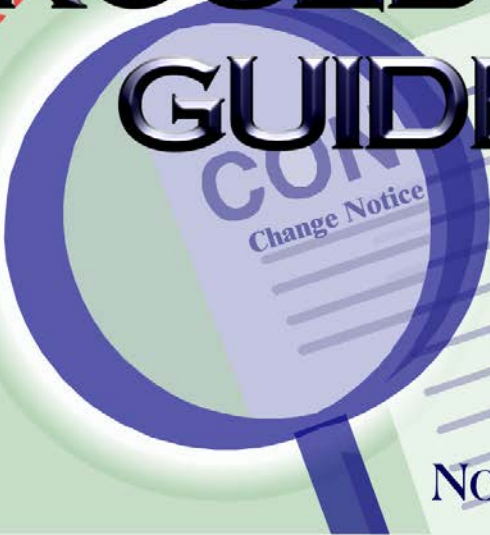




NATIONAL CHANGE NOTICE

PROCEDURE GUIDE



November 2001



A Mechanical Contractors Association of Toronto (MCAT) produced document endorsed for industry wide use by the Mechanical Contractors Association of Canada (MCAC). Distributed compliments of the Canadian Mechanical Contracting Education Foundation (CMCEF) made possible through the financial assistance of the Mechanical Contractors Association of Newfoundland and Labrador (MCANF).



TABLE OF CONTENTS

SECTION	CONTENT	PAGE
1	CCN Issued.....	2
2	Distribution.....	2
3	Material & Equipment Take-off & Pricing.....	3
4	Labour Rates Calculation.....	3
5	Manhour Calculation.....	5
6	Miscellaneous and Indirect Costs.....	6
7	Subtrade Quotes.....	7
8	Impact Costs.....	8
9	Summaries and Submittal.....	10
10	Summary and Tracking Procedures.....	16
11	Pitfalls to the Change Notice Procedure.....	20
APPENDICES		
A	Labour Rate Calculation.....	22
B	Factors Affecting Productivity.....	25
C	Overtime Costs.....	27
D	Labour Correction Factor.....	34

ACKNOWLEDEMENT

Portions of this guide have been reprinted, with their permission; from material published by the Mechanical Contractors Association of America and the Canadian Construction Association



CHANGE NOTICE PROCEDURE GUIDE

INTRODUCTION:

This is a subject upon which much has been written. However the difference with this guide is in its intent to take the Contractor, Engineer, Construction Manager, or Owner through all phases of the "Change Order (C.O.)".

Although Contractors should be aware of all the factors covered herein, the owner/architect/engineer is basically interested in establishing a simple, constant presentation that is easily approved. It is therefore prudent for all parties to reach agreement on one or two overall percentages to be approved for the particular project over and above the normal Overhead and Profit figures.

A Change Order is normally a written order to the Contractor, issued to amend a contract after it has been executed, by the party designated in the contract as having the authority to order a change.

A Change Order is not normally a verbal instruction. A field order is a change order if it involves a change in the scope of the work or the time of completion. A site instruction or an architect or engineer instruction may require a change order if such instruction involves work outside the scope of the contract.

However, the reality of contracting is that we very often proceed with changes before an official change order is issued. Doing so is risky at best, doing so without monitoring your costs, chasing the C.O., ensuring billing and payment can be a recipe for disaster.

Therefore, this guide is intended to provide a logical and readily useable format for all aspects of dealing with changes on construction projects; from the early stages of a contract, when the time is right to establish the basis of C.O. pricing, to the distribution of C.O.'s, to pricing, labouring and summarizing before submitting. Once submitted, then "log" it, "track" it; don't lose it in the mounds of paper work. When approved and returned, get it into the system for all those suppliers, subtrades and your own people to act upon. Last phase; bill it, collect on it, and keep your contract value up to date.

Each of the following sections is provided to explain the steps and methods of pricing and implementing a change order on a project.



SECTION 1: THE C.C.N. ISSUED

Formatted

Whether called a Contemplated Change Notice or one of the many other titles found in this industry, these are not in fact Change Orders.

They are, however, a request to submit a price for a change but on its own does not commit the owner to paying for any expenses incurred by the contractor.

From the contractor's viewpoint a site instruction to proceed with a change should be issued. This should guarantee payment for costs incurred to date if the change order is cancelled. It shows a willingness to proceed for the sake of the overall project, assists the owner/architect/engineer with bureaucratic red tape involved in processing the change order, but still grants a needed measure of protection for the contractor. Proper care should be taken to assure the phrasing of the site instruction and proper authorization.

It is often said that we, as contractors, should never proceed with a change until our price is approved. However, to maintain order and co-ordination on a project, many changes are completed before approval is received. It is strongly recommended that a contractor not proceed with a change until a written change order has been received. Contractors must determine for themselves the value of their relationship with the owner and/or general contractor against the risk of not being paid for a change. This becomes a business decision.

SECTION 2: DISTRIBUTION

Today's construction projects seem to be more and more burdened with excessive paperwork, while at the same time less and less detail is provided for the contractor.

It has become imperative that mechanical contractors ensure that all of their subcontractors have the opportunity to review each Contemplated Change Notice and to respond accordingly.

Therefore, establish a typical C.C.N. distribution form naming all subcontractors to the prime. This form should contain certain standard procedures for every C.C.N. ie, time to price, disclaimers on proceeding or payment without approval, etc.

Date stamp, photocopy and distribute to each of your foremen and subtrades. Request a response from the subtrades by a date noted, usually two weeks, depending on the size.

If you are unable to complete pricing of a change notice within the time allotted, the General Contractor, Owner and/or the Consultant should be notified of this and a date be indicated when a price will be complete.



SECTION 3: MATERIAL AND EQUIPMENT TAKEOFF AND PRICING

Many construction project contracts are based upon the CCDC-2-1994 with variations given in the "Supplementary Conditions". Most sub-contracts offered by General Contractors to the Sub-Contractors are usually tied back to the prime contract as noted above.

In part 6 of this contract which is titled, "Changes in the Work", several pricing methods are referenced as follows:

- a) by estimate and acceptance of a lump sum;
- b) by unit prices set out in the Contract or subsequently agreed upon;
- c) by cost and a fixed or percentage fee.

Our discussions in this bulletin relate to method (a) or "by estimate". Many Supplementary Conditions make it a mandatory condition that detailed estimates of material and labour be provided by the General Contractor and his Subcontractors for all changes in the work.

Material and equipment pricing is the one item in the estimating process which is tangible. In keeping with the requirement for detailed estimates, it is recommended the materials be itemized and separated on a system by system basis. Use of computers for printout, pricing and labouring is becoming more popular among contractors and would seem to be a more acceptable format for owners and consulting engineers responsible for approving changes.

It is further recommended that the basis of pricing for standard or line materials be established at the outset of the project, or even at the time of tender. This could be done by using suppliers pricing sheets or a recognized publication such as "Allpriser". What should be settled with the approving authority at the beginning, is therefore the appropriate publication to be used to determine the list price of the material and what, if any, the applicable discount would be.

Unlike standard materials, equipment is generally "priced on application" or P.O.A. Even if there is similar equipment already on the project, do not assume the additional equipment needed for the change will be at the same price. It is recommended that current pricing for each change of equipment be solicited from the appropriate manufacturer.

SECTION 4: LABOUR RATE CALCULATION

Calculating the Labour Rate, which should be applied to a change notice, is a difficult task. It is essential that if the contractors are to be fairly compensated for a change order, they must know their own costs. Contractors must be able to properly identify and present, if requested, all their costs prior to the addition for overhead and profit.

Listed are some of the labour costs; this list is not meant to be a definitive list, there are other labour costs, which may be incurred. (See Appendix A for example)



- 1.) **Employee Health Tax**
 - This is a statutory number
- 2.) **WHMIS**
 - Training and documentation costs
- 3.) **Workers Compensation Board**
- 4.) **Jobsite Safety**
 - These will have to include the cost of the safety committees under provincial safety rules.
- 5.) **Canada Pension Plan**
 - This is a statutory number.
- 6.) **Employment Insurance**
 - This is a statutory number.
- 7.) **Project Insurance**
 - This is to include On Site Labour, Public Liability, Personnel Disability, Fire, Theft, All Risk, where applicable to the jobsite.
- 8.) **Project Coordination**
 - Time required to assess the potential repercussions on the rest of the systems.
- 9.) **Estimating**
 - This is to cover the cost of estimating changes on a particular contract.
- 10.) **Supervision**
 - Applicable to project foreman and site supervisors
- 11.) **Small Tools**
 - Applicable to loss, wear and tear on the tools.
- 12.) **Site Facilities**
 - Applicable to full expenses for jobsite office, washroom & lunchroom, phone, storage, etc.
- 13.) **Labour Warranty**
- 14.) **Clean Up**
 - Costs incurred in disposal of material you may have to remove in making the change, in addition to the normal cost incurred in clean-up.



SECTION 5: MANHOUR CALCULATION

The number of manhours required to complete a Change Notice under normal conditions can be estimated using accepted labour units. This should be done using a mutually agreeable labour calculator. The more commonly used ones are MCAA Labor Estimating Manual or NAPHCC-PHCC Labor Calculator. Adjustments must be made for abnormal, or less than optimum, conditions existing at the job site. Factors that should be considered are: (see Appendix "D" for examples)

- 1.) **Installation Height**
 - Average installation height 10', beyond that extra equipment and men may be needed.
- 2.) **Multi-Storey Factor**
 - Labour Costs increase in a multi-storey building even when a man and material hoist is furnished and available and drinking water and toilet facilities are provided On at least alternate floors. The increase is substantially larger if only stairs or ladders are provided and drinking water and toilets are remote.
- 3.) **Material Handling**
 - The remoteness of the area where the change will be performed will dictate time and cost of handling the material. Is there storage and lay down area for the material?
- 4.) **Personnel & Material Hoist**
 - Availability and number on the job
- 5.) **Toilet Facility Locations**
 - Are toilet facilities easily accessible or are they remote?
- 6.) **Type of Stair Access Between Levels**
- 7.) **Environmental Conditions**
 - Will the changes extend the job into the winter months where temporary heat is required and adverse conditions will reduce productivity?
- 8.) **Inadequate Lighting**
- 9.) **Job Layout Due to Unusual Configuration**
 - Is the architectural facade a concern?
- 10.) **Crane Facilities**
- 11.) **Stacking of Trades (congested area)**
 - A change order, if not properly integrated into the average schedule, can transform an orderly, sequenced work plan into one in which many operations must be performed concurrently. The workmen of several trades could become stacked in a limited work area creating a situation in which work cannot be done efficiently.



- 12.) **Coffee Breaks**
 - As applicable.
- 13.) **Overtime Requirements (See Appendix C)**
- 14.) **Crew Size Inefficiency**
 - Productivity is adversely affected when workers are indiscriminately added to work crews to complete a project. Changes could create this situation by requiring additional work within the same time schedule. There is a definite limit to the number of workmen and quantity of equipment that can effectively be used on a worksite at any one time.
- 15.) **Work Sequence**
 - Has change disrupted schedule?
- 16.) **Schedule Compression**
- 17.) **Mobilization**
- 18.) **Demobilization**

SECTION 6: MISCELLANEOUS AND INDIRECT COSTS

Miscellaneous and indirect costs can vary greatly from job to job as well as from contractor to contractor – it is usually these variations, which are at the heart of Change Notice disagreements.

Indirect costs are those costs that cannot be attributed to a single item or unit of a project. Indirect costs are generally divided into two categories, direct job expenses and general overhead.

- 1.) **Equipment Rental**
 - If the equipment has been rented to do a specific change notice, the total cost of the rental should be allowed for. If it is consigned from another area of the project or another project, only the applicable part of the rental costs should be factored into the change notice.
(N.B. if the equipment is owned it should be charged at applicable rental rate.)
- 2.) **As Build Drawings, Owners' Manuals**
 - The cost of the drafting and preparation of the additional documents to reflect the effects of the change notice.
- 3.) **Consumable Supplies**
 - eg. potable water, coffee, etc..
- 4.) **Project Administration**
 - Off site personnel, eg. General Superintendent
- 5.) **Delay Penalties and/or Liquidated Damages**
- 6.) **Moving on and off Expenses**
- 7.) **Certification of Work**



8.) **Additional Financing Costs**

- This should include the cost of financing associated with the length of time between the performance of the work of the change and the date the order is actually issued and paid. It should also account for the additional cost of financing the holdback when the schedule is extended. Finally, it should consider labour financing costs. Payment is made to employees immediately, but payment of accounts receivable is not until later. One method of determining labour financing costs is as follows:

$$\frac{\text{Interest Rate}}{365} \times \frac{\text{Average Number of Days}}{\text{Billing and Receiving Payments}} = \text{Labour Financing Cost \%}$$

9.) **Freight and Cartage**

10.) **Security**

- Some projects may have special security precautions involved in doing the work, such as prisons or bank depositories. Limited access to the building and/or having to pay for security personnel to be with your crews.

11.) **Bonding Costs**

The bond amount will change depending on the size and timing of the change.

12.) **Inspection and Permit**

Any additional costs as a result of the change notice or requirements under the Building Code.

13.) **All Back Interest Cost and Lost Opportunity**

SECTION 7: SUBTRADES QUOTES

Change Notices and Orders are areas where the responsibility of the Mechanical Contractor as "Prime" is never truer. It is not enough to simply pass on subtrade quotes without reviewing their content for conformity and reasonableness with the intent of the Change Notice.

Since the piping portions of Change Notices will be itemized with material and labour pricing as outlined previously, it is important to establish the breakdown format for our subtrades. The following is only one suggestion.

A.) **MATERIALS**

- Including purchased basic or standard materials such as: ductwork per pound delivered to curbside, insulation cost with footages related to piping, site services piping, refrigeration materials, control line materials and sprinkler line materials.

B.) **EQUIPMENT SPECIALS**

- Also purchased items, but recognized as equipment. It may be a requirement of the specification to provide supplier invoices as back-up.



C.) **LABOUR**

- Using a pre-established hourly rate with estimated hours to generate a total productive labour cost. If published unit hours are available, the use of these should be encouraged.

D.) **SUPERVISION**

E.) **OVERHEAD & FEES**

- In accordance with contractual requirements.

SECTION 8: IMPACT COSTS

When preparing a change notice quotation, consideration must be given to the "Impact" of the Change Order or the effect the Change Order will have upon the performance of the other work, or the work remaining to be done that is not of itself, changed. The term "Impact" refers to the indirect delay or interference that a change on one phase of work may create on another phase. The cost of such delay or interference should be recognized as a consequential cost to be considered as a part of direct cost. A Change Order issued to one Contractor more often than not, has impact upon other Contractors.

Some factors, which affect the completion of the basic contract as a result of a change order, are:

FATIGUE:

Overtime may be required to complete the base contract work within the allotted contract time because of a Change Order. Overtime breaks the established rhythm of a project and lowers work output and efficiency through physical fatigue.

MORALE and ATTITUDE:

Skilled workmen have intense pride in their work, in its progress and in the final result. Change Orders, if not properly planned, may cause interruptions in the work schedule, require adjustments in size and makeup of crews, require moving men to other parts of the project prior to completing the one they are currently working on and with which they are intimately familiar. Frequently, work is required on a phase for which detailed plans have not been completed.

If overtime is required on a part of the project because of a Change Order, men on another part of the project not requiring overtime, will compete for some part of it.

The competition for overtime may contribute to poor morale and attitude, which reduces productivity and lowers efficiency.

STACKING OF TRADES:

Delays in the planned activities of a project result in a deterioration of the construction schedule. A Change Order, if not properly integrated into the average schedule, can transform an orderly, sequenced work plan into one in which many operations must be performed concurrently. The workmen of several trades could become stacked in a limited work area, creating a situation in which work cannot be done efficiently. A Contractor who was the low bidder and who scheduled his performance on an optimum time-minimum cost program, may find himself faced with a minimum time-maximum cost dilemma.



REASSIGNMENT OF MANPOWER:

Reassignment of workmen is generally required when changes to work in progress come unexpectedly, when changes are major or when a demand is made to expedite or reschedule completion of certain phases of the work. Productivity could decrease if sufficient time is not allowed to plan an orderly effort to ensure work proceeds smoothly and efficiently.

CREW SIZE INEFFICIENCY:

Productivity is adversely affected when workers are indiscriminately added to work crews to complete a project. Changes could create this situation by requiring additional work within the same time schedule. There is a definite limit on the number of workmen and quantity of equipment that can effectively be used on a worksite at any one time.

DILUTION OF SUPERVISION:

Field activities necessary to, and associated with, the integration of Change Order work into the work of the basic contract, requires a diversion of supervisory attention from the basic contract work. While the project manager is analyzing the change, organizing and assigning workmen, procuring the additional material, equipment and tools, etc., productivity on the basic contract will be adversely affected.

LEARNING CURVE:

When men are added to perform additional work because of Change Orders, a period of familiarization will be required until these men are oriented to the job, plans, specifications, tool locations, work producers, etc. If more than one crew is required to do certain installation work, the learning curve productivity is correspondingly multiplied.

ERRORS AND OMISSIONS:

When additional work is required because of a Change Order being issued, often the impact on the basic contract work is not properly considered. This gives rise to possible errors and omissions, which can be very costly to correct.

BENEFICIAL OR JOINT OCCUPANCY:

A Change Order which delays completion of the project could result in work having to be performed after the area is occupied by the Owner's employees. Security or badging requirements, restrictions from certain areas, noise limitations which must be observed, etc., all adversely affect productivity and efficiency.

LOGISTICS:

Delay can occur because of problems in procurement and delivery of materials, equipment, etc., due to a change in scope. Prolonged overhead and escalation of material and equipment prices and projection of labour into a new and higher wage period, also contribute to additional costs.

RIPPLE:

A Change Order issued to one Contractor more often than not has a profound effect on the work of other Contractors. The other Contractors may find themselves faced with additional costs due to having to change the schedule or sequence of operations.

TIME MODIFICATIONS:

Time modifications associated with Change Orders must be processed on a timely basis to preserve the integrity of the contract schedule. An acceleration in completion dates may result in reduced efficiency in



that the contractor may be obligated to use premium time or to add further resources which cannot be used efficiently. Conversely, an extension in time will generally result in additional overhead charges. Therefore, time and price should be agreed upon together, and unless required by operational exigencies, should be agreed upon before work is begun.

DELAYED COMPETITION:

A Change Order causing extension of the basic contract completion into a new labour agreement period, results in additional costs to the Contractor. These costs should be reflected in the Change Order Summary.

ESCALATION OF COSTS:

If the Change Order delays completion of the project, additional costs are incurred in off-site storage of material and equipment or in possible escalation of prices if delivery must be postponed. Subcontracts may also be subject to escalation.

FINANCING CHARGES:

Delays caused by Change Orders extend the completion and acceptance of the project during which time additional costs are imposed on the Contractor by his having to finance retainages for a longer period of time.

OTHER DIRECT AND INDIRECT JOB COSTS:

Most of the elements of Other Direct and Indirect Job Costs which were listed earlier in the Bulletin, are increased if completion of the project is delayed.

SECTION 9: SUMMARIES and SUBMITTAL

The purpose of the summaries and submittal sheets is to provide the consultant and or the owner with the information required to expedite the approval process of change notices.

The cover page has been based upon work originally done by the Canadian Construction Association.

Included are examples of summary sheets, which, if used correctly, are an effective means of preparing a change notice. One of these is a manually prepared example and the other is computer generated. Along with the summary sheet, submittal sheets backing up the summary sheet, should also be included and an example of these is shown.



Contractor/Subcontractor _____

**CHANGE ORDER
QUOTATION**

Consultant/Contractor _____ Quotation No. _____
_____ Date _____

Project _____ Proposed Change No. _____
_____ Other Reference Nos. _____
_____ (Title or Description)

We enclose our quotation for the changes requested by _____, on
_____, designated as _____ Proposed Change No. _____.
(Consultant)

We were furnished the following drawings and specifications:
(Number and Date)

We do not include any of the following:
(List exclusions specifically. Do not include work of other contractors or work not within the scope of your contract)

The total net change to the Contract/Subcontract Price is as follows:

Net change in Price as per attached breakdown _____.

We reserve the right to assess the impact of the change at a later date and to submit any costs related thereto. We reserve the right to correct errors or omissions.

It is anticipated that all work required by this change will be done on a straight time basis. Overtime work, if requested, will be billed as an additional item.

This quotation is for acceptance within _____ days.

We anticipate the work required by this change will require the addition/deletion of _____ days to the construction schedule.

Issued by: _____
(Name: _____)

Distributed to: _____



BID SUMMARY

PROJECT: _____

MATERIAL:

	MANHOURS	COST
Pipe & Fittings (Totals from Summary)	_____	\$ _____
Equipment	_____	\$ _____
	_____	\$ _____
8% PST		\$ _____
		SubTotal: \$ _____

LABOUR:

Field Labour	___ hours @	/hr =	\$ _____
Field Supervision	___ hours @	/hr =	\$ _____
Office Supervision	___ hours @	/hr =	\$ _____
			SubTotal: \$ _____

JOB EXPENSES:

Permits	\$ _____
Manuals	\$ _____
Special Insurance	\$ _____
Bonds	\$ _____
Job Buildings incl. Heat, Electric, & Phone	\$ _____
Scaffold	\$ _____
Welding Machine	\$ _____
Special Tools.....	\$ _____
Small Tools	\$ _____
Service Connections	\$ _____
Freight	\$ _____
	SubTotal: \$ _____



BID SUMMARY

SUBCONTRACTS	Base Price	PST	GST	Total (inc. taxes)
Excavation & Backfill	_____	_____	_____	_____
Drains	_____	_____	_____	_____
Catch Basins or Manholes	_____	_____	_____	_____
Concrete Bases	_____	_____	_____	_____
General Trades	_____	_____	_____	_____
Painting	_____	_____	_____	_____
Sheet Metal	_____	_____	_____	_____
Stack, Chimneys, & Vents	_____	_____	_____	_____
Refrigeration	_____	_____	_____	_____
Insulation	_____	_____	_____	_____
Temperature Controls	_____	_____	_____	_____
Electrical	_____	_____	_____	_____
Sprinkler	_____	_____	_____	_____
Millwrighting	_____	_____	_____	_____
Hoisting & Rigging	_____	_____	_____	_____
Cutting & Patching	_____	_____	_____	_____
	\$ _____	\$ _____	\$ _____	\$ _____

PROJECT: _____

SUMMARY

Material				\$ _____
Equipment				_____
Labour				_____
Job Expense				_____
Subcontracts				_____
			Sub Total	\$ _____
			PST	_____

Overhead	\$ _____			_____
Profit	\$ _____		0/H + M/U	_____

		Bonds	/ \$1,000	_____
			GST	_____

			TOTAL	\$ _____
				=====



Date:
Job # 12
System # 15 Process

SUMMARY

SS Tube, Sanitary

DESCRIPTION	MATERIAL QUANTITY	MATERIAL PRICE	LABOUR COST	LABOUR UNIT	HOURS
Tube	4	60	[_____]		
90 Elbow	3	5	[_____]		
	4	4	[_____]		
Tee – Full	4	1	[_____]		
Reducer – Concentric 4 X 3	5	5	[_____]		
Flange	3	10	[_____]		
Bolt + Gasket Set	3	5	[_____]		
ACME – Male End	3	5	[_____]		
Sleeve	6	2	[_____]		
Butterfly Valve	3	5	[_____]		
Joins – Welded	3	30	[_____]		
	4	19	[_____]		
Riser Clamp	4	6	[_____]		
Consumables	1	[_____]			
		Sub Totals			
			MATERIAL TOTAL	LABOUR TOTAL	
Tube			0.00		
Fittings			0.00		
Hangers / Riser Clamps			0.00		

SYSTEM TOTALS:

Material \$ 0.00
Labour Hours _____



National Change Notice Procedure Guide

JOB NO.: _____

CHANGE NOTICE NO.: _____

SUB TOTAL

DESCRIPTION:	Plumbing Material		
	Plumbing Equipment		
	Provincial Tax		
	Labour		
	Travel		
	Heating Material		
	Heating Equipment		
	Provincial Tax		
	Labour		
	Travel		
DIRECT LABOUR:	Testing		
	Material Handling		
	Productivity Loss		
	Clean-up		
	Warranty		
	Interference layouts		
	Consumable Materials		
	Small Tools		
	Painting		
	Welding		
	Supervision		
	Identification		
	Equipment Rental		
	Permits and Inspection		
	Telephone and Shack		
	Freight and Cartage		
		SUB TOTAL	
		OVERHEAD	
		PROFIT	
		SUB TOTAL	
SUB CONTRACTORS:	Core Drilling		
	Sheet Metal		
	Insulation		
	Controls		
	Refrigeration		
	Electrical		
	Excavation		
	Sprinklers		
		SUB TOTAL	
		OVERHEAD	
		PROFIT	
		GST	
		SUB TOTAL	

TOTAL EXTRA



SECTION 10: SUMMARY AND TRACKING PROCEDURES

Change Orders vary widely in their timing, dollar amounts, people involved, approval time allowed, etc., it is important to develop a means which can give you the status of a change notice at any particular time. A summary format should:

- Identify project changes;
- Record all relevant impact information;
- Cross-reference the change with the appropriate files;
- Summarize the submission status;
- Indicate owner action or inaction.

FORM A:

“Arch. C.C.N.”: is the number which the architect assigns a particular C.C.N.(contemplated change notice). The numbers on the Arch. C.C.N. that you receive may not be sequential as there could be others which have not been forwarded to you, under the assumption that they will not affect you. Time would be wisely spent by you to look at these to ensure that you are not in fact, affected.

“Cont. C.C.N.”: is the number which the General Contractor assigns an Arch. C.C.N. This may be the same number as the Arch. C.C.N. but that is highly unlikely. The reason for keeping track of both the Arch.C.C.N.# and the Cont. C.C.N.# is to avoid a misunderstanding on the status of any particular CCN when it deals with either the Architect or General Contractor.

“Description”: the work involved with the CCN

“Amount”: the price submitted for the CCN

“Change Order”: the formal approval of the CCN

“Notes”: the area where notations should be made regarding potential problems which could be encountered. eg., How many proposal submissions, are there too many price reductions by the owner, is chronic owner or consultant delay evident?



FORM B:

“File”: the internal documentation that is kept on each change

“Date CCN”: the date of the first issuing of the CCN

“Date CO”: the date the actual CO is issued

“Actual Cost”: your cost, less profit and overhead

“O/P”: your overhead and profit, which will vary from job to job.

Sheet Metal, Controls, Insulation, Electrical, Sprinkler, and Excavation are the potential sub-trades from whom information may be required before an informed response can be made to a CCN. The date the form was sent to the subtrade, the date a response was received and the amount involved should be noted.

“Submitted”: indicates whether or not the information required for approval has been submitted to the owner or owner's representative

“Invoicing Date”: the date the invoice was issued by your accounting group

“Paid”: indicates whether the invoice has been paid and the date should also be noted. This will allow you to track the length of time from invoicing to payment. If this starts to lengthen as the project proceeds, it may be the first indication of trouble ahead.

“Manhours”: the time required to perform the change order

“Est. Labour”: labour costs based on your manhour calculations at the appropriate labour rates

“Est. Mat. & Eqp \$”: the estimated cost of the material and equipment to perform the change order.



SECTION 11: PITFALLS TO THE CHANGE NOTICE PROCEDURE

There are many pitfalls during the process of getting a Change Notice approved and paid for. Listed below are some of the common areas to which special attention should be given to avoid falling into the pitfall trap. This list is not meant to be an indication of the only problems, and possible solutions which can be encountered, but as a reminder of the more common ones.

- 1.) Correctly distribute the Contemplated Change Notice to all of the sub-trades and then, ensuring a timely answer on whether or not there is a cost involved will, later on in the job, prevent claims from these sub-trades that they were not aware of the potential problem the change notice would cause.
- 2.) Compiling the pricing from both your company and the sub trades for the Change Notice in a manner in which all the prescribed facts, breakdowns, and markups are shown in a easily understood format, will prevent the owners representative from using the improper documentation as a reason to delay approving, either the change notice or payment of a change notice.
- 3.) Submitting the prices for Change Notices in the time prescribed and cataloging the dates when the price was submitted, so as to be able to properly track their progress.
- 4.) Upon approval of a Change Order, advise sub-trades and revise PO's to order the additional equipment required. Then convey this information to the job site so the work can proceed in an orderly and timely manner.
- 5.) Meet with the Architects & Owners to ensure that they realize the costs involved in a Change Notice are more significant than just the Labour & Material involved in the actual change. This helps to prevent misunderstandings when it comes to approving change notices.
- 6.) Contract documents state which overhead and profit percentages can be used for Change Orders. Also state what is to be included in these percentages. This should be considered at the time of tender.
- 7.) Communication with the General Contractors regarding what is involved in the Change Notice will prevent misunderstandings later.
- 8.) Getting approval from the Mechanical Consultant only to find that the Architect has rejected the extra.
- 9.) Making sure the Sub-trades have documented their part of the Change Order will facilitate final approval of both their change notices and yours.
- 10.) Late Change Orders affect the timing of substantial completion which ties up Holdback. Agreement should be obtained from the owner or owner's representative that the work in question not be used to calculate substantial completion as per section 2 paragraph 2 of the Construction Lien Act of Ontario.
- 11.) Getting approvals for Indirect Costs; this should be discussed before the first change notice is issued to resolve the issue before it becomes a problem.



- 12.) Delays in the approval process. If all the requested documentation has been given to the owner and there is still chronic delay apparent, this is usually a signal of the existence of a problem with the owner and warrants further investigation.
- 13.) Proceeding on verbal approval of Change Orders but only being allowed to invoice for 80% of total cost until written approval is received. This should be discussed at the onset of the project.
- 14.) Not following what is required for approval of a Change Notice in the documentation and specification of the job, will delay approval.
- 15.) Presenting all the information required to support the price you have submitted for the Change Notice, will improve the chances of timely approval.
- 16.) Not having guidelines established at the time of contract signing for what is included in Labour and Jobsite Overhead, will cause problems. This should be addressed at the time of signing a contract.
- 17.) Owners can fail to recognize how greatly the impact costs can vary compared to the original contract, when disruptions caused by change notices, occur. This can be very costly to the contractor and be the cause of a claim. Notification to the owner of the ripple effect of a change notice will be required. (As per Section Eight)



APPENDIX A

**GUIDELINES FOR DETERMINING THE COSTS ASSOCIATED
WITH PERFORMING THE WORK**

LABOUR RATE CALCULATION PER HOUR

BASE RATE:

1. WHMIS	0.45%	_____
2. WORKERS COMPENSATION BOARD	5.78%	_____
3. JOBSITE SAFETY	6.46%	_____
4. CANADA PENSION PLAN*	2.40%	_____
5. EMPLOYMENT INSURANCE*	4.20%	_____
6. PROJECT INSURANCE	1.50%	_____
7. PROJECT COORDINATION	5% – 10%	_____
8. ESTIMATING	3.30% - 10%	_____
9. SUPERVISION	12.00% - 25%	_____
10. SMALL TOOLS	8.00%	_____
11. SITE FACILITIES	1.90%	_____
12. LABOUR WARRANTY	1.22%	_____
13. CLEAN-UP	4.50%	_____

The above noted costs could be expressed as Labour Hours under Indirect Labour or in \$ under Direct Job Expenses individual line items.



1.) **WHMIS TRAINING**

Six hour course @ \$300.00

52 weeks @ 36 hours per week = 1872

Cost per hour: \$300

1872 = \$0.16 per hour (____ % of base rate)

2.) **WORKERS COMPENSATION BOARD**

This is a statutory number.

3.) **JOBSITE SAFETY**

These costs relate to jobsite safety committees that were established by the Occupational Health & Safety Act the costs are estimated as follows:

TYPE OF PROJECT	SAFETY REPRESENTATIVE/COMMITTEES REQUIRED	ESTIMATED COST TO PROVIDE
Type 1 - 5 or less workers	General site safety officer	\$ 150 /week
Type 2 - 6 to 9 workers	One health and safety representative	\$ 500 /week
Type 3 - 20 to 49 workers	A Joint Health & Safety Committee with a minimum of two members (one management and one worker)	\$ 1,000 /week
Type 4 - 50 or more workers and a project duration of greater than three months	A Joint health & Safety Committee with a minimum of four members (one "certified" management rep.; one 'certified' worker rep. Two additional reps.); A Workers Trade Committee Consisting of one member from each trade on site.	\$ 4,000 /week

Using Type 4 Example with 50 of your employees on the jobsite the minimum cost will be (assuming one employee is chosen to be on the committee)

\$4000.00

50 x 36 = \$2.22 per employee per hour

(_____ % of base rate)

Should you be on a Type 4 job and your employee is chosen for one of the committees, and you have less than 50 employees on the jobsite, insert the actual number of employees in place of 50 in the above formula and redo the calculation.

4.) **CANADA PENSION PLAN**

This is a statutory number.

5.) **EMPLOYMENT INSURANCE**

This is a statutory number.



- 6.) **PROJECT INSURANCE**
This is the mean number of a survey of Toronto firms. It included On Site Labour, Public Liability, Personnel Disability, Fire and Theft where applicable to the job site.
- 7.) **PROJECT COORDINATION**
- 8.) **ESTIMATING**
This is to cover the cost of estimating the change notices (on an average job in Toronto).
- 9.) **SUPERVISION**
Applicable to project foremen and site supervisors. On a typical project the ratio is 1 foreman per 6 employees (25% of base rate). This ratio may vary for your job and as such, so will the percentage.
- 10.) **SMALL TOOLS**
This is applicable to the loss, wear and tear on the tools. (This percentage is the mean from a survey of Toronto firms.)
- 11.) **SITE FACILITIES**
Applicable to full expenses for jobsite office, washroom & lunchroom, phone, storage, etc. (This percentage is the mean from a survey of Toronto firms.)
- 12.) **LABOUR WARRANTY**
The cost related to the warranty on the labour required to perform the change. (This percentage is the mean of a survey of Toronto firms.)
- 13.) **CLEAN UP**
Costs incurred in the disposal of material you may have to remove in performing the work required, in addition to the normal costs of clean up. This does not allow for disposal of hazardous or contaminated waste. (This number is based upon a survey of Toronto firms.)



APPENDIX B

FACTORS AFFECTING PRODUCTIVITY

There is a need to discuss the adverse effects on labour productivity resulting from causes beyond the direct control of the mechanical contractor.

A study of these productivity factors may be helpful in preparing original estimates and change orders. The individual items and titles proposed, cover a description of conditions without necessarily including each detailed condition that may be involved. The values are a percentage to add onto labour costs, of change, and in some cases, original contract hours.

The factors listed are intended to serve as a reference only. Individual cases could prove to be too high or too low.

	PERCENTAGE OF LOSS IF CONDITION:		
	Minor	Average	Severe
1. STACKING OF TRADES: Operations take place within physically limited space with other contractors. Results in congestion of personnel, inability to locate tools conveniently, increased loss of tools, additional safety hazards and increased visitors. Optimum crew size cannot be utilized.	10%	20%	30%
2. MORALE AND ATTITUDE: Excessive hazard, competition for overtime, over-inspection, multiple contract changes and rework, disruption of labour rhythm and scheduling, poor site conditions, etc.	5%	10%	15%
3. REASSIGNMENT OF MANPOWER: Loss occurs with move-on, move-off men because of unexpected changes, excessive changes, or demand made to expedite or reschedule completion of certain work phases. Preparation not possible for orderly change.	5%	10%	15%
4. CREW SIZE INEFFICIENCY: Additional men to existing crews "breaks up" original team effort, affect labour rhythm. Applies to basic contract hours also.	10%	20%	30%
5. CONCURRENT OPERATIONS: Stacking of this contractor's own force. Effect of adding operation to already planned sequence of operations. Unless gradual and controlled implementation of additional operations made, factor will apply to all remaining and proposed contract hours.	5%	15%	25%
6. DILUTION OF SUPERVISION: Applies to both basic contract and proposed change. Supervision must be diverted to (a) analyze and plan change, (b) stop and replan affected work, (c) take off, order and expedite material and equipment, (d) incorporate change into schedule, (e) instruct foreman and journeyman, (f) supervise work in progress, and (g) revise punch lists, testing and start-up requirements.	10%	15%	25%



7.	LEARNING CURVE: Period of orientation in order to become familiar with changed condition. If new men are added to project, effects more severe as they learn tool locations, work procedures, etc. Turnover of crew.	5%	15%	30%
8.	ERRORS AND OMISSIONS: Increases in errors and omissions because changes usually performed on crash basis, out of sequence or cause dilution of supervision or any other negative factors.	1%	3%	6%
9.	BENEFICIAL OCCUPANCY: Working over, around or in close proximity to owner's personnel or production equipment. Also badging, noise limitations, dust and special safety requirements and access restrictions because of owner. Using premises by owner prior to contract completion.	15%	25%	40%
10.	JOINT OCCUPANCY: Change causes work to be performed while facility occupies by other trades and not anticipated under original bid.	5%	12%	20%
11.	SITE ACCESS: Interferences with convenient access to work areas, door man-lift management or large and congested worksites.	5%	12%	30%
12.	LOGISTICS: Owner furnished materials and problems of dealing with his storehouse people, no control over material flow to work areas. Also contract changes causing problems of procurement and delivery of materials and rehandling of substituted materials at site.	10%	25%	50%
13.	FATIGUE: Unusual physical exertion. If on change order work and men return to base contract work, effects also affect performance on base contract.	8%	10%	12%
14.	RIPPLE: Changes in other trades' work affecting our work such as alteration of our schedule. A solution is to request, at first job meeting, that all change notices/bulletins be sent to our Contract Manager.	10%	15%	20%
15.	OVERTIME: Lowers work output and efficiency through physical fatigue and poor mental attitude.	10%	15%	20%
16.	SEASON AND WEATHER CHANGE: Either very hot or very cold weather.	10%	20%	30%



APPENDIX C

OVERTIME COSTS

The construction industry recognizes that there is a loss of productivity whenever overtime is worked. The magnitude of overtime productivity loss increases as the number of hours worked each day is increased; increases as the number of days worked each week is increased, and increases as the duration of the scheduled overtime is increased.

The **Construction Industry Cost Effectiveness (CICE) Project** and the **Business Roundtable** concluded from their studies that scheduled overtime creates excessive construction labour costs, rarely causes the project to be completed earlier than planned and often reduces individual worker productivity, causing a delay in completion.

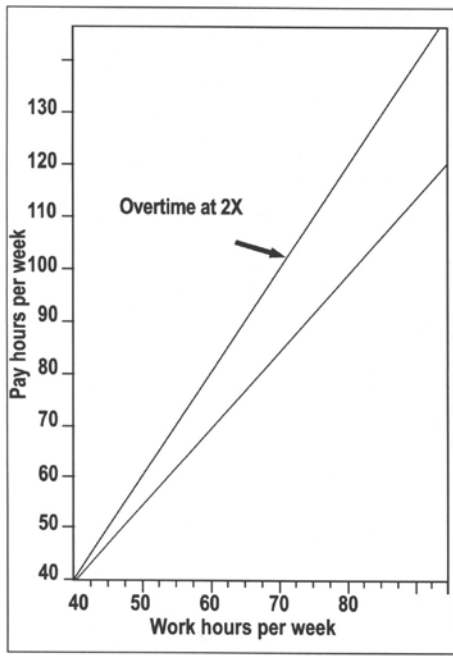
The CICE report concluded that in instances where a schedule of 60 hours a week continues for more than about two months, productivity plunges so dramatically that the project completion date stretches beyond what it would have been with the same crew working a 40 hour week.

Many Owners and General Contractors are reluctant to reimburse the Mechanical Contractors for the total cost of the overtime because they do not understand that all these additional costs are the **DIRECT** result of the overtime.

Attached are four examples of the relationship between overtime and the increasing ratio of inefficiency during consecutive overtime periods. Tables for calculation of premium time and inefficiency on overtime work, are also shown.

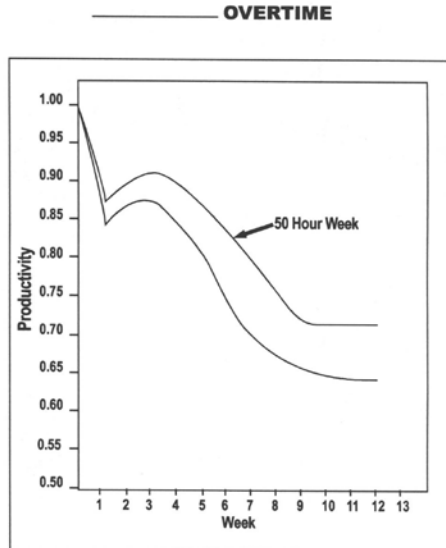


FIGURE 1
EFFECTS OF OVERTIME

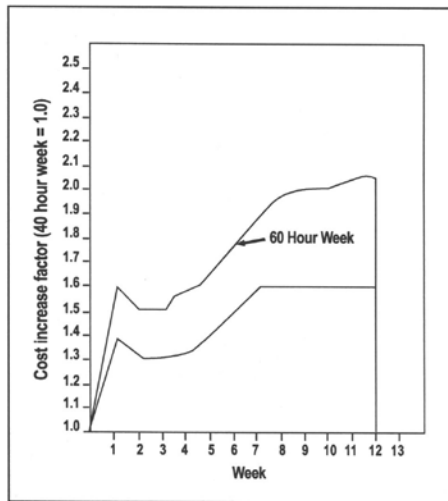


Effects of premium Pay for Overtime on Cost of Labour

Source: General Motors Corp.



Cummulative Effects of Overtime on Productivity 50 and 60 Hour Workweeks



Cummulative Cost of Overtime - Successive Weeks
Productivity Loss Plus Overtime Reruns



OVERTIME AND INEFFICIENCY:

Here are four examples that illustrate the relationship between overtime and the increasing ratio of inefficiency during consecutive overtime periods.

EXAMPLE A

ASSUME:

1. 20,000 Manhours @ straight time (4, 9's) estimated for job
2. \$20.00/Manhour is the combined crew rate before taxes and insurance
3. Overtime is at double time

PROBLEM:

With above assumptions, what is cost addition to the job on a basis of 6, 10's, instead of 4, 9's?

SOLUTION:

6, 10's = 60 Manhours =	36 straight time	= 36 hours pay
	24 overtime	= 48 hours pay
	60 hours worked	= 84 hours pay

84/60 = 1.4 multiplier if no loss of efficiency

However, 6, 10's = 17% inefficiency

Therefore, 1.4/.83 = 1.68 multiplier

20,000 Manhours @ \$20.00/mh =	\$400,000	
	672,000	1.68 multiplier
Less	400,000	original cost
	\$272,000	increased cost

Therefore, \$272,000 is the additional basic cost of 6, 10's in lieu of 4, 9's; also must add tax and insurance for labour cost.

EXAMPLE SUB. 1

Another way to calculate Example A:

ASSUME.

1. 20,000 Manhours straight time (4, 9's) estimated for the job
2. \$20.00/Manhour is the combined crew rate on straight time, exclusive of tax and insurance
3. Overtime is at double time

PROBLEM:

With above assumptions, what is cost of differential (exclusive of tax and insurance) to do the job on a basis of 6, 10's instead of 4, 9's as above?



SOLUTION:

6, 10's = 60 Manhours worked	36 @ straight time	=	36 hours pay
	<u>24 @ overtime</u>	=	<u>48 hours pay</u>
	60 hours worked	=	84 hours pay

84 hours pay/60 hours worked = 1.4 multiplier to straight time pay rate (\$20.00 straight time manhours) x (1.4) \$28.00

Therefore, \$28.00 Manhours worked is the adjusted rate

6, 10's results in 17 inefficiency

Therefore, must work 20,000/.83 = 24,096 Manhours to get 20,000 Manhours production

Therefore, (24,096) (\$28.00) =	\$674,688	Total Cost @ 6, 10's
Less	<u>400,000</u>	Total Cost @ 4, 9's
	\$274,688	Increased Labour Cost

Therefore, \$274,688 is the basic cost premium to do the job on 6, 10's rather than on 4, 9's; also must add tax and insurance factor.

EXAMPLE B

ASSUME:

1. 20,000 Manhours straight time (4, 9's) estimated for job
2. \$20.00/Manhour is combined crew rate at straight time before tax and insurance
3. Overtime is at time and one half

PROBLEM:

With above assumptions, what is cost addition to do job on basis of 6, 10's in lieu of 4, 9's?

SOLUTION:

6, 10's = 60 Manhours =	36 straight time	=	36 hours pay
	<u>24 overtime</u>	=	<u>36 hours pay</u>
	60 hours worked	=	72 hours pay

72/60 = 1.2 multiplier to straight time rate

Therefore, (\$20.00 x 1.2) = \$24.00 Manhours is the adjusted rate

6, 10's results in 17% inefficiency

Therefore, must work 20,000/.83 = 24,096 Manhours to get 20,000 Manhours production

Therefore, (24,096) (\$24.00) =	\$578,304	Total Cost @ 6, 10's
Less	<u>400,000</u>	Total Cost @ 4, 9's
	\$178,304	Increased Labour Cost

Therefore, \$178,304 is the increased cost to do job on 6, 10's rather than 4, 9's; must also add tax and insurance factor.



EXAMPLE C

ASSUME.

1. 20,000 Manhours straight time (4, 9's) estimated for job
2. \$20.00/Manhour is combined crew rate @ straight time before tax and insurance
3. Overtime at double time

PROBLEM:

With above assumptions, what is basic cost differential (exclusive of tax and insurance differential) to do job on basis of 5, 10's and 1, 8?

SOLUTION:

5, 10's and 1' 8 = 58 Manhours =	36 straight time	=	36 hours pay
	<u>22 overtime</u>	=	<u>44 hours pay</u>
	58 hours worked	=	80 hours pay

80/58 1.37 multiplier to straight time crew rate

Therefore, (\$20.00) (1.37) = \$27.40 Manhours worked is adjusted rate
6, 8's = 4% inefficient and 6, 10's = 17% inefficient

Therefore, approximate inefficiency rate is (5/6 of difference between 4% and 17%) + 4%
= 14-5/6%

Therefore, must work 20,000/.8517 = 23,482 Manhours to get 20,000 Manhours production

Therefore, (23,482) (\$27.40) = \$643,406.80	Total Cost @ 5, 10's and 1, 8
Less <u>400,000.00</u>	Total Cost of 4, 9's
\$ 243,406.80	Increased labour cost

Therefore the increased cost to do the job on 5, 10's and 1, 8 is \$243,406.80

EXAMPLE D

ASSUME:

1. 20,000 Manhours straight time (4, 9's) estimated for job
2. \$20.00/Manhour is combined crew rate of straight time before tax and insurance
3. Overtime at time and one half during week and double time on Saturday and Sunday

PROBLEM:

With above assumptions, what is basic cost differential (exclusive of tax and insurance) to do job on basis of 6, 10's)?



SOLUTION:

6, 10's = 60 Manhours =	36 straight time	=	36 hours pay
	14 overtime	=	21 hours pay
	<u>10 double time</u>	=	<u>20 hours pay</u>
	60 hours worked	=	77 hours pay

$77/60 = 1.28$ multiplier to straight time crew rate

Therefore, $(\$20.00) (1.28) = \25.60 pay rate when job is worked 6, 10's
6, 10's is 17% inefficient

Therefore, must work $20,000 \times 1.28 = 24,096$ Manhours to get 20,000 Manhours production

Therefore, $(24,096) (\$25.60) =$	\$ 616,857.60	Total cost at 6, 10's
Less	<u>400,000.00</u>	Total cost at 4, 9's
	\$216,857.60	Increased labour cost

Therefore, \$216,857.60 is basic cost differential (exclusive of tax and insurance to do work on basis of 6, 10's)



LABOUR CORRECTION FACTOR

When using a labour calculator, assumptions are made in determining the hours required to perform a task. The following conditions are assumed to be the base conditions; if conditions vary from these, a correction factor will have to be applied to the manhours needed to do the task. This will produce the actual hours needed to complete the task.

- To be installed in 1st, 2nd or 3rd floor, or 1st or 2nd Basement.
- Material stockpile to be within two hundred (200) feet of work areas.
- Material to be put in place at ten (10) feet or less above floor. (except thirteen (13) feet for hanger rod and inserts, beam clamps, etc.).
- Work to be performed off a reasonably hard and level surface.
- All work is done by experienced mechanics, knowledgeable in the type of materials being installed.
- That average working conditions and productivity exist.
- That material handling for inside work as follows:
 - (1) 0-110 kg - Material handled by hand by two men; use chain falls or similar tools.
 - (2) 111-450 kg - Material handled by use of a Roustabout; cannon carrier, chain falls, etc. to move and put material in place.
 - (3) 450-4550 kg - Material handled by small rig, lift jacks, rollers, etc. to move and put in place.
- Threaded joints are to be made on a pipe machine.

That material handling in wide-open spaces is as follows:

- (1) Pipe distribution directly from delivery truck by stringing along route of pipe.
 - (2) Material handling by power equipment.
- Labour is for productive hours only.



EXAMPLE OF LABOUR CORRECTION FACTOR – MULTI-STOREY PROJECT

The following are items to include for in the typical multi-storey office building.

- Installation Height (average of 12' 6") - 1% to 2% per additional ft. of height above 10 ft.
- Multi-Storey Factor, Multi-storey building above 3rd floor 1% to 2% per floor until above 20th floor then 2% to 4% per floor
- Material Handling
- Personnel Hoist
- Toilet Facility Locations
- Type of Stair Access between levels
- Environmental Conditions (job extends into winter)
- Inadequate Lighting
- Job Layout Due to Unusual Configuration (Non standard job layout)
- Crane Facilities (two available)
- Stacking of Trades (Congested Areas)
- Coffee Breaks (as per union agreement)
- Jobsite Safety Instructions

Applying all of these we arrive at a Labour Correction Factor of 1.36.

Therefore, to arrive at the actual number of hours required to perform the task, the amount of time indicated in the Labour Manual would have to be multiplied by 1.36 to arrive at total manhours for the change.

EXAMPLE OF LABOUR CORRECTION FACTOR - HOSPITAL AND INSTITUTIONAL -

Listed below are the items to include for in the typical hospital or institutional project.

- Installation Height (average if 12' 6") 1% to 2% per additional ft. of height above 10 ft
- Multi-Storey Factor each storey above 3rd floor 1% to 2% per floor
- Crane Facilities
- Material Handling
- Personnel Hoist
- Toilet Facility Locations
- Type of Stair Access Between Levels
- Environmental Conditions (seasonal concerns)
- Inadequate Lighting
- Job Layout Due to Unusual Configuration
- Stacking of Trades
- Coffee Breaks (as per union agreement)
- Jobsite Safety Instructions



- Complexity of Design of Mechanical System
- Co-Ordination and Interference Due to Density of Mechanical systems

Applying the above factors we arrive at a Labour Correction Factor of 1.41

Therefore, to arrive at the actual number of hours required to perform the task, the amount of time indicated in the Labour Manual would have to be multiplied by 1.41 to arrive at total manhours for the change.

EXAMPLE OF LABOUR CORRECTION FACTOR - AN INDUSTRIAL PROJECT

Listed below are the items to include for in an industrial or process project.

- Installation Height (average if 12' 6") 196 to 2% per additional ft. of height above 10 ft
- Multi-Storey Factor - each storey above 3rd floor 1% to 2% per floor
- Crane Facilities
- Material Handling, distance from lay-down area to work station.
- Personnel Hoist
- Toilet Facility Locations
- Type of Stair Access Between Levels
- Excess Scaffolding Requirements
- Environmental Conditions (seasonal concerns)
- Inadequate Lighting
- Job Layout Due to Unusual Configuration
- Stacking of Trades
- Coffee Breaks (as per union agreement)
- Jobsite Safety Instructions
- Complexity of Design of Mechanical System
- Co-ordination and Interference Due to Density of Mechanical Systems

Applying the above factors we arrive at a Labour Correction Factor of 1.46

Therefore, to arrive at the actual number of hours required to perform the task, the amount of time indicated in the Labour Manual would have to be multiplied by 1.46 to arrive at total Manhours for the change.

CONCLUSION

In the writing of this Guide we have tried to present as many factors as possible, which affect the contractor in pricing a change notice and ultimately, the performing of a change order. All parties involved in issuing and responding to a change notice should be aware of which of these factors are applicable to their project. It is in the best interest of all parties to reach agreement on one or two overall percentages for a particular project before the first change notice has been issued.



**CANADIAN MECHANICAL CONTRACTING EDUCATION
FOUNDATION**

280 Albert Street, Suite 804

Ottawa, Ontario

K1P 5G8

Tel: (613) 232-5169 / Fax: (613) 235-2793

Website: www.cmcef.org / Email: cmcef@cmcef.org