate</th>
<th>Range of Bids</th>
<th>Winning Bid*</th>
<th>Low</th>
<th>High</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM-15-6(122)269</td>
<td>$57.4</td>
<td>$39.4</td>
<td>$39.4</td>
<td>$53.2</td>
<td>$46.7</td>
<td>$7.0</td>
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<td>IM-15-7(189)289</td>
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<td>$208.5</td>
<td>$206.6</td>
<td>$300.5</td>
<td>$244.7</td>
<td>$34.8</td>
<td></td>
</tr>
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<td>IM-215-9(103)14</td>
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<td>$158.8</td>
<td>$127.9</td>
<td>$178.6</td>
<td>$153.3</td>
<td>$21.1</td>
<td></td>
</tr>
<tr>
<td>IM-70-2(36)61</td>
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<td>$183.3</td>
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<tr>
<td>IM-80-1(25)0</td>
<td>$251.5</td>
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<td>$138.6</td>
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</tr>
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<td>IM-80-1(28)20</td>
<td>$90.5</td>
<td>$119.3</td>
<td>$108.7</td>
<td>$165.3</td>
<td>$124.6</td>
<td>$23.2</td>
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<tr>
<td>IM-INH-15-7(193)316</td>
<td>$459.7</td>
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<tr>
<td>INH-80-4(71)181</td>
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<td>$14.8</td>
<td>$34.0</td>
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<tr>
<td><strong>Average</strong></td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
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<td>$3,450.2</td>
<td></td>
<td></td>
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<td></td>
<td>$38.0</td>
</tr>
<tr>
<td><strong>Percent Difference</strong></td>
<td>-5.1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: UDOT Construction Division, Dye Management Group, Inc. analysis.

Note: Totals may not add due to rounding.

Note(*): Denotes the bid price for traffic control of the lowest total (thus winning) bid offer made.
Exhibit A-3:
Variation of Lump Sum Traffic Control Bid Prices
($ in thousands)

<table>
<thead>
<tr>
<th>Project</th>
<th>Engineer’s Estimate</th>
<th>Range of Bids</th>
<th></th>
<th></th>
<th></th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Winning Bid*</td>
<td>Low</td>
<td>High</td>
<td>Average</td>
<td></td>
</tr>
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<td>Total</td>
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<td>$7,947.0</td>
<td>$3,966.9**</td>
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<td></td>
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<tr>
<td>Percent Difference</td>
<td></td>
<td>-49.9%</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: UDOT Construction Division, Dye Management Group, Inc. analysis

Note: Totals may not add due to rounding.

Note(*): Denotes the bid price for traffic control of the lowest total (thus winning) bid offer made.

Note(**): Total of winning bid traffic control prices including only those that have a corresponding engineer’s estimate.

B. Issues and Findings from Interviews

Interviews with contractors, UDOT staff, and suppliers of traffic control devices indicate that:

- **Barrels, barricades, or panels may last as little as a few days, or as much as several weeks or months.**

  Depending on the traffic conditions, devices may have a relatively short working life before they are destroyed. In one case, a UDOT maintenance crew lost its entire set of barrels, one week after receipt, from the supplier. The barrels were apparently destroyed after being hit by a truck and trailer.

- **Contractors consider devices as disposable items, and the cost for procuring and using these devices as an incidental cost of building roads.**

  Contractors believe that the increase in traffic control expense is largely due to an increase in labor costs. They also believe that traffic control is a "sunk cost" - an incidental cost to be included in the overall cost of construction. They
consider traffic control devices to be disposable items, requiring replacement every three to four months.

- **Traffic control supply firms indicate these devices can last much longer, between three and five years on average.**

  Interviews with firms specializing in providing traffic control devices indicate the devices can last much longer, between three and five years depending on the device. With proper cleaning and maintenance, some devices may last as long as six to eight years. These firms have set up maintenance and cleaning programs for their equipment to ensure the devices comply with MUTCD standards. It should be noted that these firms have a greater incentive to maintain the devices, since the devices represent their primary business.

- **UDOT currently purchases several traffic control devices, including barricades, signs, barrels, cones, and pre-cast concrete barriers.**

  UDOT purchases these devices for use on various maintenance projects throughout the state. UDOT personnel think these devices have relative short lifespans.

- **Prices for devices are based on type, condition, and quantity ordered.**

  A few firms have provided fixed prices for devices. The prices depend on the type of device. According to suppliers, barrels cost between $49 and $65 per unit for new devices, less than $30 for used. Barricades cost between $70 and $150, depending on design and materials. UDOT has a purchase agreement with one firm to supply barrels to maintenance crews at $52.63 (including shipping).

  UDOT is examining the feasibility of using plastic Type II sawhorse barricades, in lieu of steel-and-wood Type II Barricades. Plastic barricades are approximately $5 to $10 more than the steel barricades; however, they are also more durable than the steel devices. Steel devices take only one hit before requiring replacement; plastic-based devices, made of easily replaceable parts, may receive several hits before requiring replacement.

- **UDOT needs to apply standards of traffic control consistently.**

  Contractors related the experience of developing similar traffic control plans for separate but similar projects in different parts of the state, then having one plan approved and the other not approved by UDOT engineers. For example, a contractor proposed a plan not using Jersey barriers on a job because they knew of another firm who had not used the barriers on a nearly identical type of job. UDOT insisted the plan include the barriers. This action resulted in the contractor paying higher traffic control costs. This type of problem is partly due to the lack of detail provided by UDOT prior to bid. Contractors also
related experiences in which change orders were not completed in a consistent manner.

- **While some contractors are concerned with safety, others are more concerned about doing the minimum effort required to meet specifications.**

Some contractors internally track detailed analysis of costs and prices associated with their traffic control activities, similar to UDOT's unit cost method accounting. However, other firms complete only a rough order estimate of traffic control, and assume they can make up for any losses incurred by traffic control in other areas of the project. The lump sum method could be disadvantageous to the safety-conscious firms since they will complete detailed plans and estimates of costs before bidding; other firms will only complete rough estimates suitable for meeting the minimum requirements.

- **Submitted traffic control plans are not detailed.**

The traffic control plans submitted by contractors are often merely letters stating they will follow UDOT guidelines and MUTCD. Because detailed standards are not detailed by UDOT within the specification, some contractors are completing only the minimum requirements relating to public and worker safety. For example, on I-15 North of Salt Lake, the contractor has installed several miles of concrete barriers, but only works on a few miles at a time. While this plan has reduced the labor required for repositioning traffic control devices, the motoring public incurs costs due to higher levels of congestion.

- **Some contractors prefer to complete their own traffic control, in order to save time and money.**

Traffic control is integral to construction. If a subcontractor does not show up, the prime must complete the work, or lose money if the work halts. Other contractors subcontract to firms specializing in traffic control, providing turnkey solutions. These specialty firms develop the plans, supply and install the devices, and manage all aspects of traffic control for projects.

- **Contractors consider traffic control devices as disposable items in the construction process.**

If a job lasts more than three to four months, contractors believe it is more economical to buy the devices. By the end of the project, many devices may no longer be functional or need to be replaced due to damage. Overall, contractors think the devices have a relatively high turnover rate. Typically, contractors cycle the devices to other jobs and end up buying more devices during a project in order to have sufficient quantities on hand to meet specifications.
Appendix B
Survey of Traffic Control Costs

A. States Contracted

Dye Management Group, Inc. conducted telephone interviews with key staff involved with traffic control management in the following state departments of transportation:

- Arizona
- Colorado
- Georgia
- Idaho
- Louisiana
- Montana
- New Mexico
- North Dakota
- Oregon
- Texas
- Washington
- Wyoming

B. Findings

Interviews with the above departments have revealed the following information:

- Most states price traffic control devices using both unit cost and lump sum pricing methods.

  Many states appear to use lump sum for smaller, more easily defined projects such as chip seal projects. Unit cost pricing is used on larger, less easily predictable projects, such as new construction.

  Oklahoma uses the value of the traffic control as a benchmark to determine whether to price traffic control devices by lump sum or by unit. If a bid is less than $60,000, then devices are priced using lump sum, otherwise traffic control devices are paid for on a per unit basis.

  Montana Department of Transportation completed a survey in 1999, benchmarking traffic control pricing practices. The survey found that only a few states use the lump sum method exclusively.
Exhibit B-1:
Benchmark of Traffic Control Costing Methodologies for 35 States

<table>
<thead>
<tr>
<th>Unit Cost Method</th>
<th>Lump Sum Method</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL, AR, CO, DE, NE, NH, RI, VA, WV, WI</td>
<td>GA, LA, NV*, UT</td>
<td>AZ, CT, ID, IN, IA, KS, KY, ME, MD, MA, MI, NM, OH, OK, OR, PA, TN, TX, VT, WA, WY</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>21</td>
</tr>
</tbody>
</table>

Note(*): Data on Nevada was gathered during the course of this audit.

- Traffic control devices included in lump sum bids vary state to state.
  - Oregon Department of Transportation uses lump sum for temporary protection and direction of traffic and unit, pricing for traffic control devices, flagging and pilot car services.
  - Washington State Department of Transportation pays a lump sum amount for all devices except signs and labor on routine jobs. However, unit costs are typically charged on a device-day basis.

- From a small sample of states polled, it appears that few states own traffic control devices for construction projects.
  From a sample of six states, no state owns traffic control devices to be used only for construction projects. Although Wyoming Department of Transportation (WyDOT) owns a triton barrier for maintenance and construction work, it stopped furnishing traffic signals at construction projects because it was not cost effective. Contractors charged more to maintain the state’s signals than renting, transporting, and maintaining rented signals. In addition, contractors did not adequately maintain WyDOT’s equipment.

- Most states do not allow the contractor to estimate quantities for traffic control items.
  Some states allow contractors to estimate quantities, typically for lump sum items or as a refinement to the State’s base estimate. For example, Texas Department of Transportation (TxDOT) allows the contractor to estimate the traffic control quantities above TxDOT’s initial estimate. On larger projects, TxDOT provides detailed phase construction plan sheets that the contractor can refine to estimate additional quantities.

- Compared to other states, it does not appear that contractors are overcharging Utah for overall traffic control.
  A benchmark study of Utah against several other states indicates that other states pay significantly more for traffic control.