

Getting the Right Contract Package

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ABSTRACT: Construction projects may be delivered under one contract package or multiple packages divided by discipline, geographic location, or other characteristics. Dividing the construction into contract bid packages is called contract packaging, and is a vital and strategic aspect of effectively delivering tunneling projects. The process of contract packaging considers many factors, including the type of project, location, and owner's priorities.

This paper describes the key facets of the contract packaging process used recently on several tunnel projects, reports, where possible, on the success of the process, and concludes with recommendations for applying this process to achieve the right contract package.

INTRODUCTION

Underground construction projects are inherently complex and risky, involving unknown geology and congested work conditions that can increase cost and duration. The design approach taken and the use of suitable contract clauses can help reduce these impacts, but success also depends on how the contract is packaged. Contract packaging is a term used to describe the process by which owners and designers determine how the work components of a project will be best divided into packages to be presented to bidders. Contract packaging is generally of more concern on large construction contracts with schedules of several years, but can benefit smaller projects as well. The process is intended to result in an overall project that reflects the functional requirements of the owner and stakeholders, while attracting competitive bids from the contracting community, which usually provides an economic benefit to the owner.

This paper discusses a common approach to contract packaging, using experience gained on four recent projects that adopted the approach. The four projects are all large, West Coast tunnel construction projects, but are diverse in type (water supply, wastewater, and rail transportation) and location (urban and rural). The four projects are: the San Vicente Water Supply Pipeline Project (California), the Brightwater Conveyance Combined Sewerage Overflow System Project (Washington), the University Link Light Rail Project (Washington), and the Third Street Light Rail Project (California).

For large tunnel construction projects, there are usually many possible contract package configurations, due both to the scope of work and the fact that larger projects usually involve multiple disciplines, the coordination of which should be considered in the contract package process. For example, transit

projects may involve civil, architectural, and systems components, while a wastewater project may primarily involve civil and mechanical disciplines. Because of the many options available, it is important that the designer and owner identify the key components of a project and the possible contract package combinations at an early stage of the design process. This allows sufficient time to incorporate owner feedback and changes into the design process without compromising the delivery of the final design package.

In many cases, a decision is made based on what is needed without a lot of study. The contract packaging process described in this paper is logical and incorporates an "as objective as possible" evaluation of criteria. The result is a solution that can be logically and objectively justified, if necessary, to the various stakeholders.

CONTRACT PACKAGING PROCESS

The first step in the contract packaging process is to correctly identify the extent of the work. Once this is done, the components can be divided into contract packages. Some work elements are best left as "stand-alone" contracts. Others are better suited to being combined with other work. Usually, several combinations result from these two steps. On the four example projects referenced above, contract packaging was considered during preliminary design. This is the most appropriate time to consider contract packages, because generally there is a good amount of information known about the work at this stage of design, but there is still time to fully evaluate the packages and make any necessary changes. A good rule of thumb is that contract packages should be considered no sooner than the 30% design stage

(preliminary design stage), and no later than the 60% design stage. It is common to begin with more possible contract combinations than the team can effectively evaluate. It is necessary to eliminate any combinations that are clearly inappropriate, based on the owner’s objectives and the level of importance the owner has assigned to various functional requirements.

For most tunneling projects, the contract packaging approach becomes a trade-off between two sets of competing interests, namely: (1) construction schedule versus community disruption (i.e., the project will be completed faster if there are more access points such as shafts/portals, but access points impact the community); and (2) contract size versus contractor interface (i.e., contractor interference can be avoided by making one large contract, but that tends to limit competition).

Once any clearly inappropriate packages have been eliminated, and the list of options reduced to a manageable number, contract package evaluation begins. There are several ways to evaluate contract packaging combinations. The common, and recommended, approach facilitates the comparison and ranking of the contract packaging options. It uses a weighted value that is the sum of the product of a Rating Value (RV) assigned to each contract package, and an Importance Factor (IF) that is assigned to the evaluation criteria. This method is best implemented in a workshop forum, where key project decision makers can provide input and reach agreement. The objective of the workshop is to ensure that the correct IF is applied to each criterion.

The evaluation process will always be affected by individual project realities, the experiences of the participants, and the time available for the evaluation process. However, if the key decision makers take time to determine the most appropriate project-specific evaluation criteria, the process will likely be a success.

EVALUATION CRITERIA

General criteria are defined to help rank contract packaging options. These criteria generally relate to cost, risk, and community/environmental issues. Each criterion can be evaluated based on the knowledge and requirements of the workshop participants (the evaluation team), taking into account the rating value and importance factor approach described above, in order to meet the overall project objectives. Typical criteria are outlined in Table 1 and discussed in more detail below. It must be realized that, while these criteria are generally considered to cover the full range of categories that may be important to an owner, there may be further categories that apply

Table 1. Typical contract packaging criteria

Considerations	Criteria	
Cost	Initial Project Construction Cost	
	Provision for Similar Excavation Equipment and Methods	
	Reduction of Contract Overhead Costs	
	Attract Qualified Contractors and Maximize Bid Competition	
	Mining Efficiency and Spoil Material Disposal	
	Primary and Secondary Lining	
	Owner’s Cash Flow	
	Project Schedule	
	Risk	Traffic
		Noise and Vibration
Work Opportunities for Local Contractors		
Community/Environmental		

to specific owner requirements. These should be identified during the evaluation process.

Cost Considerations

Initial Project Construction Cost

The importance of this criterion depends on the initial project construction cost or “bid price.” Differences in cost are primarily related to equipment costs, site supervision, and indirect costs. This particular criterion considers only the initial bid price; issues related to potential change orders or claims are included in other criterion within the analysis. The costs associated with construction management are also not evaluated by this criterion, but are assessed by a separate consideration for reduction of contract overhead.

Provision for Similar Excavation Equipment and Methods

This criterion is used to differentiate between contract packages that will allow for similar means and methods to be used for various elements of the work and those that will not. Economies of scale can be realized by providing opportunities for a contractor to use identical or similar means and methods for more than one reach of the tunnel. Using identical or similar means and methods can also optimize equipment commissioning and learning curve periods by allowing the same personnel to undertake multiple contract start-up phases. Logistics dictated by site accessibility are also considered in this criterion. The primary aspect of this consideration is size of contract (in financial terms). Larger contracts tend to be more favorable.

Reduction of Contract Overhead Costs

Contract packaging can affect the amount of indirect and overhead costs that will be incurred by the contractor. Reductions in contract overhead costs can be realized by combining tunnel reaches into larger contract packages. Such reductions present in the form of lower office supervisory costs, site supervision costs, and construction management costs. This criterion considers contractor indirect and overhead costs that will be increased or reduced as a result of contracting alternatives. For example, if the civil (excavation and support) and architectural finishes contracts on a tunnel contract are combined, the contractor's indirect costs will be reduced. This could also apply to functions like traffic control (flaggers), dust control (tankers), etc. The criterion may also consider reductions (or additions) in the contractor's personnel and the owner's contract administration personnel, both in the number of people and the duration for which they are needed. Generally speaking, more staff is required for multiple contracts than for a single large contract. The primary factor for this consideration is size of contract. Larger contracts tend to be more favorable.

Attract Qualified Contractors and Maximize Bid Competition

Offering a greater number of smaller-dollar-value packages tends to promote more competitive bids. This is because the number of potential contractors with suitable financial and bonding capabilities will generally increase as the size of the contract package is reduced. When evaluating against this criterion, options that involve more contracts are rated more favorably than those that involve fewer contracts.

In some circumstances, such as was the case on the example projects, it may be beneficial to attract suitably qualified large tunnel contractors during the bid process. Such contractors are typically more attracted by larger-value contracts. In such cases, the decision makers must weigh the benefits of releasing multiple small contracts with the drawback of possibly receiving bids from contractors not sufficiently experienced to carry out the work. If the decision makers decide it is more important to have multiple small contracts than to attract large tunnel contractors, the issue of receiving bids from unqualified contractors can be addressed by including a qualification stage in the contract solicitation phase.

The market conditions and the availability of labor at the time of contract bidding will impact a contractor's ability to competitively bid for contract packages. Larger contracts tend to attract suitably qualified large tunnel contractors regardless of market conditions. This may not be the case with smaller-sized contracts where the potential profit may be less and the bid competition greater.

The best price will be obtained by enhancing economic competition (i.e., ensuring the maximum number of qualified bidders for each contract package). Packages need to be sized large enough so that well-qualified and experienced contractors will bid, but small enough that the contracts are not overly restrictive (due to bonding, insurance, management of subcontractors, etc.). In monetary terms, the dividing line between "large enough" and "small enough" is highly variable, and depends on the type of work and practices for bonding and sharing financial risk. Based on recent bidding results, contracts in the range of \$250 million seem to strike a good balance of qualifying without restricting.

The law in certain states, like the State of Washington, requires contractors to provide 100 percent bonding for individual contracts. This requirement may be difficult for contractors to meet on large contracts, particularly for smaller contractors. Discussions with bonding companies working within the tunneling industry have indicated that a reduction in the size of the bond would not change the nature of the bid competition. This is because the sureties rate the risk on the value of the total contract and not on the bonded amount. The risk to the sureties is therefore considered the same, whether they are bonding 100 percent or 50 percent of the contract amount. This risk can be mitigated by reducing contract values. While reducing contract values may increase competition, it may also attract less qualified tunnel contractors. The primary factor for this consideration is the size of contract. Larger contracts tend to be more favorable.

Mining Efficiency and Spoil Material Disposal

The area available for construction will determine how efficiently mining (tunnel excavation), including spoil material disposal, can be undertaken. Smaller site areas, commonly called staging areas, tend to create more restrictions in tunnel operating logistics. As the available land area will more than likely vary between staging areas, it is important to ensure, for example, that TBM launch sites are sufficiently sized to optimize tunneling operations. The contract packaging, and the identification of appropriate staging areas for working and receiving shafts/excavations, may impact the bid submission prices, since operating efficiency will be accounted for in these prices. The primary factor for this consideration is the size of the site. Larger construction sites tend to be more favorable.

Primary and Secondary Lining

This criterion considers the importance of continuity between primary and secondary lining materials in terms of procurement and installation for the various contract package alternatives. There is likely to be a cost benefit to issuing fewer contract packages, as

the contractor will be able to obtain competitive pricing for materials and may use the same lining installation equipment on several contracts. The primary factor for this consideration is the size of the contract. Larger contracts tend to be more favorable.

Owner's Cash Flow

This criterion relates to the impact of contract packages on the owner's cash flow. With several contract packages, the owner may be able to plan the contract awards such that activities that are very costly, such as TBM excavation, are staggered through the project schedule. With a single contract package this flexibility may not be available. However, the owner may be able to plan for cash flow on an annual basis if the schedule and costs are known. The primary factor for this consideration is the size of the contract. Smaller contracts tend to be more favorable.

Risk Considerations

Project Schedule

One of the primary risks on an underground project is going over the estimated overall construction schedule. Schedule considerations include time benefits offered to other contractors (e.g., early hand-over to systems and start-up), third parties, and the community. For example, there may be significant public relations advantages and physical benefits to giving a community early access to the stations on a transportation project. It is also important to achieve a balance between the design schedule and the construction schedule by allowing enough time for design but beginning construction as quickly as possible. The evaluation should also include an assessment of any schedule benefits that may be offered to any other contract elements within the project.

This criterion is used to assess each contract package alternative according to the estimated total construction duration. This criterion also considers the potential, and impact thereof, of conflict arising between separate contractors working within overlapping contract reaches. Certain contract package combinations increase the potential for conflict between contractors/subcontractors. Such conflicts can result in inefficiencies in the work and increase the risk of claims attributed to delays or impacts upon the contractor's operations. Control of these types of conflicts requires contract language addressing this risk (e.g., use of schedule milestones or cooperative work disclaimers). Interfaces can also lead to increased safety risks (e.g., congested working space during construction). It is desirable for a contract package to require interface between contractors only at underground interface points or during break-ins at common shaft areas. Interfaces are normally handled by establishing a specific time window within each contract for the work to occur,

which is less risky than trying to operate long-term out of a common shaft or portal. If contractors anticipate conflicts they may increase their bid prices. If conflicts actually occur, the final cost of individual contracts will increase.

One factor to be considered is the size of the contract. Larger contracts tend to be more favorable, because the risks of conflict and negative impacts to the work and schedule are managed by the contractor. Another factor is the number of contractors needing access to a single site within the same time period. Limiting the number of contractors needing such access is more favorable.

Community/Environmental Considerations

Traffic Considerations

Traffic impacts associated with portal and tunnel construction (e.g., hauling spoil out and materials and equipment in) should be considered in evaluating contract packages. This criterion relates to tunnel drive directions, the establishment of associated shafts or portals, and the impact of construction on surrounding communities. The primary consideration is the shaft or portal site. Sites adjacent to freeways or other transportation routes tend to be more favorable. Those that require materials and muck to be hauled through residential areas tend to be less favorable.

Noise and Vibration Considerations

This criterion addresses the impacts of noise and vibrations on the public. The primary consideration is the shaft or portal site. Sites adjacent to residential areas, and to a lesser extent commercial areas, tend to be less favorable.

Work Opportunities for Local Contractors

The packaging of contracts can have a significant impact on the number of local tunnel contractors that are suitably experienced and qualified to bid. A large number of smaller contract packages will tend to attract a greater response from tunnel contractors because the number of contractors who are financially able to perform the work will increase as the contract package value decreases. The increase in number of respondents generally results in increased bid competition and lower costs for the owner.

Smaller subcontractors performing utility work, trucking, paving, and landscaping are impacted to a lesser extent by the number of contract packages, since they will not be prime bidders. Goals for attracting minority/women-owned business enterprises and Small Economically Disadvantaged Businesses (SEDB) will likely apply to all contracts. The primary factor for this consideration is the size of the contract. Smaller contracts tend to be more favorable.

Table 2. Criteria and favorability of outcomes based on contract size

Criteria	More Favorable	Less Favorable
Initial Project Construction Cost	Neutral	Neutral
Provision for Similar Excavation Equipment and Methods	Large contracts	Small contracts
Reduction of Contract Overhead Costs	Large contracts	Small contracts
Attract Qualified Contractors and Maximize Bid Competition	Large contracts	Small contracts
Mining Efficiency and Spoil Material Disposal	Large construction sites	Small construction sites
Primary and Secondary Lining	Large contracts	Small contracts
Owner's Cash Flow	Small contracts	Large contracts
Project Schedule	Large contracts	Small contracts
Traffic	One contractor per site	Multiple contractors per site
Noise and Vibration	Construction site adjacent to freeways	Construction site in residential neighborhoods
Work Opportunities for Local Contractors	Construction site in commercial or industrial areas	Construction site adjacent to residential areas
	Small contracts	Large contracts

Regardless of the way contracts are packaged, it is important to identify discrete elements of work that could be performed by small and disadvantaged contractors. The breakdown of the contract packages should consider the scope, specific expertise required, dollar value, and schedule for these discrete elements. Clear divisions and information will enable good communication with the SEDB contractors and allow them to bid competitively. In terms of providing opportunities specifically for SEDB firms, there is no apparent advantage to having smaller or larger contract packages.

In all contract packaging scenarios, efforts should be made to identify and encourage contracting opportunities for SEDB firms. Although consideration of this factor is unlikely to impact the size or content of the contract packages, once the contract packages have been determined, potential subcontracting opportunities should be assessed for inclusion as goals in the individual contracts.

Summary of Contract Packaging Criteria

Table 2 summarizes the criteria discussed above and indicates whether the outcomes are likely to be more or less favorable with large or small contracts.

Although these criteria tend to favor larger contracts, the evaluation process needs to ensure that the criteria are adjusted to reflect the specific elements of the given project. On some projects, large contracts may not be desirable due to the owner's cash flow requirements or because the contract value is excessively large and may deter bid competition. It must also be noted that individual projects may have other evaluation criteria which are not mentioned

here. The criteria included in this paper are simply some of the most common for underground projects.

CONTRACT PACKAGE OPTIONS

After the contract packages have been evaluated against the project-specific criteria, they are systematically rated to establish the most viable combinations of packages. While there may be other contract package options available, those selected for rating should be the options considered most likely to be adopted on the project. The contract package combinations should include any recommendations and/or comments that may have been made by Owner Review Boards or Value Engineering teams during the early stages of the project.

As mentioned previously, it is recommended that the contract package options be discussed and evaluated in a workshop with all key project decision makers. A summary of the contract packaging options, assumptions about the project, and advantages/disadvantages of each package should be distributed to the attendees prior to the workshop. The workshop approach allows the design team to learn firsthand the requirements of the owner's staff and the key stakeholders. It also reduces the risk of the decision-making process being driven by an individual's personal experience. The input of the workshop attendees is invaluable in either confirming the initial evaluation or providing additional information to refine the initial evaluation. However, it is important that the evaluation process does not become bogged down by too many opinions and irrelevant details. To this end, the role of the workshop facilitator is vitally

important. The facilitator should possess the necessary technical and interpersonal skills to move the process forward harmoniously and expeditiously.

Almost all project owners and stakeholders want a contract solution that:

- Lowers construction management inspection costs and the contractor's on-site overhead costs. Efficiencies in contractor's overhead are marginally better on a single large contract because one site office can serve more than one mining operation.
- Allows the contractor flexibility and opportunities for innovation with regard to the selection of mining methods and scheduling.
- Avoids contractor interference problems at interfaces. Interfaces create the potential for some interference between adjacent contractors. Interface requirements may have to be put into the contract to allow the tunnel contractor access to the adjacent contract.
- Ensures qualified bidders. Where the owner would be relying upon just one contractor to perform the work, it is critical to prequalify the bidders and the contractor's key personnel to be sure that they possess adequate skills and experience in all aspects of the work.
- Promotes bid competition and increases opportunities for local contractor participation.
- Is appropriate for smaller packages. Smaller packages give smaller contractors an opportunity to participate in the work, shorten the schedule, and provide an opportunity to utilize mining equipment and contractor expertise that is more suited for the particular type of ground to be excavated.
- Is divided such that packages involve similar ground conditions. The reuse of excavation equipment results in considerable cost savings.
- Provides economies of scale in primary and secondary lining procurement and installations.

Once the contract packaging options have been determined and evaluated, using the agreed-upon evaluation criteria, the recommended contract package for the project can be selected.

OTHER CONSIDERATIONS

Timing of Bid Advertising

Advertising two or more contracts for bid simultaneously affords the opportunity for tunnel contractors to submit separate or combined bids. The owner can either accept a combined bid from a single contractor, or award contracts to separate contractors in a "mix

and match" format. On previous projects where this approach was adopted, some commercial benefit was apparent (i.e., the combined bid had a lower value than the separate contracts added together). This approach does introduce risks; in particular, it requires a significant portion of the design work to be completed simultaneously, and it may actually limit the number of bids received from smaller contractors.

On several of the example projects, the design schedules were developed such that bidding documents for the main tunnel reaches were finalized at approximately six-month intervals. The benefits of this approach were: a more structured design process for the designer and the owner and good bid competition on all the tunnel contracts.

Contract Size and Bonding

In the tunneling industry, \$250 million projects are not uncommon and have been found to be not too large to attract qualified bidders. For such a job, contractors often form joint ventures that allow them to share risk, staff the job completely, or meet bonding requirements (in some cases). However, even with these joint ventures forming, there is still enough competition to ensure at least three bids. For contracts of values up to \$250 million, many tunnel contractors who could perform the work would probably consider bidding individually, rather than forming a joint venture. For projects in the \$325 to \$400 million range, more than two contractors are likely to team together as a joint venture, for bonding purposes, resulting in larger teams and less overall competition.

Market Conditions and Impact on Delivery

Tunnel contractors' interest in bidding on projects is affected by various factors. One of these factors is the market condition at the time the contract is advertised. The market condition includes other projects going on at the time and other contracts released for bid at the same time. For the example projects, the design teams conducted research to identify any tunnel projects that would be advertised within two to three years of the example projects. The forecast was updated periodically to reflect changes and allow the example projects to be advertised during periods that maximized economic competition.

Industry Outreach

To stir up contractor interest and encourage the submittal of bids, it is recommended that industry outreach programs be implemented. The tunnel contracting community can be informed of upcoming projects through the following venues:

- Owner-led briefings of interested contractors (contractors often contact owners to inquire about upcoming projects);
- Promotion at regional and national conferences; and
- Information dissemination on the owner's Web site, including information on the plan and profile, standard Terms and Conditions, and information about how the contractor can schedule a one-on-one briefing.

EXAMPLE PROJECT STATUS

The four example projects are all at varying stages of design and construction. Two are in construction, one is in final design, and one is in preliminary design. On the two projects where construction has started, the contract packaging option selected has been highly successful. The tunnel contracts for both projects received multiple bid submissions with bid submissions generally lower than the engineer's estimate. In each case the owner has expressed satisfaction with the contract packaging process.

RECOMMENDATIONS FOR PROCESS APPLICATION

Contract packaging is the division of a project's work scope into separate contracts based on considerations similar to those used for selecting the delivery method. Time spent during the preliminary design stage, and as part of the early works during the final design stage, is highly effective in getting the right contract package. Provided that the development of

contract package options and evaluation criteria has fully encompassed the owner/stakeholder requirements as well as the design team's technical expertise, then the selection process will be relatively straightforward. Once this is complete, the recommended packaging will define the way forward for the design schedule, the tender advertising and bid process, and the construction schedule.

Based on experience gained on several projects, the following approach is recommended:

- Determine project's work scope and specific components;
- Ascertain the requirements of the owner and stakeholders;
- Develop a list of evaluation criteria;
- Draw up initial contract packaging options, including a planned preliminary screening process;
- Circulate initial results to decision makers;
- Conduct a contract packaging workshop, being sure to fully inform attendees about the process and project, and engage an experienced facilitator;
- Document the results of workshop, including any follow-up actions;
- Ensure that the recommended contract packaging strategy is still compatible with proposed contract delivery methods;
- Proceed with design on the basis of the agreed-upon packaging and delivery strategy;
- Input contract packaging decisions into the program master schedule for both design and construction.