

**MEMORANDUM**

April 1, 2014

**TO:** Government Operations and Fiscal Policy Committee

**FROM:** Aron Trombka, Senior Legislative Analyst *AT*  
Carl Scruggs, Research Associate *CS*  
Office of Legislative Oversight

**SUBJECT:** **Office of Legislative Oversight Report 2014-6: *Change Orders in County Construction Projects***

The Council released Office of Legislative Oversight (OLO) Report 2014-6: *Change Orders in County Construction Projects* on March 18, 2014. The report responds to the Council's request for a report that examines the change order process for County Government capital facility construction projects. The report describes the regulatory framework and practices that govern change and field orders. In addition, the report provides case studies detailing the change and field orders for six recently completed facilities. Finally, the report identifies methods used by state and local governments to assess and mitigate the risk associated with capital project construction contract change orders. The Executive Summary for Report 2014-6 appears on © 1-3.

At this worksession, the Government Operations and Fiscal Policy Committee will consider the findings and recommendations of Report 2014-6. At the worksession, OLO will present an overview of the report. David Dise, Greg Ossont, Ernie Lunsford, Hamid Omidvar, and Suresh Patel of the Department of General Services (DGS) will attend the worksession to provide comments and answer questions.

**COUNCILMEMBERS PREVIOUSLY RECEIVED COPIES OF REPORT 2014-6 AND SHOULD BRING A COPY OF THE REPORT TO THE WORKSESSION.**

**SUMMARY FINDINGS**

This section summarizes the key findings of Report 2014-6.

***Finding #1: Construction contract change orders are not inherently beneficial or detrimental to the progress of a capital project.***

The change order process is a procurement tool that, when managed properly, can offer substantial benefits to a contract manager. The change order process is a method to respond to changing requirements that arise during the construction phase of a project. In the absence of a change order process, the original construction contract likely would require a higher payment amount to compensate the contractor for assuming responsibility for addressing unanticipated work requirements.

However, change orders also may result in undesired cost increases and delays. Once an agency has entered into a contract with a construction firm, an opportunity no longer exists to competitively bid changes to work requirements. Rather, by its very nature, the change order process requires the agency to only consider pricing and staffing offered by the contractor (or through a subcontractor).

***Finding #2: For the overall capital program managed by DGS, change and field orders had only a moderate effect on contract costs.***

Change and field orders aggregated together for all 17 capital projects studied by OLO resulted in an overall increase in contract costs of 8.0%. Of the 17 projects, nearly two-thirds (11 projects) experienced a change in contract cost resulting from change and field orders of less than 10%. In fact, change orders for two projects resulted in a reduction in final contract costs. A single project, the Council Office Building Data Center Rehabilitation, incurred change and field order cost increases of greater than 20% of contract costs. With the exception of the Council Office Building Data Center and Takoma Park Fire Station projects, the capital budget appropriations for the projects were sufficient to cover the additional cost incurred by change and field orders.

***Finding #3: For the projects studied, field orders had a substantially greater effect on contract costs than did change order.***

For the 17 projects studied in this report, field orders had a substantially greater effect on contract costs than did change orders. On average change orders added about \$37,400 (or 0.5%) to contract costs. In contrast, field orders added about \$569,900 (or 7.5%) to contract costs on average.

***Finding #4: For the overall capital program managed by DGS, change orders had a significant effect on the construction schedules.***

In the aggregate, change orders for the 17 projects studied by OLO increased the overall construction time by 30.3%. Of the 17 projects, just under half (47%) had increases in contract time resulting from change orders of less than 10%. For two projects, change orders extended the contract time by 10% to 20%. For the remaining seven projects, change orders extended contract time by more than 20%. Two projects (COB Data Center and Mid-County Community Recreation Center) experienced delays that more than doubled the construction time period.

***Finding #5: In several projects, the cost increases and delays approved through change and field orders were the result of unforeseeable conditions and uncontrollable events.***

Change and field orders are caused by a variety of factors, some of which are unforeseeable and uncontrollable. The projects reviewed included cases in which:

- a large and experienced construction contractor declared that it would cease business operations while working on an ongoing project;
- a previously reliable supplier delivered improperly manufactured building materials; and,
- a local utility modified code requirements while a capital project was under construction.

In each of these cases, the unforeseen condition or uncontrollable event necessitated execution of change and field orders to allow project construction work to proceed.

***Finding #6: Certain types of capital projects are particularly susceptible to plan modifications during the construction phase and as a result bear a higher risk of cost increases and delays.***

Projects with complex or specialized architectural and engineering requirements often involve additional risk of unanticipated change. Unforeseen events are more likely to occur when designing and constructing facilities which are dissimilar to other facilities recently built by the County. The risk of plan errors and omissions may rise when a facility design involves a level of complexity and specialization that is unlike other projects.

The County has encountered the risk associated with complex, specialized projects. Of the capital projects studied in this report, the one that experienced the greatest cost increase and time delay was a specialized project unlike most other County projects, the COB Data Center Rehabilitation. Design of this project was performed initially by an architectural and engineering contractor that lacked the expertise to design a complex facility such as the Data Center. As a result, the construction phase of the project required a substantial extension of time (more than a year) to correct design errors.

Conditions at the construction site constitute another potential risk factor. In general, projects located at redeveloped sites or on previously disturbed land run a higher risk of encountering subsurface problems such as subterranean rock, contaminated soils, and underground storage tanks. Moreover, when performing construction at a previously developed site, a project is necessarily affected by pre-existing conditions including the location of utility lines and other underground structures, stormwater drainage patterns, and surrounding vehicle and pedestrian networks.

Undetected adverse site conditions have affected County capital projects. The Colesville Salt Barn project incurred a large cost increase after the construction contractor found rubble and other debris buried at the previously disturbed site. Routine pre-construction soil borings did not discover the subsurface debris.

In addition, renovation projects present further risk resulting from the integration of new construction with pre-existing elements of the building. Renovation projects often encounter deficiencies in the materials and systems retained from the original building. For example, in both the Gaithersburg Library and Olney Library renovation projects, construction crews encountered deteriorated sections of the existing buildings that necessitated unplanned repair work.

***Finding #7: Methods exist to mitigate the risk associated with change orders. These methods commonly involve higher expenditures at the outset of a project in order to contain costs during the construction phase.***

Some jurisdictions require government agencies to conduct a risk assessment before constructing a capital project. A capital construction risk assessment may include an evaluation of potential variables that could necessitate change orders and affect project cost and time. Through the risk assessment process, the government identifies pre-construction measures that mitigate the government's exposure to factors that could produce unanticipated expense and delay. Risk mitigation strategies include:

- **Unit Pricing**: One strategy to control the cost risk of change orders is to specify unit costs for labor and materials requested through a change order in the original construction contract. Establishing fixed unit prices for potential change order work removes price volatility from the process and thereby controls costs.

- Evaluation of Site Conditions: Unfavorable site conditions (such as poor or contaminated soils, buried utility lines, and underground storage tanks) are one of the primary causes for change orders. Soil borings and other sub-surface testing provide vital information necessary for facility construction but also come at a cost. Conducting extensive pre-construction site testing reduces the risk that change orders will be necessary but adds cost to the planning and design phase of a project.
- Design Review: Design review is a process of evaluating architectural and engineering plans to identify errors, omissions, and other problems. Extensive review can increase the time and cost of the planning phase of a capital project but can also yield greater time and cost savings during the construction phase. In one type of design review, third-party reviewers examine design specifications and suggest revisions to improve the product, reduce costs, or save time. Another form of design review, Building Information Modeling, is a computer-based project management tool that converts design plans into three-dimensional form to create a virtual model of the proposed building. Design reviewers can then view the building model and correct design problems, conflicts, or omissions that would occur if the building were constructed as designed.
- Alternative Procurement Practices: DGS awards separate contracts for architectural and engineering design and for construction of capital projects (“design-bid-build” contracting). In “design-build” contracting, a government enters into a single contract for both the design and construction of a capital project. The design-build approach may prevent unexpected cost increases and delays by requiring the contractor to assume the financial risk for changes in project design. In “construction management at risk” contracting, the government hires a firm in the pre-construction stage to consult on project budget, schedule, and design. During the design phase, the government and the contractor agree on a guaranteed maximum price for the construction work. The contractor assumes the risk of constructing the project as designed for an amount not to exceed the guaranteed maximum price. These alternative procurement methods reduce cost risk to the government but may prompt bidders to request greater compensation to account for assuming a higher level of risk.

***Finding #8: DGS recently has begun to compile and maintain project-specific data on the effects of change and field orders on changes contract cost and time.***

DGS provided all requested contract, change order, and field order data requested by OLO. For many projects, DGS retrieved many contract documents from archives. At the outset of this study, DGS did not maintain project-specific data on the effect of change and field orders on contract cost and time. Concurrent with the OLO study, DGS began to develop and maintain project-specific change and field order data. DGS plans to consolidate the data into a master file to help identify factors that cause project cost increases and delays.

## OLO RECOMMENDATIONS

Based on the findings of Report 2014-6, OLO offers the following three recommendations for Council action.

***Recommendation #1: Request that DGS establish a capital project risk assessment process.***

As discussed in Finding #6, certain types of capital projects are particularly susceptible to plan modifications during the construction phase and bear a higher risk of cost increases and delays. Risk factors include:

- complex or specialized architectural and engineering requirements dissimilar to those of other facilities recently built by the County;
- project location at a redeveloped site or on previously disturbed land; and
- integration of new construction with pre-existing building elements.

OLO recommends that the Council request that DGS establish a process to assess and rate the relative cost and scheduling risk of pending capital projects based on the presence or absence of known risk factors such as those listed above. The purpose of this assessment is to identify projects with especially high risk of cost increases and delays at the outset of the contracting process.

***Recommendation #2: Request that DGS selectively employ alternative procurement and contracting methods as necessary to mitigate the cost and schedule uncertainty of high risk projects.***

OLO recommends that the Council request DGS to adjust procurement and contracting methods as necessary to mitigate the cost and schedule uncertainty for high risk projects. As outlined in Finding #7 (and described in detail in Chapter VII), a variety of strategies exist to mitigate exposure to factors that could produce unanticipated expense and delay. DGS should selectively employ these strategies commensurate with the risk level of the project. For example, a specialized and complex project dissimilar to other County facilities may carry a high risk of design errors and omissions, and so, may be a worthy candidate for an alternative procurement approach such as design-build contracting. While risk mitigation measures may increase the time and cost of the planning phase, nonetheless, these strategies help moderate project uncertainty and can yield greater time and cost savings during the construction phase.

***Recommendation #3: Encourage DGS to continue to collect and monitor project-specific change and field order data to track trends and to identify factors that raise the risk of cost increases and schedule delays.***

Concurrent with this OLO project, DGS began to compile and maintain project-specific data on the effects of change and field orders on contract cost and time. OLO recommends that the Council encourage DGS to continue to compile and monitor change and field order data for each capital project. Analysis of this data may help identify factors that raise the risk of project cost increases and schedule delays. As discussed in the previous recommendation, recognition of cost and schedule risk factors is a vital prerequisite to selecting the most appropriate procurement and contracting practices for a construction project.

# Change Orders in County Government Construction Projects

OLO Report Number 2014-6

March 18, 2014

The Department of General Services (DGS) manages the design and construction of most County Government capital projects. DGS approves change and field orders to modify the work requirements, cost, and schedule of facility construction contracts. This report examines the change and field order process for County Government capital facility construction projects.

## Change Orders and Field Orders

A change order is a written directive to the contractor directing a change in the work within the general scope of the contract. A change order may adjust the contract cost and/or time. DGS also may direct a change in work by another form of written directive known as a "field order." Two factors distinguish a field order from a change order. First, a field order must be the result of "unforeseen and unanticipated conditions." Second, the unforeseen conditions addressed by a field order must warrant "immediate action to mitigate costs or avoid delays." A field order may not modify the contract price.

Construction contract change and field orders are not inherently beneficial or detrimental to the progress of a capital project. The change order process is a method to respond to changing requirements that arise during the construction phase of a project. When managed well, the change order process can offer substantial benefits to a contract manager.

In the absence of a change order process, the original construction contract likely would require a higher payment amount to compensate the contractor for assuming responsibility for addressing unanticipated work requirements.

However, change orders also may result in undesired cost increases and delays. Once an agency has entered into a contract with a construction firm, an opportunity no longer exists to competitively bid changes to work requirements. Rather, by its very nature, the change order process requires the agency to only consider pricing and staffing offered by the contractor (or through a subcontractor).

## Factors that Cause Change and Field Orders

Multiple conditions precipitate the need for a construction contract change or field order.

- Site Conditions: Projects located at redeveloped sites or on previously disturbed land run a higher risk of encountering subsurface problems such as subterranean rock and contaminated soils. In addition, renovation projects present further risk resulting from the integration of newly constructed and older pre-existing elements of the building.
- Errors and Omissions: Facility design plans sometimes include errors and omissions, particularly when the design contractor lacks the specialized expertise to design a complex project.
- Third Party Involvement: Often, facility construction requires coordination with a third party (other than the County and its contractors). Construction progress may be dependent on the performance and requirements of the third party.
- Code Compliance: Regulatory agencies review construction plans and conduct site visits to ensure that the facility is built in compliance with all relevant codes. On occasion, standards change after the completion of construction plans but before the start of facility construction.
- Modified User Requirements: On occasion, the using department will modify the facility requirements after completion of the architectural and engineering plans.

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## **Change and Field Orders in Recent County Projects**

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OLO reviewed the change and field orders documents for 17 capital projects managed by DGS that reached substantial completion in Calendar Years 2009 through 2013. For these projects, change and field orders had a moderate effect on contract costs. Change and field orders aggregated together for all 17 capital projects resulted in an overall increase in contract costs of 8.0%. Eleven projects experienced a change in contract cost of less than 10%. In fact, change orders for two projects resulted in a reduction in final contract costs. A single project, the Council Office Building Data Center Rehabilitation, incurred change and field order cost increases of greater than 20% of contract costs. With the exception of the Council Office Building Data Center and Takoma Park Fire Station projects, the capital budget appropriations for the projects were sufficient to cover the additional cost incurred by change and field orders.

Field orders had a substantially greater effect on contract costs than did change orders. For the 17 projects, field orders had a substantially greater effect on contract costs than did change orders. On average change orders added about \$37,400 (or 0.5%) to contract costs. In contrast, field orders added about \$569,900 (or 7.5%) to contract costs on average.

For the overall capital program managed by DGS, change orders had a significant effect on the construction schedules. In the aggregate, change orders for the 17 projects studied increased the overall construction time by 30.3%. Of the 17 projects, just under half (47%) had increases in contract time resulting from change orders of less than 10%. For two projects, change orders extended the contract time by 10% to 20%. For the remaining seven projects, change orders extended contract time by more than 20%. Two projects (COB Data Center and Mid-County Community Recreation Center) experienced delays that more than doubled the construction time period.

## **Foreseeable and Unforeseeable Risk**

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Change and field orders are caused by a variety of factors, some of which are unforeseeable and uncontrollable. In several recent projects managed by DGS, the cost increases and delays were the result of unforeseeable conditions and uncontrollable events, including:

- a large and experienced construction contractor declared that it would cease business operations while working on an ongoing project;
- a previously reliable supplier delivered improperly manufactured building materials; and,
- a local utility modified code requirements while a capital project was under construction.

In each of these cases, the unforeseen condition or uncontrollable event necessitated execution of change and field orders to allow project construction work to proceed.

With some adverse conditions cannot be foreseen, one can anticipate that certain types of projects are particularly susceptible to plan modifications during the construction phase. Projects with complex or specialized design requirements bear a higher risk of cost increases and delays. Of the 17 projects studied, the one that experienced the greatest cost increase and time delay was a project unlike any other County project, the COB Data Center Rehabilitation. Design of this project was performed initially by an architectural and engineering contractor that lacked the specialized expertise. As a result, the construction phase of the project required a substantial extension of time (more than a year) to correct design errors.

DGS recently began to compile and maintain project-specific data on the effects of change and field orders on changes contract cost and time. At the outset of this study, DGS did not maintain project-specific data on the effect of change and field orders on contract cost and time. Concurrent with the OLO study, DGS began to develop and maintain project-specific change and field order data. The availability of this data may help identify factors that raise the risk of project cost increases and delays.

## **Risk Assessment and Mitigation**

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Some jurisdictions require government agencies to conduct a risk assessment before constructing a capital project. A capital construction risk assessment may include an evaluation of potential variables that could necessitate change orders and affect project cost and time. Through the risk assessment process, the government identifies pre-construction measures that mitigate the government's exposure to factors that could produce unanticipated expense and delay. Risk mitigation strategies include:

- **Unit Pricing:** A government can control the cost risk of change orders by specifying unit costs for labor and materials in the original construction contract. Establishing fixed unit prices for potential change order work removes price volatility from the process.
- **Evaluation of Site Conditions:** Sub-surface testing provides vital information necessary for facility construction. Conducting extensive pre-construction site testing reduces the risk that change orders will be necessary but adds cost to the planning and design phase of a project.
- **Design Review:** Design review is a process of evaluating architectural and engineering plans to identify errors, omissions, and other problems. Extensive review can increase the time and cost of the planning phase of a capital project but can also yield greater time and cost savings during the construction phase. In one type of design review, third-party reviewers examine design specifications and suggest revisions to improve the product, reduce costs, or save time. Building Information Modeling is a computer-based tool that converts design plans into a virtual model that allows reviewers to better identify and correct design problems.
- **Alternative Procurement Practices:** In "design-build" contracting, a government enters into a single contract for both the design and construction of a capital project. The design-build approach may prevent unexpected cost increases and delays by requiring the contractor to assume the financial risk for changes in project design. In "construction management at risk" contracting, the government hires a firm to consult on project development and to assume the risk of constructing the project for a pre-determined guaranteed maximum price. These procurement methods reduce cost risk to the government but may prompt bidders to request greater compensation to account for assuming a higher level of risk.

## **Office of Legislative Oversight Recommendations**

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OLO offers the following three recommendations for Council action.

### **1. Request that DGS establish a capital project risk assessment process.**

The Council should request that DGS establish a process to assess and rate the relative cost and scheduling risk of pending capital projects based on the presence or absence of known risk factors such as those listed above. The purpose of this assessment is to identify projects with especially high risk of cost increases and delays at the outset of the contracting process.

### **2. Request that DGS selectively employ alternative procurement and contracting methods as necessary to mitigate the cost and schedule uncertainty of high risk projects.**

The Council should request DGS adjust procurement and contracting methods as necessary to mitigate the cost and schedule uncertainty for high risk projects. DGS should selectively employ risk mitigation strategies commensurate with the risk level of the project. While risk mitigation measures may increase the time and cost of the planning phase, these strategies nonetheless help moderate project uncertainty and can yield greater time and cost savings during the construction phase.

### **3. Encourage DGS to continue to collect and monitor project-specific change and field order data to track trends and to identify factors that raise the risk of cost increases and schedule delays.**

The Council should encourage DGS to continue to compile and monitor change and field order data for each capital project. This data could help identify change order risk factors.

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