

A Decision Process For Project Delivery Options

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Introduction

The most common contracting process used by public agencies throughout North America is the sequential design/bid/build (D/B/B). Typically, the process is open public tender, award to the lowest qualified bid, and, for civil works, payment by unit prices. Although alternative methods of contracting reportedly can result in higher value through fewer disputes, better quality, and more on-time performance and building within defined budgets, the D/B/B system is expected to remain as the most common system for repetitive, recurring types of construction, particularly where the project is funded by the public owner and financing is not to be furnished by the contractor. Although the D/B/B system is suited for the majority of work processes, it is often applied to all circumstances without consideration of alternative methods of delivery. The intent of this decision process is to ensure that alternative delivery systems are considered and applied to those situations where significant increases in value can be obtained.

There were two driving forces that led to the creation of a formal decision process regarding project delivery. The prime reason was the introduction of a new agency, which required assurance that it was getting the best return on its investment in infrastructure. The existing agency had only used the traditional methods—a form of cost plus for emergency work and D/B/B for everything else. The second driver for a formal process was that very few project managers had any previous opportunity to make delivery decisions from even a limited range of options. This process has the potential to be an instrument of change, as one approach is to require each project manager to complete the selection guides and include these completed decision guides with the recommendation to implement the project. The new agency could get some comfort that the options had at least passed through the consciousness of the project manager and hopefully received serious consideration.

Factors to Consider in Deciding Project Delivery

The proper selection of a project delivery method is a major step toward achieving a successful project. Many project and/or construction managers (P/CM) find them-

selves faced with the dilemma of choosing a process without being certain of the factors to consider. In selecting the most effective delivery method for any construction project, the P/CM needs to consider a number of factors including :

- Owner competence:
 - ability to assess alternative project deliveries
 - ability to assess contractor competence
 - personnel available with ability to handle selected delivery method
- Project Factors:
 - size
 - complexity, i.e., new technology involved in design or construction
 - potential for innovative approaches in either scope or method
 - degree of definition of scope (what is to be built)
 - degree of diversity of scope (different types of work involved)
- Contractors:
 - level of industry activity
 - sufficient number with relevant experience to ensure competition
 - level of trust with owner
- Project Risks:
 - identified and appropriately allocated
 - potential for concealed/unforeseen conditions
 - potential for significant changes in the work
 - impact of scheduling changes, contractor, and/or subcontractor failure
- Social objectives:
 - local hire and local purchase for construction
 - opportunities for minority groups
 - meeting safety and environmental expectations.

A unique feature of this list is not just the inclusion of owner competency but that it is listed first. Without the “ability to assess alternative project deliveries,” there will be no change in our practices and no improvements. Competency of the owner’s personnel is such a significant criterion for project success that the following two Laws of Project Organizations have been formulated:

1. Owners largely determine success or failure by the people they assign to lead a project.
2. Project teams can only perform as well as the owner’s project management team allows them.

CII research (Construction Industry Institute 1990) found that Strategic Project Organizing (an owner function) was the most significant success factor with the potential to realize gross savings of 15 percent of total project cost.

Decision Tree

The process to determine if an alternative project delivery strategy is appropriate consists of a series of choices that are shown as the Decision Tree in Exhibit 1. The traditional D/B/B (tendered unit price process) referred to above is shown as the double horizontal line bisecting the chart indicating that this is the trunk of our tree and the default option of our decision process. The delivery options to be considered are shown as branches off the trunk of the tree.

The four stages in the process, identified as vertical zones and labeled at the bottom of Exhibit 1, are:

1. Contract Packaging.
2. Contracting Method.
3. Payment Method.
4. Evaluation Method.

Gordon (1994) proposed a sequential process for choosing an appropriate contracting method. A similar decision tree for the process outlined in this reference was made for comparison and confirmation. Although the nomenclature was different, the resulting diagram proved to address the same factors as those in the proposed decision tree in Exhibit 1.

Decision Guides

As previously described, the project delivery alternatives are shown as branches off the decision tree with the “trunk” of the tree being the traditional D/B/B approach. For all branches, except the direct award, a decision guide is provided to evaluate the factors that affect the decision. Most references list all the factors in making the selection, but, as they are silent about relative weightings, they imply all factors are equally important. Since this is not the case, weighting is incorporated into the scoring system of each decision guide. The weightings provided are only indicative; they are not fixed and will be changed to meet project circumstances and owner requirements.

For each project, the evaluator only has to answer one question on each factor with a “yes” or “no.” The weighted scores for each answer are totaled for the two columns. The total score for each column is compared. The higher

score is the recommended alternative, and the variance between the scores indicates the strength of the recommended decision. These guides are not cookbook recipes to be precisely followed, and they are not substitutes for common sense and good judgment.

Stage 1—Contract Packaging

One of the first steps to take when deciding on project delivery options is to examine the number and types of contracts that are best for the particular situation. Will there be a Single Contract or will Multiple contracts be better?

Of the standard factors listed above, ensuring an adequate number of bidders and diversity of scope are most significant to this decision. In addition to the standard factors, the decision regarding the number and type of contracts must take into consideration:

- potential for disruption to the public
- natural combinations of work packages due to project layout (logistics)
which may require either a combination or splitting of contracts for a given type of work.

Decision Guide MVS was developed to assist in this decision.

Stage 2—Contracting Method

This stage recommends one of the three following contractor selection processes/type of contracts:

- direct award/cost plus
- public tenders/unit price
- proposal calls/lump sum (design/build).

Direct Award

This method involves direct award to the next qualified contractor on a list of prequalified firms at prenegotiated hourly rental rates for equipment. This variation of cost plus contracting is used for work:

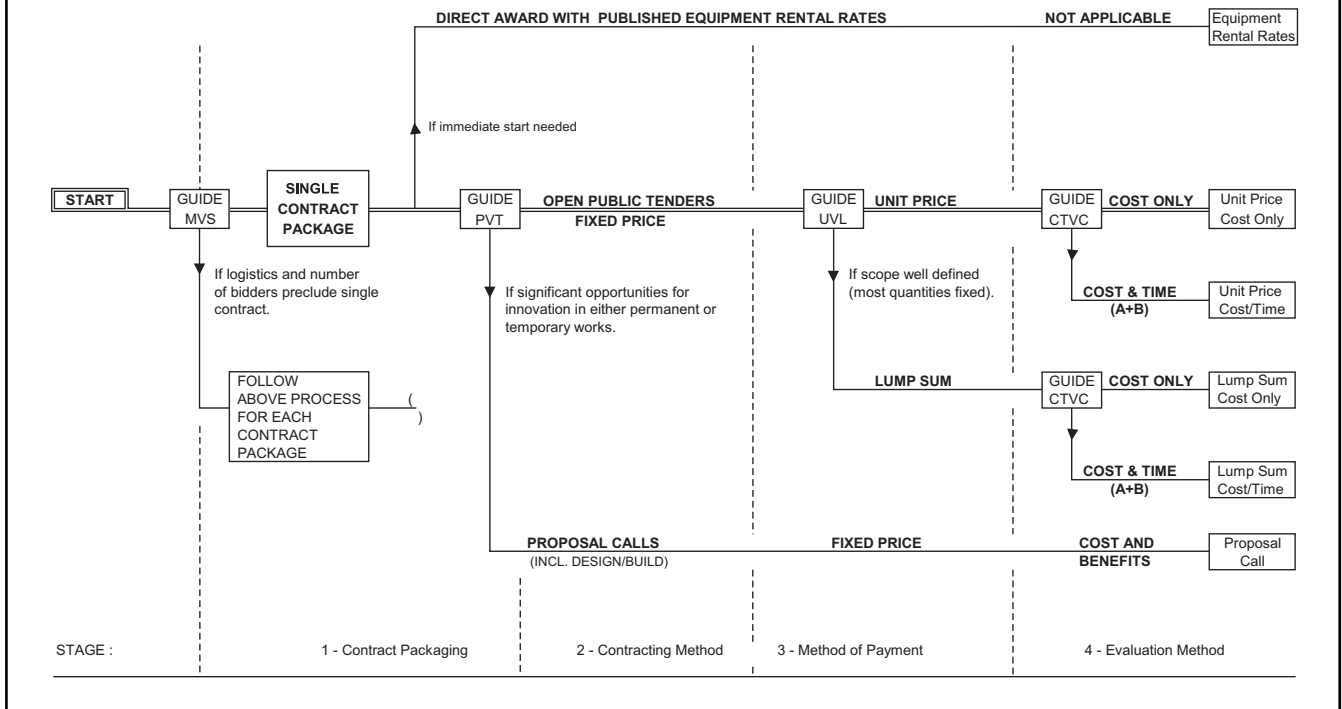
- where the need for immediate start does not allow for a proper tendering process, or
- too small to justify a tendering process, or
- whose scope cannot be adequately defined.

Since urgency is the prime criteria, no formal decision process was considered necessary, and no decision guide has been developed.

Tenders (Design/Bid/Build)

Where the scope and schedule are well defined and the objective is limited to minimum initial cost, open public (competitive) tenders are the standard. This is the D/B/B type of delivery where the designer and contractor are

Exhibit 1. Decision Tree for Project Delivery Options



retained separately by the owner. The owner first selects a designer, based upon qualifications to develop a project concept defined by the owner's needs and goals. At the completion of the design phase, the project should be described by a complete set of plans and specifications, which are put out for tender. Unlike the designer, the contractor is not expected to understand the owner's needs; rather, the qualified low bidder agrees to construct the facility in accordance with the drawings and specifications. The designer's function during construction is usually limited to a supporting role, on behalf of the owner, to ensure the integrity of the final product. In this method, responsibilities are fragmented and shared (although not equally), with the owner being the final arbiter of disputes and claims.

Proposal Calls (Design/Build)

A "proposal call" is a more-general process that includes design/build. The proposal call process is well established—generally two stages with the first calling for and evaluating Expressions of Interest to obtain a short list of qualified parties followed by receiving and evaluating about three detailed proposals. Scoring is on the basis of a number of criteria of which price is only one—although the major one. After valuation based on

weighted criteria, the award is made to the highest scoring proposal.

Although design/build is the best known form of proposal call, the potential range of proposal calls is much broader. Wherever there are either opportunities for innovative approaches or objectives beyond the lowest initial cost, proposal calls should be considered. For example, one proposal call required the successful proponent to form a joint venture with a company formed by the aboriginal bands affected by a highway project. Proposals were evaluated on price and opportunities for aboriginal economic development. A proposal call was also used on an extremely congested section of the Trans-Canada Highway near Vancouver, B.C., where the permanent works were not subject to change (i.e., not conventional design/build). Proposal valuation was based on price and minimum disruption of traffic (i.e., planning and temporary works).

In design/build delivery, the owner retains a single entity that provides both design and construction services for a project. There are two major differences between design-build and the "traditional" design/bid/build project delivery. First, with design-build, project responsibility and control is in the hands of a single entity from concept through to design and construction to completion.

The second important difference of design-build is the early design level at which a construction contract price is agreed upon. With design-build, the contract price is often set at concept or early schematic design (10 percent to 30 percent design document completion level). The traditional D/B/B method requires 100 percent completed design documents, and the contract price is not known until complete bids are submitted.

Although design-build is not widely available in the public sector (Gordon 1994), it can be an effective and attractive project delivery system. Some states in the United States (U.S.) still prohibit design-build by requiring a competitive bid to a completely designed project (the D/B/B process). Of the fourteen federal agencies responding to a 1991 survey (Builders Future Council), nine used design-build at present for some work, and seven expected growth in this method in the following two years. In the U.S., the construction of structures appears to be the prime area in which a contractor designing and building a project as a single entity is being considered. However, the concept does show some potential for more widespread use.

The 1992 American Society of Civil Engineers Policy Statement on design-build in the federal sector listed the following factors to consider when using design-build:

1. Pre-selection of design-build offerers, based on qualifications of the team.
2. Owner scope of work information that is of sufficient detail to allow competing teams to cost effectively produce their proposals.
3. Selection criteria that is communicated clearly and structured to reinforce the qualifications-based selection process.
4. Pre-determined reimbursement for the "short-listed" firms that were pre-selected.
5. Assurance of direct line of communication between owner and design professional.

A challenge of the decision guide for this stage (PVT) was to consider both the more-general proposal call opportunities and the more-specific design/build at the same time. Decision Guide PVT was developed to assist in this decision. The overall scoring would indicate if a proposal call is warranted; positive scores in the shaded areas would recommend design/build. This Decision Guide is shown in Exhibit 2.

Stage 3—Payment Method

Although there is no limit to the different types of contracts that can be made between the owner and the contractor (Bower and Donnelly 1991), three types have been developed and are available in standard form—fixed price, cost-plus, and unit price. What are often

called different types of contracts are, more specifically, different methods of payment. The major factors in deciding the appropriate method of payment are scope definition and quantity variability.

Whereas direct award is a cost-reimbursable contract where the owner has all the risk for cost overruns, fixed-price contracts (either unit price or lump sum) distribute the risk between the owner and the contractor. With fixed prices, the owner does not have either the right to direct the contractor in the means and methods of construction or the right to inquire about the actual cost of performing the work as he does with direct award. The contractor will be entitled to keep any additional profit earned as a result of cost-saving measures but will also be responsible for overruns.

The standard type of payment used in civil works is unit prices. With this method of payment, the owner retains the risk of quantity variation. Although unit price contracts do not guarantee the final cost, they may be advantageous to the owner where the quantity of work items vary as they avoid the contingency that may be in a lump sum.

A lump sum contract (also referred to as stipulated price contract) transfers most of the risk to the contractor who receives a specified amount of compensation for performing the work, including labor, materials, and equipment, as well as overhead and profit.

Since the owner's supervision costs are higher with the unit price method of payment, the lump sum contract is encouraged wherever beneficial. The transfer of risk also changes the nature of the contractor's approach and will provide more creativity with respect to how the scope is delivered. Decision guide UVL was prepared to assist in this selection.

Stage 4—Evaluation Method

Cost Only

The most prevalent method of evaluating public tenders is to compare all tenders that meet the requirements of the tender call and award to the contractor submitting the lowest qualified bid. For our purposes, we call this "cost-only" valuation.

Cost/Time Method

The Transportation Research Board (a unit of the U.S. National Research Council) formed a task force on Innovative Contracting Practices in 1991 (Builders Future Council 1991), which examined the processes various agencies used to contract for construction. Of

Exhibit 2. Decision Guide PVT

Element	Circle the answer that applies	
<u>Schedule Urgency</u> - Is there a potential benefit from an earlier completion date?	Yes <input type="text" value="5"/>	No <input type="text" value="5"/>
<u>Innovation</u> - Is there a potential for innovation in the design of the permanent works? Is there a potential for innovation in the construction methods?	Yes <input type="text" value="10"/>	No <input type="text" value="10"/>
	Yes <input type="text" value="5"/>	No <input type="text" value="5"/>
<u>Industry Capability</u> Are there sufficient numbers of qualified participants to get at least three competitive teams?	Yes <input type="text" value="5"/>	No <input type="text" value="5"/>
<u>Cost of Work</u> - Is total cost of construction work to be contracted > \$5 M?	Yes <input type="text" value="10"/>	No <input type="text" value="10"/>
<u>Owner Competency</u> Does Owner have available adequate field supervisory experience to handle tendered contracts? Does Owner have available adequate experience with proposal calls/design-build?	No <input type="text" value="5"/>	Yes <input type="text" value="0"/>
	Yes <input type="text" value="0"/>	No <input type="text" value="5"/>
<u>Unusual Social Objectives</u> - Is there a potential need to obtain contractor input on various ways to meet unusual social objectives?	Yes <input type="text" value="5"/>	No <input type="text" value="5"/>
SCORE (TOTAL NUMBERS FOR CIRCLED ANSWERS)	<input type="text" value=""/>	<input type="text" value=""/>
GUIDELINE FOR HIGH SCORE	If this column results in the highest score, a proposal call is better delivery method.	If this column results in the highest score, a tender call is probably the best delivery method.
	If the shaded items are "yes", consider Design/Build	

most interest to our work was an alternative process they called "A+ B bidding." From the perspective of a decision process, this innovative practice is primarily a method for valuation of tenders, which could be called "the Cost/time Method of Evaluation." The executed contract is a traditional one (Herbsman 1995), and the type of payment could be either lump sum or unit prices.

The basic principles of this method are that in the cost (or "A") part, the contractor bids prices like in any other

process. If the contractor is awarded the project, those prices will be the base for the cost reimbursement for constructing the project. In the time (or "B") part, the tender documents provide the bidder with the owner's value of a time unit (such as a day, hour, week, etc.). This figure, known in the highway industry as the road-user cost (RUC), includes the cost of traffic delays and agency costs such as construction inspection and interest during construction. Each bidder must plan the work and "bid" a

schedule, i.e., their estimated time required to complete the project with the knowledge of how the owner will value time.

When all the bids are submitted, the owner determines who is the lowest combined (A + B) bidder using the following formula: $LCB = A + B \times RUC$ where LCB = lowest combined bid of bidder (\$); A = cost estimate of bidder (\$); B = time estimate of bidder (e.g., days); and RUC = road user cost, as was determined by the owner (\$ per day).

The contractor must complete the project within the contract time (which was her bid time). If the contractor is late, she will pay a liquidation damage, which is usually equal to the RUC value that was part of the bidding process. Most organizations are using a second version of the A + B method that combines the A + B with an Incentive/Disincentive (I/D) clause. The only difference between this version and the A + B only version is that if the contractor completes the project ahead of schedule, she will receive an incentive fee.

The evaluation of the cost/time method by various American agencies (Herbsman 1995) shows that a substantial reduction in contract time as compared to the time of similar projects bid in the conventional method has been achieved. In most cases, the contractors were able to complete the project within the schedule they had bid. The evaluation showed that the reduction of time was achieved with no addition to the cost. How did contractors achieve these results under the cost/time process? The major conclusion from analyzing case studies is that the low bidding time was estimated and achieved by better organization, better planning, and better use of resources—not by raising the cost.

Canadian experience has been less comprehensive but, in one case, more enthusiastic. One province has been using cost/time selectively for the past year and was positive about the results. It only used the method where there was a high benefit to the road users and high contract administration costs and where the scope could be well defined.

It analyzed the outcome of fourteen projects where the cost/time method had been used. In eleven of the fourteen contracts, the lowest bid was also the shortest schedule. The cumulative durations quoted for the eleven contracts were 70 percent of the cumulative days estimated by the owner. Of these eleven low-price/short-duration bids, six had been completed at the time of the interview and were done in 87 percent of the cumulative bid durations. Combining the two factors would indicate that actual durations could be as low as 60 percent of owner estimates!

The second province has adopted the cost/time method as its standard way of doing business—it uses cost/time on all tenders. In 1997, it used the cost/time method on about fifty contracts—most were in the \$1–3 million

range. At the time of our interview, twenty-seven of the fifty contracts had been completed. Of these twenty-seven, bonuses were paid on twenty-one contracts, indicating that the majority of contractors are able to bid a contract duration and complete earlier than their own estimates. Four of the other contractors have been assessed penalties.

The data from these two Canadian provinces supports the U.S. experience that:

- Owners tend to overestimate the time required to complete contract work.
- Contractors can bid reduced durations for the work and still be cost effective.
- Contractors can beat their own estimates and collect bonus payments.

Although the theory is that cost/time valuation provides an optimized bid based on the owner's stated value for time, the industry may not yet be that mature. It appears that cost/time is requiring bidders to plan the work better at the time of preparing their bids, and thus they are achieving the improbable results of both the low-price and short schedule. In the short term, this could be the prime advantage of using the cost/time method. As the industry adapts to the method, the optimization should develop.

Decision Guide CTVC was developed to assist in this decision.

Conclusions

1. A decision process consisting of a decision tree and a series of decision guides can be developed for selecting the optimum type of project delivery system.
2. Requiring the use of the guide is proposed as a method of accelerating a change of practices.

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