

Analysis of Change Order Markup Allowances on Stipulated Price Building Contracts

Dr. Aminah Robinson Fayek, P.Eng., and Moses Y. Nkuah, CCC

ABSTRACT: On a project of any size, change orders have become an integral part of the construction process. Most stipulated price contracts contain predefined markups for the reimbursement of labor burdens, overhead, and profit on change order work. This article investigates the adequacy of these markup allowances based on an investigation of the practices of Canadian building contractors. Recommendations are made on future research required to develop a fair and equitable change order pricing strategy to adequately compensate contractors.

KEY WORDS: building, change orders, labor burden, markup, stipulated price

A change order is defined as a written amendment to a contract signed by the owner and the contractor stating their agreement upon a change in the work, the method of adjustment or the amount of adjustment in contract price, if any, and the extent of the adjustment in contract time, if any [2]. On a project of any size, change orders have become an integral part of the construction process. Change orders are typically caused by one or more of the following factors [5].

- Incomplete bid drawings or drawings that lack constructability.
- Incomplete, vague, or incorrect specifications.
- Differing site or substructure conditions.
- Schedule delays or interference with other contractors.
- Changes in provincial, federal, or local laws, procedures, permits, codes, or zoning ordinances.
- Late delivery of owner-furnished equipment, or shortages of construction materials or equipment.
- Labor shortages, strikes, or jurisdictional disputes.
- Work suspension caused by funding shortages (due to cost overruns, inadequate budget, or inflationary pressures).
- Schedule acceleration necessitated by an earlier plant completion requirement.

- Payment schedules and incorrect invoicing.
- Incorrect contract type.
- Defects in material, workmanship, and performance warrantee problems.
- Changes in owner's needs.
- Acts of God causing damage to completed work or equipment.

In addition, most construction contracts contain a "change" clause that allows the owner to make changes to the original contract work, usually within the scope of the original contract. A change made while work is in progress may affect the construction cost and schedule. On a cost-reimbursable project, the contractor may be asked to evaluate a change before it is implemented or may be directed to implement the change without prior evaluation. In either case, the owner finally absorbs the cost and schedule consequences. On a stipulated price contract, several techniques are employed for costing changes, including the following [8].

- Price and schedule adjustments may be negotiated before work on a change is started.
- If the project is completely or partially unit-price, the unit prices themselves provide the pricing of changed items.
- On a contract that is essentially of the unit-price category, the bidding documents may include a listing of work

tasks for which quantity variations may be expected, and the contractor asked to provide a unit price for those variations.

- The contractor may be directed to proceed on a change with after-the-fact adjustments negotiated based on time and materials expended. Although many standard contracts do not permit this, it is at times industry practice.

In practice, on a stipulated price contract, the contract documents contain clauses that stipulate the items to be considered when the cost associated with performing a change in the work is being determined. The prime components of these costs (labor, material, equipment, and subcontracts) are usually well defined. Most stipulated price contracts also contain predefined allowances (i.e., markup percentages) for the reimbursement of labor burdens, overhead, and profit on change order work. These allowances and the manner in which they are applied to the total cost of the changed work vary greatly among owners.

In order to facilitate a monetary change to a construction contract that reflects the value of the change, an "equitable adjustment" is required. In other words, the contracting parties should remain in the same financial position in which they were had the change not occurred, regardless of whether or not that position is one of profit or loss [3]. To address the issue of "equitable adjustment" of overhead, profit, and labor burden recovery on change orders, alternative pricing methods may need to be devised for change orders on stipulated price construction contracts. The objectives of this article are to examine industry guidelines and contract conditions for change order reimbursement clauses, and to compare these allowances with the actual costs incurred by contractors in administering and performing change order work. Based on these findings, recommendations are made on future research required to develop a fair and equitable change order pricing

ing strategy to adequately compensate contractors.

Previous Research and Industry Standards on Change Order Markup Allowances

The issues of change order pricing, change order effects, overhead and profit allocation, and labor burden allocation have been examined by several researchers [3, 4, 6, 7, 10, 11, 12]. Some of the main findings and recommendations of these researchers can be summarized in the following.

- The majority of change orders are a result of errors or omissions in the original contract documents.
- Some changes serve to increase the scope of the project.
- Change orders can affect the project rhythm and cause significant schedule as well as cost effects.
- Most public (i.e., government) contracts contain pre-defined markups for overhead and profit on change order work; however, the magnitude of the markups and the way in which they are applied to the various resource category costs vary greatly.
- The Eichleay formula, widely used to calculate a contractor's home office overhead losses due to owner-caused construction delays, is not normally valid under all circumstances.
- Many contractors feel that markup allowances on change order work do not adequately compensate for actual field overhead costs, and markup allowances do not provide for home office overhead completely or, in some cases, at all.
- Overhead rates on changed work should be mutually established between the owner and the contractor, or else by an independent certified auditor.
- Compensation for change order overheads should take into account the nature of the effects on the work (i.e., cost, time, or both).
- Allowances for profit should account for the nature of the work (e.g., risks, difficulty, magnitude of change order, period to perform change).
- Labor burdens should be assessed from the contractor's actual rate

schedules, rather than using pre-defined percentages.

A review of Canadian construction industry standards on change orders was conducted. The Canadian Construction Documents Committee Standard Construction Documents [2], which are widely used throughout Canada for the construction of industrial, commercial, and some institutional facilities, do not contain any statement on the payment of markup allowances on change orders. The Canadian Construction Association [1] provides guidelines for the reimbursement of markup for overhead and profit on change orders; they recommend a combined percentage of 20 percent for work done by a contractor's own forces and 15 percent for work done by subcontractors. The scope for these markups (e.g., includes/excludes supervision, site costs, etc.), however, is not adequately defined. Neither organization provides guidelines for allowable labor burden on change order work. H. Saunders [11], who conducted a review of US Department of Transportation (DOT) forms, had similar findings; he concludes, "a wide variety exists both in the treatment of costs by contracts as well as the values used in them as markup on changes. Cost definitions vary by local usage and by definition."

An Investigation of Markup Allowances on Change Orders on Stipulated Price Building Contracts

An investigation of the practices of Canadian building contractors was conducted to examine the adequacy of existing procedures employed in reimbursing contractors' profit, overhead, and labor burden on change order work on stipulated price building contracts. The investigation was conducted in the form of a mail-out questionnaire between May and August 1999 in Alberta, Canada. The total number of contractors contacted was 11, of which six responded. This article provides a summary of the results of the study as they pertain to change order markup allowances. The complete findings of the study are described by M.Y. Nkuah [9].

Each company was asked to report on a recently completed commercial building project with a stipulated price contract. Six projects were obtained, four involving public sector (i.e., government)

owners, and two involving private sector owners. All projects surveyed had a fixed percentage markup on change orders stipulated in the contract. The average allowable change order markup for overheads on contractors' own work was 7.0 percent. The average allowable markup for profit on contractors' own work was 5.4 percent. An average of 6.2 percent was provided as an allowable markup for overhead and profit on subcontractors' work. These markup allowances are well below those recommended in the Canadian Construction Association guidelines [1]. On all projects surveyed, labor wage rate, material, and equipment were priced as direct costs on change orders. Five of the respondents priced subcontracts as direct costs on change orders. In all six projects, bonding and insurance, off-site administration costs, and planning, estimating, and scheduling of the work formed part of the overhead costs on change orders. In five cases, on-site administrative costs, small tools and consumables, and permit, legal and accounting fees were included in change order overhead. On four projects, clean up was included as part of the overhead costs on change orders.

On three of the projects, the contractual percentage allowable for labor burden cost was in the range of 20 to 25 percent. In each of the other cases, the percentage allowable for labor burden was in the range of 26 to 30 percent, 31 to 35 percent, and 36 to 40 percent, respectively. All respondents include the following items in labor burden: worker's compensation, unemployment insurance, Canada Pension Plan, and medical-dental coverage. Four of the six contractors include insurance and payroll tax as labor burden. Three include their company pension plan as labor burden. One of the contractors includes a wage protection fund as labor burden. Other items of labor burden include time keeping, safety allowance, union benefits, and small tools. Contractors were asked to provide actual allowances for labor burden components, as a percentage of the base wage rates. Table 1 shows the average percentage allowances for labor burden components. The average actual value for labor burden is 29 percent, which is greater than the contractual allowable labor burden in four of the six projects surveyed.

A breakdown of the average time spent at each stage of change order admin-

Table 1—Average Allowances for Labor Burden Components (As a Percentage of the Base Wage Rate)

Labor burden component	Average percentage allowance
Vacation pay and statutory holidays	9.44
Worker's compensation	2.76
Unemployment insurance	3.43
Canada Pension Plan	3.50
Company pension plan	3.25
Payroll tax	0.73
Safety	2.70
Medical-dental coverage	2.80
Total	28.61 (~29%)

istration is shown in table 2. On average, three hours are spent in administering a change before work even commences on the change. This breakdown of time assumes that every single trade quote is received on time and is accurate to such a degree that the consultant does not question a single item, and that the owner accepts the change order cost without canceling the change. The results of the survey, however, indicated that in many cases, change orders are priced more than once and affect more than one trade, adding to the administrative cost of the change. The percentage of priced change orders that were approved in the projects surveyed ranged from 56 to 100 percent. In only two of the projects, change orders were priced an average of once; in one case, the average number of times change orders were priced was three times. In all cases, an average of two or more trades were affected by each change. Furthermore, all contractors indicated

that on some occasions change orders contemplated and priced were cancelled by the owner, and that no compensation was provided.

A number of additional comments and suggestions were made by the contractors surveyed, as follows:

- Changes are very disruptive to work flow, and in most cases owners and consultants question each and every cost. It is difficult to assess and charge for the loss in workflow, since the timing of the change and the effect on the project's schedule are difficult to quantify in terms of dollars.
- Numerous small change orders have a negative effect on a project by: extending the project duration; not providing a sufficient fee to offset costs; frustrating the supervisory staff; and, greatly increasing the potential for errors and additional lost time and money.

Table 2—Average Time Spent Administering a Change Order

Change order administration	Average time spent (minutes)
Design review/verification	17
Site inspection	12
Preparation of cover letter and faxing of request for change to trades	12
Entering of request for change into change order log	5
Clarification/field questions and quotations from trades	16
Preparation of quotations for consultants	18
Receipt of approved change order, submission of approval to trades	30
Revision of schedules and work sequence	13
Cross-checking of change with drawings	16
Posting of changes in specifications and on all drawings	16
Layout and ensuring that trade forces are complying with change	19
Accounting processing of change in monthly billings	8
Total time spent	182 (~3 hours)

- Overhead cost calculations should include items such as winter heating costs, small tools, safety, site security, survey and layout, utilities (e.g., telephone, electricity), power distribution and consumption, and miscellaneous labor and cleaning.
- The owner should compensate the contractor for the time spent in processing a cancelled change order.

The information gathered from this study, while limited in terms of sample size, provides valuable insight into current industry practices in pricing change orders and in mechanisms for the compensation of change orders. There is no accepted standard set of markups for change order reimbursement in the building construction industry. There is evidence of the differences in the distribution of allowable markups in the contracts studied, despite the fact that they are all stipulated price building contracts with predominantly public sector owners. Furthermore, the percentage allowable for labor burden cost in several of the contracts surveyed is inadequate. On average, three hours are spent in administering a change before work even commences on the change. The cost of simply administering the change substantially reduces the markup allowance for reimbursing the contractor for additional overhead costs and profit. Furthermore, although contractors spend a significant amount of time processing change orders, they are not normally compensated for the time spent on cancelled change orders, which consequently adds to the overhead cost of the project.

Clearly, the results of this study indicate that existing pre-defined markup allowances for overhead, profit, and labor burden costs on change orders do not fully compensate the general contractor. Further research is therefore required to develop a more equitable change order pricing strategy.

Recommendations for Future Research

In order to improve existing methods of change order reimbursement, the following issues warrant further research:

- Development of a standard definition of items comprising home office overhead, project overhead, and labor burden.

- Development of a breakdown of time spent in pricing and repricing change orders.
- Establishment of a set of realistic percentages for allowable markup for overhead on general contractors own work, allowable markup for profit on general contractors own work, and allowable markup for overhead and profit on subcontractor's work. Allowances should account for the complexity of the change, the time the change order is issued during the work, the value of the change, the number of trades affected by the change, the time spent in pricing the change, and the number of times the change is re-priced.
- Establishment of an allowance to compensate the general contractor for the time spent in pricing change orders that are cancelled.

Ideally, research on these issues should take the form of case studies of actual projects under construction, to document the above items as they occur on the project. Partnering between researchers, owners, consultants, and contractors would facilitate such study. The further development of the findings presented in this article may help owners, consultants, and contractors develop a fair and equitable change order pricing strategy that adequately compensates the contractor and suits the actual practices of the building construction industry.

Acknowledgments

The authors would like to thank the companies that participated in this survey for their valuable time and information. A special thanks goes to Mr. Chuck Burnett, who helped formulate the survey. This research was funded by the Construction Research Institute of Canada (CRIC).

References

1. Canadian Construction Association (CCA). **Guidelines for Determining the Costs Associated with Performing Changes in the Work**. Document No. 16. Ottawa, Ontario: Canadian Construction Association, 1992.
2. Canadian Construction Documents Committee (CCDC). **Stipulated**

3. **Price Contract. Document No. 2**. Ottawa, Ontario: Canadian Construction Documents Committee, 1994.
3. Cilensek, R.F. *Cost Guidelines for Change Orders*. **Transactions of AACE International**, Morgantown, WV, 1986.
4. Cox, R.K. *Managing Change Orders and Claims*. **Journal of Management in Engineering**, 13, no. 1 (1997): 24.
5. DeFeis, J.H. *Change Orders: Causes, Prevention, Control, and Resolution*. **Cost Engineering**, 28, no. 10 (1986): 16-19.
6. Just, M.R., and J.P. Murphy. *New Ideas in Overhead Recovery*. **Transactions of AACE International**, Morgantown, WV, 1995.
7. Mohn, S. *The Eichleay Formula: Time to Retire?* **Civil Engineering**, 60, no. 6 (1990): 60-62.
8. Neil, J.N. *Impact of Changes on Project Schedule*. **Transactions of AACE International**, Morgantown, WV, 1989.
9. Nkuah, M.Y. *Analysis of Change Order Markup Allowance in Lump-sum Building Contracts*. M.Eng. Thesis. Department of Civil and Environmental Engineering, University of Alberta, Edmonton, Alberta, 1999.
10. Sarvi, H. *Overhead and Profit on Change Orders*. **Civil Engineering**, 62, no. 8 (1992): 59-61.
11. Saunders, H. *Survey of Change Order Markups*. **Practice Periodical on Structural Design and Construction**, 1, no. 1 (1996): 15-19.
12. Suhanic, G. *Change Order Impact on Construction Cost and Schedule*. **Transactions of AACE International**, Morgantown, WV, 1980.



Dr. Aminah Robinson Fayek, P.Eng., is an assistant professor in the Department of Civil and Environmental Engineering at the University of Alberta, specializing in artificial intelligence and computer applications in construction engineering and management. She earned her B.Eng. in civil engineering from McGill University and her M.A.Sc.

in construction engineering and management from the University of British Columbia, Canada. She earned her Ph.D. in construction engineering and management from the University of Melbourne, Australia. She has industrial and consulting experience in planning and scheduling, cost estimating, project control, and the application of information technology in construction. She is a prior member of AACE International. She can be reached at: arobinson@civil.ualberta.ca



Moses Y. Nkuah, CCC is an estimator with AMEC E&C Services, Ltd. He received an M.Eng. degree in construction engineering and management from the University of Alberta in 1999 and a B.Sc. degree in building technology from the University of Science and Technology, Ghana in 1991. His experience includes contract administration, cost estimating, project planning, and scheduling. He is a member of AACE International and the Project Management Institute. He can be reached at moses.nkuah@amec.com.◆



By choosing AACE International's CEO training, you not only give your employees quality courses at an exceptional price, you also minimize staff travel costs and time out of the office. "Downtime" and travel costs are major obstacles to providing the necessary continuing education they need to stay on top of their field. These obstacles often increase the cost of continuing education by 2-3 times.

Onsite training is the obvious answer!

The professional staff at AACE International will be happy to work with you to customize our courses to fit your needs and schedule.

Contact AACE's professional education department at 800.858.COST or 304.296.8444, and let us help you meet your company's training needs with a quality-proven professional seminar at your company's site.