GUIDE TO COST PREDICTABILITY IN CONSTRUCTION:

AN ANALYSIS OF ISSUES AFFECTING THE ACCURACY OF CONSTRUCTION COST ESTIMATES

Prepared by the
Joint Federal Government / Industry Cost Predictability Taskforce

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Table of Contents

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Note from the Taskforce Chairman

What at first appeared to be a relatively simple task to review the various and mostly obvious causes of poor cost predictability increasingly grew in each taskforce meeting as more and more variables were raised and reviewed. As the topics for consideration ranged from first bid comparison, whether low, median or average, to cost growth during construction, to final project cost, and even whether to review various "soft costs" to the extent that they may have an effect on cost predictability, etc., it soon became apparent that a clear and rigid definition of the scope of the taskforce had to be established. This would limit the discussions to achieve definable recommendations relating to the original rationale for the taskforce, which was to analyze the increasingly large variances being experienced by PWGSC, DCC, and others between their "pre-tender estimate" and the subsequent contractors' bids.

The basic question whether such increasing variances are the result of the construction industry's "pricing strategies", or of an inaccurate or insufficient estimating process, was soon concluded to be the latter, since with few exceptions, under a normal and competitive bidding process actual bid prices are generally the best indicator of the prevailing competitive market conditions for a specific project at that time. Upon further review it was also found that the owners' estimating process was seldom properly completed up to a reasonable Class A level, and in most cases only up to Class B, or even a brought forward Class C!

Also, it must be recognized that each project is unique and different from the previous one in varying degrees. Although many projects may be relatively repetitive and "similar", such as "standard" office buildings or schools, many others are non-standard and individually complex, unique, one-of-a-kind, remotely located, etc., or any combination thereof, such as leading edge lab facilities, historic building renovations, environmentally challenged locations and increasingly green, sustainable, and more innovative structures and systems.

Further, since the preparation of project estimates has typically been based on historical information, such information may be outdated, or perhaps not even exist for certain individual types of projects; therefore, the associated degree of accuracy of the estimate can be expected to vary accordingly.

For this reason the taskforce concluded that the previously accepted degree of accuracy for Class A estimates should be expanded from +/- 5% to a range of +/- 5 to 10%, to accommodate the range of such non-standard projects, with a similar variation applied to the other classes of estimates. As well, for projects involving significant renovations, or challenging geographic, environmental, or other unique circumstances, a further allowance should be analyzed and included.

In addition, whereas the previous cost predictability guidelines were related primarily to the degree of design development completion, it became obvious that with the increasing variety and complexity of various projects, the potential accuracy of estimates must equally recognize the relationship to the level of complexity of any particular project, or its level of estimating difficulty. For this reason, a Cost Estimate Variance Matrix was developed, to recognize the combination of both these dimensions in arriving at a reasonable estimate variance.

Finally, since estimating and bidding is not an exact science, the expectation for estimate accuracy must be realistic, in relation to the particular type of project and in proportion to the quality and time expended to produce a specific level of estimate accuracy. But at any level, adherence to the recommendations of this guide should definitely improve cost predictability.

In this respect it bears repeating the obvious, that to achieve a realistic Class A estimate requires the following ingredients:

1. Class A professional and experienced estimating qualifications;
2. Class A completed project design documentation; and
3. Class A time, sufficient to produce the required estimate analysis with accuracy.

Lastly, the taskforce was fortunate to have the benefit of senior, experienced, informed, articulate, and independent cross-sector representatives; I sincerely want to thank each of them for their effective and dedicated participation in the production of this guide.

Executive Summary

Large discrepancies between pre-tender estimates and actual bids for construction have a serious impact on the viability of a project. Owners, architects, engineers, cost consultants, contractors and subcontractors all have a vested interest in ensuring a high degree of cost predictability. This issue, raised at the Federal Government / Industry Real Property Advisory Council, resulted in the formation of a Cost Predictability Taskforce, to research and recommend solutions to this increasing problem.

Defining Cost Predictability
For the purpose of this guide, "cost predictability" is defined as "the prediction of a construction cost estimate, as compared to the median of competitive bids", where "prediction" is defined as "an assertion on the basis of data, theory or experience, but in advance of proof".

As such this guide will apply only to procurement processes that typically require the submission of a total project bid, such as a design-bid-build or design-build process, and although not directly applicable to the construction management process, it could also be applied to the sequential trade contractors' bids.

Similarly, many of the same underlying principles could also be applied to the further development of cost predictability guides for the increasing range of P3 and lease/purchase procurement process variations.

Taskforce Analysis
There is no common statistical database on variances between pre-tender estimates and final bid results for the Canadian construction market. However, members of the task force shared internal data that showed up to 40% of tenders had low bids that varied, either up or down, by more than 30% from the pre-tender estimate and fewer than 20% of tenders had bids within 10% of the estimate. While this was not the case with all of the taskforce members, all agreed that cost predictability was an increasingly serious issue facing the industry.

It was agreed that the following key actions are required to ensure better cost predictability:

- engage qualified professionals to prepare estimates;
- use appropriate economic models in the estimating process;
- ensure that the project approval process recognizes cost predictability issues;
- include scope revision mechanisms in the project approval process; and
- recognize the degree of accuracy of the estimate being used.

A large number of factors contribute to variances in estimate to bid prices. This guide will provide practical advice and discuss the primary ways to improve the cost predictability of projects. The consequence of a failure is often a cancelled project.

The Cost Estimate Variance Matrix
As shown in the Cost Estimate Variance Matrix, the accuracy of estimates varies throughout the project design cycle and according to the complexity of the specific project, and several other factors that may be unique to a project. Depending on the class of estimate and the complexity of the project, variances can range from 5% to 30%. If additional unique aspects or risks apply to a project, these variances should be analyzed and increased by an appropriate amount.

Improving Cost Predictability
Early in the project life cycle, i.e., before the requirements are well-defined and before accurate estimates are available, owners will need to set budgets. The challenge for all stakeholders is to ensure that the appropriate scope and cost management framework is adopted to ensure the desired, or required, degree of cost predictability. The following recommendations should be considered to improve the cost predictability between the final pre-tender estimate and actual bid prices:

Before Tender
- include sufficient contingency to address market volatility, timing of construction, and other exclusions in the estimate;
- consider possible scope variations in the tender as a contingency to adjust to the owner's budget;
- give designers sufficient time to finalize 100% bid documents for the pre-tender estimate; and
- allow cost consultants or estimators sufficient time to prepare and finalize pre-tender estimates.

During Tender
- keep the cost consultant involved during the tender period;
- monitor addenda changes and bidding environment; and
- revise estimates to reflect scope changes and addenda.

After Tender
- involve the cost consultant in the post tender review;

- analyze bid results against estimates for lessons learned;
- consider value engineering to improve bid versus estimate variations; and
- keep a record of historical estimate versus bid data.

Cost Predictability Guarantee

There is no guarantee that pre-tender estimates will precisely match bid prices, just as there is no expectation that all bid prices will be the same. In reality, there are too many variables influencing final bid prices to expect 100% accuracy. However, following the recommendations in this guide will help improve and define the cost predictability of projects.

Taskforce Participation*

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* **NOTE:** The positions and titles of the taskforce members are those which they held during the earlier development of this guide, and may have changed by the time it went to print.

Introduction to the Cost Predictability Issue

The problem of cost predictability was introduced by Public Works and Government Services Canada (PWGSC) at the joint Government of Canada / Canadian Construction Association (CCA) meeting in April 2003, where the departments identified a need to improve the accuracy of its pre-tender construction estimates (Class A estimate) which were increasingly resulting in variances of greater than 30% from the bids received. This issue was delegated to the Project Delivery Working Group of the Federal Government / Industry Real Property Advisory Council for action and it was concluded that the problem of cost predictability was a generic problem, not only on federal government projects, but also for private industry projects. Therefore, it was subsequently decided to establish a separate taskforce to review this issue to:

- analyze the problems inherent in the cost predictability process;
- review procedures to improve cost predictability;
- develop a guide paper with recommendations to improve cost predictability; and
- develop procedures to monitor future cost predictability improvements over an initial five year period.

As a basic premise, the taskforce first noted that every construction project is unique and different from the last. Even if some buildings or projects may appear to be similar, circumstances such as varying site conditions, seasonal weather changes, different scheduling requirements, or local practices, can create significant estimating and cost differences. Even where buildings could be substantially similar, such as primary schools, there is still a tendency to redesign every next one for architectural diversity, technical advances, or other reasons.

In general, there is no easy way to establish consistent pre-tender estimates for even the most common construction projects that could form a reasonable market-specific and time-sensitive database for construction costs. While there are cost indices available, they are only useful in establishing utilitarian baselines, not in constructing an overall estimate that is within 5% of the median bid.

A complete estimate is a composite of literally thousands of individual estimate items and considerations, including construction techniques, innovative ideas, site supervision, productivity factors, front-end specifications, and scheduling, etc., all of which play crucial roles in arriving at the final cost. As well, such factors as occasional mistakes (large or small), aggressive or conservative bidding for individual bidders' reasons, misinterpretations or misunderstandings of the bid documents, and various risk control procedures also play a significant role in the final outcome.

Bid closing involves an amalgam of prices being received by several individuals within each firm that must be evaluated and entered, the majority of which takes place within the last one-half hour period before bid closing, with major decisions happening up to the final minutes and seconds. Meanwhile, similar processes happen at the multi subcontractor and supplier levels.

In addition, local or national construction industries are becoming increasingly affected by global trends and influences, which can create significant and unexpected volatility and unpredictability in the construction marketplace. Recent examples of such market volatility would include:

- The volatility in the 2004 marketplace relating to structural steel and all steel-based commodity pricing.
- The abnormal cost escalation in BC during 2006 leading up to the Vancouver Olympics.
- The unprecedented run-up in almost all construction material prices in 2008, especially for steel and oil-based products, across the world.
- The equally unprecedented and sudden global financial crisis, and resulting potential temporary collapse of both the commodity and construction markets in 2008-2009.

All of this volatility requires an assessment of risk on the part of each and every contractor, subcontractor and sub-subcontractor who endeavour to strategize and plan for eventualities to establish a costing framework for the project duration, which could be many months or years, that fits within specific corporate risk tolerance levels, while at the same time striving to be the low bidder.

Therefore, as a result of this multi-variable bid process, it is not uncommon to see a range of variations in contractor bid prices. Generally this range can be up to 10%; however, for smaller and one of a kind projects this range can be as high as 50% or more.

The taskforce also found that many existing budgeting and project approval processes do not permit a sufficient degree of flexibility to deal with large variances in bid prices. This should be internally reviewed by each owner,

in order to provide for sufficient organizational flexibility to be able to mitigate the results of such potential estimating variances and market volatility.

The taskforce also needed to consider whether the pre-tender cost estimates should be targeted for the eventual low contractor's bid, which often results in the actual contract award price, or whether it would be more prudent to target for the "median" of the various contractors' bids, which is generally considered to be closer to the "true" cost of the project.

Notwithstanding the obvious and necessary consideration attributed to the low bid value in any tendering scenario, there is a fundamental difficulty with attempting to target the low bid as the point of comparison in a cost predictability analysis. It is almost impossible to attempt to predict the effects of particularly innovative or unique bidding solutions on the part of individual bidders on any particular project because one or more may include: possible labour or specialized equipment advantages, locational or logistical advantages, a particularly aggressive bidding approach by anyone bidder ("this is my job" attitude), and even occasional mistakes etc. All of these items may combine to generate the low bid or to the contrary, if none of these competitive bidding solutions are applied, may result in a high bid.

In order to balance the effects of such bidding solutions with an understanding of the myriad of logistical elements, market considerations, and costing variables inherent in the estimating process, the taskforce has selected the median bid approach as the most appropriate and professionally attainable for comparison of pre-tender estimates within this guide.

In summary, it must be recognized that given the myriad of variables that affect the contractor's bid at any given location and at any given time, it is highly problematic for any one individual or agency, no matter how qualified or "in tune" with local conditions and market influences, to arrive at a consistent and accurate pre-bid estimate for construction services. Perhaps the best that should reasonably be expected from such pre-bid estimates is a reasonable approximation of costs that reflect the many variables including the size, scope, complexity, and locality of a specific project.

Nevertheless, given the significant and apparently increasing variations between the bid and pre-tender estimate, it is necessary for the industry to analyze and improve on the various factors that affect cost predictability. Within this context, and based on an understanding of how this component of the industry operates, issues and considerations are recommended for review and guidance during the estimate preparation process.

Issues and Considerations in Cost Predictability

1. Consideration of Local or Regional Market Influences

The preparation of pre-tender estimates should consider such specific factors as:

- the number of bidders on the project, and in each trade;
- the number of other projects being tendered at the same time;
- the likelihood that certain trades will only bid to certain contractors;
- complicated phasing of the project;
- pre-qualification of contractors;
- heritage issues;
- available time periods for tendering and construction;
- timing of the tender; and
- political mood.

The selection of a cost consultant should be reviewed to ensure previous experience with similar complexity and circumstances of the particular project, and to reflect a greater need for additional risk analysis specifically related to construction hard costs.

The pre-tender estimate should show the various influences that have been considered and the "factor" applied for these influences. A pre-tender estimate should clearly indicate what is "in" and what is "out", and why, so that some of the "out" items can be analyzed and added to a Risk Management Plan.

There is often a failure to recognize how a competitive marketplace, or lack thereof, may affect bid prices. Cost consultants should analyze market volatility and anticipated trends. Confirm with the cost consultant that they have consulted with local construction associations, as well as with local contractors and/or sub-contractors, as contractors who are regularly bidding on projects are best able to evaluate market volatility. Note that political decisions can also temporarily impact the local competitive market.

2. Current and Accurate Information Should Be Shared between Stakeholders

Obtain concurrence from all stakeholders that the same information is being used, otherwise stakeholders may use different numbers as reference points. During public construction projects several types of budgets are produced and monitored in several ways. Therefore ensure that all stakeholders and government departments maintain the latest estimate provided by the cost consultant.

3. Cost Estimates Should Be Prepared during Tender Period for Changes to Schedule or Addenda

Request updates of the estimate during the bidding period. Ensure that each addendum is accompanied by a cost (and schedule) impact on the original estimate before the addendum is released. Ensure that the change is acceptable to the owner and not simply a "wish" list from the design team or a stakeholder. Keep in mind that schedule changes may also result in cost changes. This applies particularly to the Class A estimate stage.

4. Incomplete/Uncoordinated Bid Documents, Causing Different Interpretations

Improve the quality of tender documents and allow sufficient time for consultants to prepare and coordinate them. Complete a checklist for both constructability and coordination prior to tender. Addenda should be kept to a minimum, ideally with no more than three. Note that uncoordinated bid documents eventually result in change orders. Thus, past quality of tender documents could be used as criterion in the future performance evaluation of design consultants.

5. Failure to Recognize the Appropriate Class of Estimate

An earlier, less accurate, Class C or B estimate may sometimes be passed off as the pre-tender estimate, so ensure that a proper pre-tender estimate is prepared, developed from the 100% tender documents before tendering.

6. Fast -tracking Projects or Proceeding with a Project before It Is Well Defined

With a fixed end date, there is often a push to start work on a project long before all parameters are defined. This may cause a great deal of cycling, with the increased potential for incorrect estimates. For example, fast-tracking may result in no pre-tender estimate. When it is determined that the estimates are wrong, the project is often well-advanced, and therefore difficult to realign or stop. Consequently, one should allow sufficient time for the preparation of estimates, or increase design contingencies using proper risk management analysis. Also, keep in mind that different procurement methods will have an impact on project estimates.

Including the cost estimator in the fast track stream, in which estimates are upgraded on a regular basis, will ensure that construction costs are within budget throughout the design and construction process by continuously updating the budget and estimates as the design progresses and true costs are identified through the progressive bidding process. Similarly, corresponding reductions in contingencies should be made as a result of the continuous risk management of the project. All members of the design and construction team should be kept fully informed each time the budget and resulting estimates are updated.

7. Project Objectives or Program Not Clearly Defined when Developing the Initial Budget

Allow for the redefinition of the project scope and budget when project objectives or program are not clearly defined, then adjust estimates. Employ the integrated design process; in other words, ensure that all stakeholders have input from concept onward.

8. Scope Creep - Growth in Project Objectives or Programs during Design Development

To manage scope creep and absorb its impact:

- immediately adjust for any changes;
- use value engineering techniques with input from various sectors;
- ensure that the introduction of additional project requirements, such as waste management, sustainability, LEED certification, etc., is analyzed before being incorporated.

9. Proper Use of Contingencies

Develop a database of contingencies that includes realistic design, project and construction contingencies based on building type, size, location, etc.

It is not sufficient for estimators to list the risk factors, they must also quantify them. Therefore, cost estimators and quantity surveyors must clearly describe all the qualifications, exclusions, and assumptions to the owner in a way that can be understood, e.g., this risk may increase the estimate by a specific amount.

The following two escalation contingencies should be taken into consideration:

- market escalation up to the bid; and
- embedded escalation within bid prices, i.e., the real reflection of contractor future price escalation for labour and material during the construction period.

Where cost escalation contingencies have been included, they may only refer to the bid date; this is particularly applicable in relation to longer duration projects. If possible, shorten the time from conception to completion, or include proper allowance for labour and material price escalation.

10. Mistake of Designing to Maximum of the Budget

Construction budgets are living documents and are very fluid. Therefore, early budgets are identified at a very rough level against which the initial design is done. However, this initial budget should be reduced by project contingencies, etc., to more properly determine a conservative design budget.

11. No Consideration or Misuse of Data about Similar Projects

Consider the history of similar projects, including factors such as: the original estimate, final costs, market influences at the time of the original project, and variations between the previous project's scope and the current one. When using budgets from previous projects one should take into account lessons learned. This applies in particular to the Class D Estimate stage.

12. Use of Single-source Product Specifications

When dealing with specialized trades or products, performance specifications should be utilized. Single-source products should be avoided whenever possible and should only be used when stakeholders are fully knowledgeable about the lack of competition or where there is only one capable source to undertake the work. In such cases, the budget will need to be increased to reflect the limited source of the product providers by increasing this particular item's cost above normal pricing levels. While a competitive bid will usually result in a lower overall cost, this must be weighed against quality, standards, maintenance, etc.

13. Actual Errors in the Estimate or Bid Preparation

Double check and overview all estimates before submission to avoid making errors. Look at rewarding firms with such qualities as a good history of estimating or team experience during the consultant selection stage.

14. Ensure That the Estimate Is Produced by a Qualified Individual

Ensure that qualified and experienced personnel, e.g., CIQS or Gold Seal qualifications, are used for budget preparation and conceptual estimation. Identify in the original consultant selection the qualification and experience

requirements that are specific to each particular project and evaluate accordingly.

15. Outdated Estimate Used

There may be a time lapse between initial pre-tender estimate development and the project proceeding; therefore, projects and estimates that are delayed or shelved need to be updated to make the proper allowances for current market conditions. Successive estimates must be updated accordingly, and also include for any additional addenda issued.

16. No Consideration for Normal Cost Inflation

Consideration for industry-specific cost inflation should be given. Note that government inflation forecast sheets only predict stable flat line inflation and spikes in construction inflation are typically only adjusted after the inflationary event has happened.

17. Pressure to Meet Limited Budget

Estimates should not be altered to meet limited budgets. If the estimate exceeds the budget, owners should achieve the intended result by either increasing the budget or modifying the scope of work.

18. Mistake of Reducing Project Schedule at the Investigation Stage

In an attempt to speed up the project and get it out to tender sooner, consultant investigations are often shortened or eliminated. This often leads to surprises during construction when it is more difficult and costly to react to them.

Ensure that consultants have sufficient time and compensation to do thorough investigations of the project designs and costs.

Cost Estimate Variance Matrix

The following matrix has been developed to provide a range of estimate variance (plus or minus), based on the level of construction documents completion, in combination with an evaluation of the level of complexity of the project:

COST ESTIMATE VARIANCE MATRIX ± %			
Class of Estimates	**Based On**	**Project Complexity** LOW	HIGH
D	Concept sketch design	20	30
C	33% Design development	15	20
B	66% Design development	10	15
A	100% complete tender documents	5	10
Unique Projects, Circumstances, or Risks		Varies	Add to Above %

- Project complexity recognizes the different degrees of difficulty in estimating, from a low complexity normal, standard, typical, and repetitive project, through to medium complexity, and up to high complexity projects such as structurally or aesthetically-variant projects, leading-edge environmental projects, full-service hospital facilities, complex mechanical or electrical systems, etc.
- Although the majority of projects will fall within this range, occasionally unique, one-of-a-kind or first-of-its-kind projects, such as the Canadian Museum of Civilization, a Gehry / Guggenheim museum, the Chinese Olympic Bird Cage, the elevated Norman Foster Bridge in France, etc. cannot be predicted within any specific predetermined percentage accuracy, and will require project-specific evaluation. Similarly, components of an otherwise lower complexity project may require unique consideration, such as the sloping concrete walls of The Canadian War Museum, or unique acoustical requirements in a concert hall, for example.
- The matrix allows for the interpolation of varying percentages of accuracy, corresponding to the selected level of complexity horizontally, and corresponding to the level of construction documents completion vertically.
- In addition, aside from the level of complexity of any specific project, there may also exist unique circumstances, even for a low complexity project, such as a severe geographic or climatic environment, very difficult site conditions, or an extremely demanding energy requirement, etc. Such unique circumstances should also be individually evaluated.
- Another potential variance should be individually evaluated if a project involves significant renovations, or historic restorations.
- And lastly, commercial or competitive market conditions will always require particular evaluation.

Recommendations for Improved Cost Predictability

Recommendation 1

Utilize qualified estimating personnel throughout the life of the project—budget preparation, design, tendering, post-tender review and construction phases.

The use of unqualified estimators will result in inaccurate estimates and, hence, inappropriate budgets.

Recommendation 2

Ensure all stakeholders have input early and often throughout the life of a project and that they continue to work together to identify and mitigate risk factors. Clear definition of project objectives, program and scope will avoid potentially expensive surprises, such as scope growth.

Recommendation 3

Give designers sufficient time to finalize bid documents. Provide sufficient time for estimating professionals to review 100% finished documents and prepare a final Class A estimate.

Upon completion of the tender documents, sufficient time must be allowed for professionals to accurately take off quantities and prepare a fully detailed Class A estimate. If the drawings are not at 100%, or the cost consultant is not given sufficient time, this should be reflected by increased risk contingency. Time must be sufficient to also analyze current market conditions, including what other projects are being tendered that may affect the bids on the project.

Recommendation 4

Ensure project budgets consider all essential factors and include or adjust for them when applicable.

The essential factors include:

- the percentage variance between the project budget and potential project cost for the various classes of estimates;
- local influences, e.g., a shortage of skilled labour will cause an increase in the cost of the associated service(s), whereas an abundance of skilled labour will result in a more competitive bid;
- making adjustments to account for any time lapse that occurs between the initial budget development and the project proceeding to tender;
- the seasonal timing of construction;
- quantifying and costing exclusions in the estimate to accurately reflect the complete project scope;
- considering the costs associated with similar, previously completed projects;
- the higher than average risk in terms of post award scope change that is often the result of fast-tracking projects; and
- labour, materials, financial, or geographic market volatility or other factors anticipated prior to tender that can have a significant effect.

Recommendation 5

A widely usable database for the Canadian market, that can be properly interpreted and used by the estimating industry, is required, especially for publicly funded construction that has essentially no market-force comparison. Better historical information would lead to a higher degree of success earlier in the process. All levels of governments, who would benefit from the database, should provide resources.

To develop and maintain a usable database one should take into consideration the current and future construction economic outlook. As such, an analysis would have to be performed along with referencing the database.

Recommendation 6

Include sufficient contingency to address market volatility, timing of construction, and other exclusions in the estimate. The owner should understand all exclusions through detailed discussions with the cost consultant who should try to quantify exclusions.

Recommendation 7

During tender:

- ensure tender ready documents are complete and coordinated;
- avoid single source specifications, i.e., use alternates or negotiation clauses to permit scope revisions;
- revise estimates during the tender period to reflect all addenda; and
- keep the cost consultant involved during the tender period.

Recommendation 8

After tender, analyze bid results against estimates to maintain a lessons learned database to avoid repeating mistakes in future projects.

Postscript

Although reference has been made in this guide to "the increasing range of procurement process variations", the adoption of various procurement methods different from the historically standard design/bid/build method on which this guide is primarily focused has not only increased, but in fact accelerated, and other as yet undeveloped variations will no doubt continue to appear.

Since the initiation of the study for this guide, the design-build process has been increasingly adopted, to the extent that it is now also a "standard" method. Followed by the P3 process, which in its most basic form is a combination of design/build and financing, plus facilities management, and most recently the BIM (Building Information Modeling) process, which with its IT systems support enables perhaps the ultimate collaborative design/build environment, as well as the latest IPD (Integrated Project Delivery) system.

And coincidental with these advanced procurement processes, the importance of life cycle cost analysis has also become increasingly evident as a significant component in the owner's project decision process.

However, in all these various procurement processes the basic principles of this guide will continue to be applicable, but as in any "living document", will require appropriate adaptation to suit the particular process. For example, although these advanced procurement processes can provide increasing collaboration and more appropriate risk-sharing and tolerance between all the stakeholders in a project, and associated improved cost predictability, they also require even better initial project scope definition as part of the owner's role and responsibilities, advanced "conceptual" estimating ability and experience by the contractors, and a more collaborative mindset by all stakeholders.

Appendix 1 – Classes of Estimates

Understanding Estimates

Information on estimating and quantity surveying is available through the website of the Canadian Institute of Quantity Surveyors (CIQS) at www.ciqs.org.

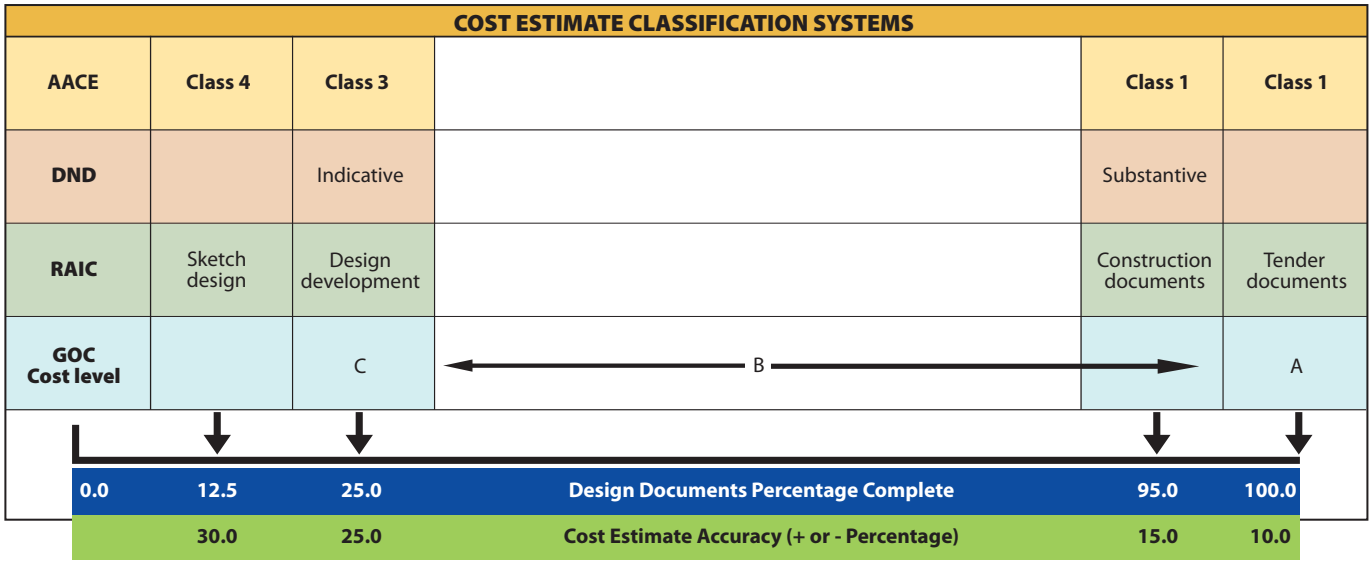
As is evident from the following estimate classification chart, there are some differences of process, usage and terminology, between the various associations, government departments, and cost consultants and estimators regarding the percentage design completion attributed to the ABCD estimate classifications.

However, since the cost estimating process should be relatively continuous during the entire design process, resulting in possibly several levels of Class C and Class B estimate upgrades, for the purpose of clarity in the Cost Estimate Variance Matrix, the taskforce has assigned "benchmark" levels of design completion for a Class C estimate at 33%, and Class B estimate at 66%.

For relatively complex or sizeable projects, four categories of estimates should typically be prepared as shown in the Cost Estimate Classification chart and the Cost Estimate Variance Matrix.

The final Class A estimate or pre-tender estimate should be based on tender-ready documents, and include for all current market conditions, material price fluctuations, labour conditions, and current market trends. It should very closely approximate the related bids submitted by the construction industry, and therefore, for new construction projects, can be expected to be within 5% to 10% of the median of competitive bids.

In this context, it is critically important to have a good understanding of the different estimating processes used, between the cost consultant's virtual estimate program, and the contractor's actual bid preparation process, in order to fully comprehend the potential for significant variances between the pre-tender estimate and the contractors' bids.



Legend

AACE Association for the Advancement of Cost Engineering
DND Department of National Defence
GOC Government of Canada
RAIC Royal Architectural Institute of Canada

Class D Estimate

A Class D estimate is generally an estimate based on the initial functional program and broad concept approach. Usually by this time, the site and program have been approved. Initially, the owner may guess at the amount of budget available which figure may be low due to a lack of up-to-date cost advice. Then after initial design concepts, consultants prepare an order of magnitude estimate comprised of an elemental summary and based on a rough cost per square metre. This enables verification of the order of magnitude budget, as a reflection of a program and building envelope on a particular site. This often results in a modification of the budget or program, or both. The accuracy of this estimate is generally +/- 20 to 30% accurate depending on the complexity of the project and whether the project is new construction on a greenfield site or a renovation. The cost consultant should provide advice on design and pricing allowances for items not yet known, as well as risk allowances. Inflation due to the length of time for working document production, as well as the duration of construction should also be included in the unit rates. This estimate should contain the following contingencies: design, pricing, bid, construction, escalation, and scope. This estimate usually forms the basis of an agreement between the owner and the consultant.

Class C Estimate

This is a schematic design (construction documents) development estimate, where the program is set; the consultants have provided plans, elevations, sections, and an approximate palette of materials, as well as a concept design to allow form and spaces, and the design is generally completed up to 33%. The cost consultant can now measure drawings more accurately for an elemental estimate which can provide a framework to modify or refine parts of the design. There may be as many as three or more concept designs that require comparative costing.

From the documentation and information provided, where possible quantities of all major elements are assessed and measured and priced at rates considered competitive for the particular project under stipulated lump sum form of contract. The estimate is a determination of the fair market value for the construction of the project, not a prediction of the low bid.

Owners and project managers need to carefully read the exclusions and inclusions list, as well as the cost considerations of the cost estimate. These should be reviewed with the cost consultant along with the remainder of the cost report.

Class B Estimate

This is a construction document estimate based on working drawings and more detailed dimensioning from computer generated drawings and systems with preliminary plans for mechanical and electrical. Generally, such items as structural grid, element sizes, and weight are all determined. The outline specifications of all systems and materials are available. The initial Class B estimate is upgraded from 33% during design development, which depending on the project can be at 50%, 66% or 95%.

Class A Estimate

This estimate can only be produced after the construction documents are 100% complete and a minimum of two weeks following the completion of drawings is required to prepare the estimate. This estimate is of sufficient quality and reliability as to warrant approval from the owner to proceed with tender, as it is based on detailed systems and component design and takes into account all project objectives and deliverables. It requires that project systems be designed and specified to completion based on a realistic construction schedule and accurate material and labour costs. As such, it is the final estimate before tender call. Typically, the total forecast is presented in an elemental format or trade format and includes all actual associated fees and costs and carries an expected degree of accuracy of 5% to 10%. The number of bidders, the market conditions, non-standard materials, and non-standard designs can affect this accuracy. There are some exceptional and unique projects which are politically prominent, historic, or of an unusual complexity whose Class A estimate may vary by more than 10%.

Appendix 2 – Documents Recommended for Estimates

1. Recommended for a Class D Estimate

- The final functional program, with adjustments as required and containing the following:
  - o The client's philosophy, values, goals, and desired "image"
  - o Community goals and concerns
  - o Explicit space requirements for the future building, including:
    - Definition of the activities which will take place in each space
    - Functional relationships of the spaces
    - Functional adjacencies relative to programs provided
    - Expansion capacity beyond program
    - Telecommunications and connectivity requirements report
    - Security requirements report
    - Site requirements, including:
      - ~ Parking
      - ~ Circulation
      - ~ Orientation
      - ~ Public access
      - ~ Barrier-free access
      - ~ Noise
    - Ecological, environmental concerns.
- Other requirements including:
  - o Regulatory issues such as zoning and building code requirements
  - o Other preliminary requirements from authorities having jurisdiction.
- Broad volumetric concept and plans showing relative disposition of major accommodation areas.

2. Recommended for a Class C Estimate

Architectural Sketch, Design, Design Development

- Provide site analysis, showing all key site-related information and drivers which influence design approach and proposed solution
- Provide design site plan showing proposed project outline, orientation, main accesses, traffic patterns, parking, snow removal/storage areas, and other major exterior program requirements
- Provide design project plans showing relative disposition of accommodation areas, circulation patterns, floor layouts, service rooms and spaces, etc.
- Provide design elevations and sections indicating the basic design approach materials and aesthetic philosophy
- Provide perspectives and/or a model and
- Provide horizontal and vertical space relationships.

Landscaping

Provide plans showing:

- Hard and soft landscaping
- Planting concept
- Pedestrian pathways
- Site furniture including flagpoles
- Preliminary exterior lighting and signage layout and
- Amenity areas.

Structural

Provide the following:

- A recommended structural system, including the structural frame materials, the structural grid layout, and the foundation
- A summary of alternative systems
- The design loads applicable to the building and
- Foundation recommendations, based on existing geotechnical information.

Seismic

- The structure is to be designed for the minimum base shear as defined by the National Building Code of Canada.

Mechanical

- Incorporate in the submission a schedule of requirements, including a listing of all areas and rooms, providing a description of the specific mechanical requirements and functions for each
- Identify the volume of outdoor air to be supplied per person
- Identify the delivery rate of air supply to occupied spaces
- Identify the location of the entry point of all mechanical services into the building and

- Identify the area, in square metres, and the location of mechanical spaces in the building.

Electrical

- Proposed basic electrical systems of significance to the early design
- Site plan showing location of service entrances
- Distribution diagram showing single line diagrams to distribution centres
- Floor plan(s) with sample locations of major electrical equipment and distribution centres
- Lighting layout(s) for typical spaces
- Distribution systems for lighting, power, and telecommunications
- Telephone rooms, conduit, and telecommunication cable system requirements and layout
- Provide an electrical design synopsis, including examples for specifications, that describes the electrical work in sufficient detail for assessment.

Hazardous Waste Management

- Develop a hazardous waste reduction and management plan.

Commissioning

- Define commissioning requirements.

Specifications

- Preliminary outline specification.

3. Recommended for a Class B Estimate

Architectural Preliminary Working Drawings

- Provide working drawings or a site plan showing the project and existing, or proposed environmental items, including the following:
  - o Traffic patterns:
    - Pedestrian,
    - Vehicular (including drop off area and access to parking areas), and
    - Access to the garage for vehicles;
  - o Parking:
    - Employees
    - Visitors
    - Loading areas
    - Snow removal and storage areas
    - Other exterior program requirements that influence overall site design (e.g.: garage, emergency generator, sewage disposal field, well, etc.)
  - o Grading:
    - Existing and proposed grade elevations
    - Storm drainage elements
    - Cross sections
    - Cross sections through the site to show the relationship of the building to proposed ground elevations and planting, to illustrate the three-dimensional aspects of the site. Include three-dimensional sketches of main features
- Provide floor plans of each floor showing all accommodation required, including all necessary circulation areas, stairs, elevators, etc. and ancillary spaces anticipated for service use. Indicate project grids, modules, etc., and dimensions
- Provide elevations of all exterior project facades showing all doors, windows, mechanical openings/ vents, electrical fixtures, down spouts and trim accurately sized and projected from the floor plans and sections. Indicate clear floor and ceiling levels and any concealed roof levels
- Cross sections through the project to show floor levels, room heights, inner corridor elevations, etc.
- Detail sections of walls or special design features requiring illustration and explanation of this stage, including fireproofing methods.

Landscaping plans as preliminary working drawings

- Planting plan
- Hard and soft landscaping (paved, grass and ground cover areas)
- Pedestrian pathways, sidewalks and links
- Site furniture layout including flagpoles
- Lighting layout
- Signage
- Amenity areas
- Location of hose bibs
- Site services layout showing all buried services and above ground structures such as hydro boxes, hydrants, generator, septic, well, etc.
- Draft NMS format specifications for all relevant landscape construction items.

Perspective and Schematics

- Project perspectives, to show three-dimensional building with site colors and materials where possible.

Structural Preliminary Working Drawings

- From the geotechnical report that includes borehole soils information prepare concept foundation design, And analyze anticipated construction problems and groundwater conditions.
- Preliminary drawings that indicate the structural framing system, the grid layout, the location of shear walls, the location of expansion joints, the structural frame materials, the foundation and any other significant or unusual details
- The design loads applicable to the building.

Mechanical Preliminary Working Drawings

- Site plan showing service entrances for water supply, sanitary and storm drains, location of well and septic system or connections to public utility services, including all key invert elevations
- Drawings showing preliminary sizing of ventilation including ducting, crossovers and fire dampers cooling and heating systems showing locations, and all major equipment layouts in mechanical rooms
- Drawings of the fire protection systems showing major components including water storage and pumping for buildings not on municipal water services
- Produce preliminary working drawings based on the approved design development
- Update the schedule of requirements
- Provide information of all internal and external energy loads in sufficient detail to determine the compatibility of the proposal with existing services, approved concept and energy budget
- Describe the mechanical systems to be provided and the components of each system. Describe the perceived operation of the mechanical systems
- Describe the building systems controls
- Explain the acoustical and sound control measures that are to be included in the design. Refer to the sounds rating requirements specified in the space data sheets.

Electrical Preliminary Working Drawings

Provide drawings showing advanced development of the following:

- Site plan showing service entrances
- Single line diagram of the power circuits with their metering and protection, including:
    - Complete rating of equipment
    - Maximum short circuit levels on which design is based
    - Identification and size of services
- Electrical plans with:
    - Floor elevations and room identification
    - Legend of all symbols used
    - A panel schedule with loadings for each panel
    - Communication system distribution
    - Radio antenna mounting with cabling to distribution system
    - Radio system distribution
    - All conduit and wire sizes except for minimum which should be given in specification
    - Floor layout for lighting, power, telecommunication systems, addressable fire alarm, security, closed circuit television and other systems etc.
    - Schedule for motor controls
    - Lighting layout and fixture schedule clearly indicating methods of circuiting, switching and fixture mounting
    - Electric heating layout and schedule (if applicable)
    - Owners metering and control connections
    - Elevator equipment and control (if applicable).

Provide the following data:

- Total connected load
- Sizing of standby load
- Short-circuit and protective device coordination requirements and calculations showing the ratings of equipment used.

Commissioning

- Refine operational and performance requirements as required from the design development
- Define commissioning requirements
- A commissioning brief describing major commissioning activities for architectural, mechanical, electrical, security and integrated system testing.

Specifications

- Provide a list and draft specification sections of all NMS sections to be used
- Submit outline specifications for all systems and principle components and equipment

- Provide the outline specifications and manufacturers literature about principle equipment and system components proposed for use in the project.

4. Recommended for a 50% Class B Cost Update

This submission indicates the intended scope of the balance drawings and specification and illustrates initial progress in technical development of the approved design.

General

- Complete list of intended final working drawings
- Complete list of specification divisions and sections.

Architectural Working Drawings

- Plans of each floor, with room names, numbers and m2 sizing
- Roof plan
- All elevations showing M&E openings, fixtures, entrances, etc.
- Cross sections through building in at least three (3) locations
- Typical exterior wall sections
- Typical details
- Garage details
- Preliminary door, window, finish schedules, etc.
- Controlling horizontal and vertical dimensions
- Preliminary furniture, equipment and millwork plans based on previously identified requirements for new and relocated items. The method of procurement as well as the definition of the furniture system(s) to be used.

Landscape Working Drawings

- Planting plan with plant list, planting details and comprehensive notes and instructions
- Paving layout with coordinates and dimensions, typical and special construction details, cross sections and comprehensive notes and instructions
- Site plan with typical and special construction details, cross sections, and comprehensive notes and instructions
- Signage, flag pole and lighting location plan, typical and special construction details, cross sections, and comprehensive notes and instructions
- Irrigation layout (if applicable) with all relevant construction details, cross sections, and comprehensive notes and instructions
- Grading and drainage plan with all existing and spot elevations, including finished grades and invert elevations.

Structural Working Drawings

- Framing plans that indicate the grid layout, and the location of shear walls and expansion joints
- The size of the main structural elements and the structural frame materials
- The foundation layout and the bearing values
- Design loads and calculations.

Mechanical Working Drawings

- Floor plans
- Sections
- General plumbing and fixture layouts and pipe sizes
- General ductwork layouts and ducts sizes
- General sprinkler layout with source equipment located
- Boiler or furnace room and mechanical room plan with preliminary details
- Schematics of controls and wiring diagrams

Electrical Working Drawings

- Lighting plan including fixture descriptions
- Power service and electrical entrance
- Electrical distribution layout for each level
- Fire alarm, communications, security and miscellaneous
- Electric heat if applicable
- Floor plans showing typical power outlets
- Elevator machine room plan (if applicable) with preliminary details
- Generator and preliminary details.

Specifications

- Draft sections as available at this stage from each discipline.

5. Recommended for a 66% Class B Cost Update

This submission indicates substantial technical development of the project well developed architectural and engineering plans, details, schedules and specification data.

General

- List of working drawings and specification
- Security drawing.

Architectural Working Drawings

- Site plan showing the building, location of municipal services (if provided) and paved areas
- Plans of floors showing room names and numbers, all door swings, fire hose cabinets, drinking fountains, etc.
- Roof plan, indicating drainage, any fall protection required, roof type, etc.
- All elevations showing materials, floor and ceiling levels, footings and roof levels, opening windows, wall louvers
- Cross and longitudinal building sections, interior corridor elevations
- Detailed wall, partition, floor and roof sections
- Construction details showing cells and patrol corridor
- Millwork and finishing carpentry details
- Door, window and finish schedules and details
- Preliminary hardware schedules
- Stair details, ramps, exterior steps
- Reflected ceiling plans for all ceilings, showing lights, sprinklers, diffusers and any other ceiling mounted fixtures
- All grid lines, dimensions, scales and details symbols
- Any operating system details to be completed must be described.

Landscape Working Drawings

- Demolition and removals plan (if required)
- Planting plan with plant list, planting details and comprehensive notes and instructions
- Paving layout with coordinates and dimensions, typical and special construction details, cross sections, and comprehensive notes and instructions
- Site plan showing special construction details, cross sections, and comprehensive notes and instructions. Additional details as necessary to describe the electrical/telephone entrance as well as municipal services if provided
- Signage, flag pole, lighting plans with all construction details, cross sections, and comprehensive notes and instructions
- Irrigation layout (if applicable) with all relevant construction details, cross sections, and comprehensive notes and instructions
- Grading and drainage plan with all existing and spot elevations, including finished grades and invert elevations.

Structural Working Drawings

- Framing plans that show the grid layout with all shear walls and expansion joints located and described in detail
- The size of all structural elements and the structural framing materials
- The foundation details including footings, floor slabs and walls with bearing values and loading
- Design details for all structural floors and ceilings showing loading assumptions
- Design loads and calculations.

Mechanical Working Drawings

- Plot plan showing water and septic services from municipal source, wells, or septic systems
- Details design drawings for wells and septic systems
- Floor plans showing all mechanical components accurately located and specified
- Separate mechanical plans for ventilation and plumbing in cell block area
- Sections
- Detailed plumbing and fixture layouts and pipe sizes
- Detailed ductwork layouts and sizes
- Detailed sprinkler layout with source equipment located and specified
- Boiler or furnace room plan with all details
- Detailed schematics of control system and wiring diagrams of all mechanical units
- Drawings for mechanical specialties should show sizes and locations of all components. Schematic drawings, diagrams and schedules should be well developed in the drawings and many of the details should be nearing completion
- Any outstanding details to be completed must be described.

Electrical Working Drawings

- Plot plan showing incoming power and telephone service with standard details
- Single line diagram of the power circuits with their metering and protection, including:
  - Complete rating of equipment
  - Maximum short circuit levels on which design is based
  - Identification and size of service

  - Connected load and estimated maximum demand on each load centre
  - Floor plans of systems showing:
  - Room identification
  - Legend of all symbols used
  - Circuit numbers at outlets and motors
  - All conduit and wire sizes except for minimum sizes should be given in the specification
  - For each panel, a panel schedule with loadings
- Plans to provide details of all electrical systems including communications (telephone/data/radio), addressable fire alarm systems, security/cctv and any other electrical systems
- Single line diagrams or riser diagrams for electrical, radio and communication systems
- Elementary control diagrams for each system
- Schedule for motors and controls
- Complete lighting layout, including emergency lighting, with fixture schedule clearly indicating circuiting, switching, fixture types and mounting methods
- Separate lighting and electrical plan and details for cell block area
- Electrical heating layout and schedule if applicable
- Elevator equipment and control system layout (if applicable)
- Standby power system with equipment specified including generator and automatic transfer switch
- Lighting and power layout for emergency power
- Provide the following data:
  - Total connected load
  - Maximum demand and diversity factors
  - Sizing of standby power load
- Short-circuit and protective device coordination study complete with calculations showing the required ratings of equipment to be used and verifications that breakers and fuses to be specified are correct types and rating to handle anticipated fault currents and will facilitate protective coordination of whole system.

Specifications

- Complete specification index
- Draft section general requirements
- Draft section for elevators (if required)
- Draft section mechanical general requirements
- Draft section electrical general requirements
- Other draft sections available (at least 1/3 to 1/2 of the full specification should be available for review at this stage).

6. Recommended for a 95% Class B Cost Update

General

Essentially complete working drawings ready for tender call. The specification will be a fully printed and bound document. Documents must include all revisions required by previous reviews. Final coordination and some details yet to be completed.

Colour Schemes

Submit colour schemes to indicate overall theme and intent of proposed colour ranges i.e. earth tones, vibrant colours or grey/blue range etc. Colour schemes should include all usual surfaces and materials to be coloured on site, plus any items provided with a colour finish or texture during prefabrication. Indicate any untreated or natural-finish surfaces contributing to the overall appearance of the project. Provide colour chips, material samples, etc. to fully illustrate the scheme.

Submissions

- Essentially completed working drawings and specification
- Updated production schedule with explanation of changes in target dates, etc.
- All necessary standard details and master specifications clauses from DND/PWGSC incorporated into the working drawings and/or specifications
- All site information, topographic, legal and soils investigation reports, surveys, borings, etc., required by the contractor
- Support data, studies, calculations, etc.
- Final project description. This consists of a report that details the entire design, systems, materials, equipment, etc. and their relationship to meet the project's set budget and schedule
- Updates to the commissioning plan, commissioning specification and systems operating manual
- Updated "security" drawing.

7. Recommended for a Final Class A Estimate

- All details specifications and coordination of all documents to be complete

- Two complete sets of signed and sealed originals of the working drawings with CADD files on CD and indexed pdf format
- Two typed originals of final specifications with electronic (CD) and indexed pdf formatted copies for tendering
- Commissioning plan
- Systems operations manual
- Colour schedules
- One set of soil investigation report with amendments if any
- Inspection authorities' submission
- Final security drawing
- List required shop drawings, material samples, mock-ups etc.
- Listing of all required extended warranties, maintenance materials and spare parts to be provided as part of the contract
- Listing of all required site work/materials testing required with detailed budget.

Appendix 3 – Qualifications for Estimators and Cost Consultants

Canadian Institute of Quantity Surveyors (CIQS)

1. Professional Quantity Surveyor (PQS)

A member who has completed all of the academic and experience qualifications of the institute together with the Test of Professional Experience (TPE).

The duties of a PQS, include, but are not limited to the following:

- Preparing construction tenders from information provided by architects, engineers and other design consultants.
- Managing, administrating and coordinating of all types of construction projects, including sub-contracts; preparation of construction progress schedules; setting up and operation of cost control systems; valuation of changes and finalization of contracts.
- Giving of advice on construction cost planning to prospective owners, architects, engineers and public authorities.
- Preparing and interpreting tender documents, specifications, general conditions, other parts and forms of contracts.
- Checking and analyzing of tenders.
- Conducting or participating in arbitration and court hearings.

The education and training of a Professional Quantity Surveyor (PQS) is designed to provide a detailed and comprehensive knowledge of construction and construction methods and the ability to provide cost and financial advice at any stage of a building project. Separate divisions of the institute comprise members specializing either in mechanical and electrical installations, but all Professional Quantity Surveyors have a working knowledge of the practical aspects and design features of such installations. The Professional Quantity Surveyor has a thorough knowledge of the laws relating to construction projects and the accounting and administration procedures essential to the successful management of construction contracts.

Preparation of Cost Estimates

A large number of the institute's members are employed as estimators by the major construction, civil engineering, mechanical and electrical contractors. In this capacity they are responsible for preparing bids for all types of construction work and in the case of many firms, estimators may also be responsible for the management of construction contracts. Successful estimators are well informed about all aspects of the construction industry particularly current market conditions affecting the cost of construction, technological innovations which may improve productivity, contractual laws and obligations, material specifications, scheduling, regional variations affecting supply of labour and materials, and modern construction methods. An ever-increasing part of any construction project involves the work of specialist sub-contractors. Estimators must compile lists of all such firms operating in their locality and be aware of each firm's competency and financial capacity. They must build up and maintain a good working partnership with the best of these firms. Estimators are in a position of great responsibility, since a single decision by them can sometimes mean the difference between a profitable or a losing project, and successful estimators enjoy corresponding respect from colleagues and employers.

Preliminary Estimating & Cost Planning

The PQS in private practice provides complete cost control and cost planning services to the industry. Through his knowledge of building designs and components he is able to establish budgets from minimal information provided at the feasibility stage. This information may be limited to a schedule of net area requirements before any drawings are produced.

The PQS will be responsible for advising and reporting on costs through the design stage to maintain the integrity of the established budget and to ensure that the owner receives the best value for his money.

This analysis can involve the evaluation of the cost effectiveness of alternative building shapes, component specifications, and various materials and in addition the provision of cost checks at various key stages through the design process.

In order to carry out these services effectively, the PQS / ECA must possess a wide knowledge of building design and material costs. He must also work closely with all members of the design team and therefore have the ability to communicate effectively both orally and in written form.

Project Monitoring Services

Many financial institutes require the input of the PQS / ECA to advice on construction loans. This work is typically divided into two stages.

Stage 1 - Budget reviews: In this stage an analysis of the proposed budget is undertaken to ensure inclusion of

items normally associated with a project of its kind, as well as confirming that the budget is adequate to complete the project.

Stage 2 - Progress draw reviews: In this stage, a periodic review of the request for funds is undertaken to determine that it is reasonable and to confirm that the remaining budget is adequate to complete the project.

2. Construction Estimator Certified (CEC)

A member who has completed all the academic requirements as defined in the CIQS syllabus or equivalent and the two years approved North American industry experience qualifications required by the institute for the designation CEC.

The duties of a CEC include, but are not limited to the following:

- Pricing and preparing formal tender submissions.
- Managing, administering and coordinating all types of construction projects.
- Conducting pre-bid negotiations with subcontractors and suppliers.
- Negotiating contracts with owners.
- Verifying subcontractor and supplier payments.
- Pricing and negotiating change orders.
- Preparing construction progress schedules.
- Preparing monthly cost forecasts and progress claims and
- Recording final unit prices for data base reference

The education and training of a Construction Estimator Certified is designed to provide a detailed and comprehensive knowledge of construction and construction methods and the ability to measure various types of construction projects including the ability to price, administer, negotiate and analyze the various stages, methods and types of construction.

Separate divisions of the Institute are available for those specializing either in mechanical or electrical installations.

CIQS estimator members are employed by the major construction, civil engineering, mechanical, electrical contractors and by specialist sub-contractors. They are well informed about all aspects of the construction industry particularly current market conditions affecting the cost of construction, technological innovations which may improve productivity, contractual laws and obligations, material specifications, scheduling, regional variations affecting supply of labour and materials and modern construction methods.

In order to carry out these services effectively, the Construction Estimator Certified must possess a wide knowledge of building design and material costs. There is also the requirement for the ability to work closely with all members of the construction team and have the ability to communicate effectively both orally and in written form.

Canadian Construction Association's Gold Seal Certification Program

A Gold Seal Certified (GSC) estimator can be qualified under:

1. the Examination criteria whereby an individual must score a minimum of 100 or more Gold Seal certification points and satisfy two requirements regarding experience, education and training; or
2. the Senior Practitioner criteria whereby an individual must have a minimum of 15 years relevant Canadian experience as an estimator and score a minimum of 200 Gold Seal certification points

A special point scoring system has been developed to assess individuals in the following five categories: industry experience, trade skills, related management skills, education, and training.

	Senior Practitioner	**Examination**
Minimum Total Score	200 Points	100 Points
Work Experience	Minimum 150 Points (15 Years)	Minimum 50 Points (5 Years)
Trade Experience	Maximum 30 Points	Maximum 30 Points
Related Management Experience or Prior Gold Seal Certificate	Maximum 30 Points	Maximum 30 Points
Education	5 to 40 Points	Minimum 25 Points
Training	- - -	

Scope of Work

Accurate estimates are necessary to make a profit and because the estimate is prepared prior to construction, a great deal of emphasis is placed on the pre-construction phase of a project. For this reason, estimating is one of the most important phases of every contractor's business

and makes the estimator a key player in the construction industry.

As a Gold Seal recipient, the estimator working for a contractor is expected to carry out a wide range of duties under the general direction of company management.

By reviewing the drawings through the various phases of construction, the estimator must be able to visualize a project and providing solutions to problems, such as where equipment and material will be placed. They must have sufficient construction experience to possess a working knowledge of job conditions, including labour and material take-offs, methods of handling materials on the job, the most economical methods of construction, and methods of dealing with labour. With this experience, the estimator will be able to mentally construct the job and give an accurate estimate of cost.

An estimator must have sufficient knowledge of labour performance and operations to convert them into costs for a project. This includes an understanding of how much work can be accomplished under given conditions. This ability is developed through experience in construction and a study of completed projects.

Further, an estimator must have the ability to keep historical information on all kinds of costs including those of labour, material, overhead, equipment, and availability of required items; and be capable of assembling bids and meeting bid closure deadlines.

Appendix 4 – Sources of Information and References

Canadian Institute of Quantity Surveyors
www.ciqs.org

Royal Institution of Chartered Surveyors
www.rics.org

The International Cost Engineering Council
www.icoste.org

"Estimating the cost of capital projects: an empirical study of accuracy levels for municipal government projects" by S.M. AbouRizk, G.M. Babey, and G. Karumanasseri

Gold Seal Certification
www.goldsealcertification.com