Concessionaire Selection for Build-Operate-Transfer Tunnel Projects in Hong Kong

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Abstract: A significant realignment of risks between project participants is a fundamental facet of the new procurement paradigm of BOT (build-operate-transfer). A BOT concessionaire assumes far more and deeper risks than a contractor. One critical contributor to the success of a BOT project is the selection of an appropriate concessionaire who has the necessary capacity to provide the best overall deal throughout the build-operate-transfer process. However, various BOT-type procurement protocols are not yet proven and are still being tried and tested. Many countries are at the lower ends of their learning curves. Therefore, there is a need to benchmark the best practices that have been emerging. The Hong Kong government has developed a well-structured concessionaire selection framework supported by the Kepner-Tregoe decision analysis technique. This paper analyzes and draws experiences and lessons from this concessionaire selection practice. Current concessionaire selection practices worldwide are also discussed with a view to improve the procurement process of regions lacking in such experiences or expertise.

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Introduction

Facing inadequate public financial status and increasing demand on infrastructure facilities, many governments worldwide are exploring new infrastructure procurement routes through public-private partnerships (PPP), among which the BOT (build-operate-transfer) type arrangements are a popular option. In addition to the utilization of private funds, such arrangements also draw in managerial skills and operational efficiencies from the private sector. A striking feature of a BOT scheme is the major realignment of risks between various project participants. Compared with contractors in traditionally procured projects, BOT concessionaires assume far more and deeper risks. These can be broadly classified into: (1) elemental risks, comprising physical, design, construction, operation and maintenance, technology, finance, and revenue generation risks; and (2) global risks, comprising political, legal, commercial, and environmental risks (Merna and Smith 1996).

Many countries are still at the lower ends of their learning curves on BOT arrangements. Various BOT-type procurement protocols are not yet proven and are still being tried and tested. Therefore, there is a need to benchmark the best practices. There are three key problems associated with BOT projects (Smith 1995): (1) availability of experienced developers and equity investors; (2) the ability of governments to provide the necessary support; and (3) the viability of corporate and financial structures. Problems 1 and 3 indicate that the selection of an appropriate concessionaire is critical to the success of a BOT project.

Since the late 1960s, five large tunnel projects have been successfully developed in Hong Kong through the BOT approach (Zhang and Kumaraswamy 2001), with the first one transferred to the government in 1999. They are the Cross Harbor Tunnel (CHT), the Eastern Harbor Crossing (EHC), the Tate's Cairn Tunnel (TCT), the Western Harbor Crossing (WHC) and the Route 3 Country Park Section (R3CPS), as shown in Table 1. Based on past BOT experiences, the Hong Kong government has recently formulated a well-structured concessionaire selection framework, which incorporates the Kepner-Tregoe decision analysis technique. This framework had been used in the selection of concessionaires for two new BOT projects, the WHC and R3CPS. After a review and critique of current worldwide concessionaire selection practices (in terms of the selection process, prequalification, and tender evaluation methods), this paper provides an analysis of the Hong Kong concessionaire selection procedures and derives useful experience and lessons from this, with a view to improve the procurement process of countries or regions that have not benefited from such experiences or expertise.

Concessionaire Selection Practices

The selection of a suitable concessionaire depends on three elements (Tiong and Alum 1997): (1) the quality of the definition of project-specific criteria; (2) the quality of evaluation of the available tenders; and (3) the quality of the understanding of what these tenders can achieve. A workable selection technique should clearly indicate the stages involved in the selection process and what measures to take at each stage. It should enable evaluators to derive both quantitatively and qualitatively the relative advantages, disadvantages, and risks involved in each alternative tender.

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Table 1. Build-Operate-Transfer Tunnel Projects in Hong Kong

Project name	Concession period (years)	Construction start date (dd/mm/yy)	Opening date (dd/mm/yy)	Approximate cost HK$ (million)	Approximate cost US$ (million)
Cross Harbor Tunnel	30	09/69	08/1972	320	56
Eastern Harbor Crossing	30	07/08/86	21/09/89	4,400	564
Tate's Cairn Tunnel	30	11/07/88	01/06/91	2,150	277
Western Harbor Crossing	30	02/08/93	01/04/97	7,500	969
Route 3 Country Park Section	30	31/05/95	30/07/98	7,250	936

Uniqueness of Concessionaire

BOT represents a significant paradigm shift in project procurement. While nominally proceeding just a couple of steps beyond a design and build/turnkey contract, by adding the finance and operation functions, it in reality leaps ahead in terms of philosophy. It moves from a reactive contractor in a traditional project to a proactive concessionaire in a BOT project. The BOT concessionaire provides an excellent special purpose vehicle, where diverse functions of finance, design, construction, and operation are integrated and a cooperative relationship formed, while in a traditional project these functions are fragmented and the relationships among multiple participants are often confrontational.

To play its role in financing, building, operating, and finally transferring the project to the public client, the concessionaire enters into contracts with various participants in the project, including the public client, investors/shareholders, lenders, main contractor(s), main designer(s), insurers, material/equipment suppliers, operators/maintainers, and intermediate/end product/service purchasers.

Competitive Selection Process

Three approaches have been adopted internationally to select the concessionaires for BOT-type projects: (1) negotiated tendering; (2) invited tendering; and (3) open competitive tendering. Open competitive tendering is a trend in the international concessionaire selection practices. For example, it has been adopted in the United Kingdom in its (Private Finance Initiative PFI) projects, e.g., on the DBFO (design-build-finance-operate) roads; in toll roads in the United States under its Intermodal Surface Transportation Efficiency Act (ISTEA); in BOT tunnel projects in Hong Kong; and in power projects in many developing countries such as China, India, Malaysia, the Philippines, and Thailand. This open competitive tendering process consists of the following stages: (1) request for prequalification; (2) prequalification; (3) invitation to tender; (4) tender evaluation and shortlisting; (5) negotiations with shortlisted tenderers; and (6) selection of best tender and award of concession.

Prequalification

The concessionaire is often a consortium formed for a particular project and usually has no track record. What makes things more complicated in concessionaire selection is that the concessionaire has more commitments than a mere contractor. In addition to construction, the concessionaire is also responsible for finance, design, long-term operation and maintenance, and transfer of the project facilities to the client in operational conditions at the end of the concession period. The competence of the concessionaire is dependent on the overall resources and capabilities of the constituent companies, the concessionaire's ability to formulate competitive financial and technical packages, and the partnering skills of the proposed project participants. Hatush and Skitmore (1997) have identified and grouped various selection criteria into five criterion packages to facilitate contractor prequalification. They are general, financial, technical, managerial, and "safety and health" packages. These criterion packages are also applicable to concessionaire prequalification. However, appropriate adjustments should be made to reflect (1) the revised risk allocations in BOT projects in general; (2) the uniqueness of each specific concession; and (3) the composition of the concessionaire, and the resources and capabilities of, and role played by, each constituent company.

The prequalification process is mainly aimed at reducing the number of interested consortia to a shortlist (e.g., of three or four), each consisting of reputable and experienced contractors, operators, and investors. This ensures that unsuccessful consortia do not incur unnecessary tendering costs, which are much higher than those for similar projects through the traditional design-bid-build (DBB) procurement route. Apart from additional commercial evaluations, compared with the DBB approach, a much longer time horizon and more complicated contractual and financial relationships need to be assessed in the tender for a BOT project. For example, tender costs for PFI (private finance initiative, a government framework that also uses the concept of BOT in the procurement of public works and services) projects in the United Kingdom range from 0.48 to 0.62% of the total project costs, as compared with 0.18 to 0.32% for design and build projects, and 0.04 to 0.15% for traditional DBB projects (Kumaraswamy and Zhang 2001). This is an example indicating that tendering costs for BOT projects can be much higher than those for traditional projects.

Competitive Tender Evaluation Methods

Simple Scoring System

Maximum achievable score points are assigned to each predetermined selection criterion, against which alternative tenders are evaluated, and a score is then awarded to each tender for each criterion. The awarded score for each criterion may range from 0 to the predetermined maximum achievable score points for that criterion. The total score for a tender is the sum of all awarded score points of all the evaluation criteria. The tender with the highest total score is chosen as the winning tender. This scoring system has been used in toll highway projects in the United States, for example, in four toll roads in California: the Santa Ana Viaduct Express, the Mid-State Tollway, the San Miguel Mountain Parkway, and the SR 91 Median Improvement. The evaluation criteria and the maximum achievable score points used in the four California toll roads are shown in Table 2.

J. Constr. Eng. Manage. 2002.128:155-163.

Table 2. Evaluation Criteria and Maximum Score Points Used for California Toll Roads (Levy 1996)

Evaluation criteria	Maximum score points
Transportation service provided	20 points
Degree to which proposal encourages economic prosperity	10 points
Degree of local support for the project	15 points
Relative ease of proposal implementation	15 points
Experience/expertise of sponsors and support team	15 points
Supports for environmental quality and energy conservation	10 points
Degree to which nontoll revenues support proposal costs	5 points
Degree of technical innovation displayed in proposal	10 points
Supports for achieving civil rights objectives	10 points
Highest achievable score	110 points

NPV Method

The NPV (net present value) method can be used to assess the commercial and financial packages of a BOT tender. For conforming or equivalent designs, the tender with the lowest NPV of tolls/tariffs over the concession period is selected as the winning tender. This method is suitable for projects where there are relatively correct estimations of the quantities of products or services to be provided by, for example, a power plant or water treatment project based on the public client's offtake agreement. The client may also compares the NPV of the construction, operation and maintenance costs, and financing charges over the concession period or (even the whole project life) for further evaluation.

The equation for calculating the NPV of toll/tariff revenues can be expressed as

$$NPV_k=\sum_{j=1}^{n} R_{kj}(1+i)^{-j} \qquad (1)$$

where NPV_k = total net present value of the toll/tariff revenues of tender k over the concession period; R_{kj} = toll/tariff revenues of tender k in the j operation year; n = concession period; and i = discount rate.

One shortcoming of the NPV method is that it ignores the relative advantages and disadvantages of the technical solution in different tender proposals (Tiong and Alum 1997), since, although these tenders are conforming or equivalent, there are no two tenders that are the same in all technical aspects.

Sensitivity Analysis

In BOT tender evaluation, financial aspects are usually assigned a much higher weight as compared with other packages. For example, in the Laibin B power station in China, financial aspects were given an 84% weight (60% for the electricity tariff +24% for the financial proposal). Therefore, more diligence should be exercised in analyzing the financial aspects of BOT tenders. Sensitivity analysis is recognized as a useful analytical tool for evaluating financial investments. While this technique cannot evaluate risk per se, it can identify variables that contribute most to overall investment riskiness and project returns and highlight those variables in a diagrammatic form, to point the decision maker to where efforts should be directed to keep those variables within specified limits and thus effectively control risks. The possibilities of errors in the estimation of various variables can be combined to derive an overall effect on the financial feasibility of the project. It can also direct attention to critical variables that require special/extra forecasting efforts because of their potentially significant impact on the final decision—for example, where it is identified that a small error in estimating such variables may make the NPV negative or depress the internal rate of return below the desired rate. Sensitivity analysis usually requires no additional information. Only a percentage increase or decrease of the variables already used in a normal financial analysis is needed. Important variables considered from a sensitivity perspective include inflation rate, revenues, construction/refurbishment costs, interest rates, debt/equity ratio, offtake, operation costs, construction time, and project life. Sensitivity analysis is usually conducted within the range ±20%, while it sometimes goes as high as 30% for high-risk variables (Lumby 1991; Woodward 1995).

Multiattribute Analysis

This technique takes into consideration the major attributes of each alternative to be assessed. In BOT tender evaluation, the multiple attributes of a BOT project proposal can be assessed against various criterion packages (e.g., general, financial, technical, managerial, legal, and environmental). Of course, each of these packages may in turn include many subcriterion packages. According to their relative importance, varying weights are assigned to each main package and may also be assigned to each subpackage within that main package, and maximum available score points are allocated to each criterion within a main or subpackage. Each tender proposal is then evaluated against every criterion and awarded a score for that criterion. The proposal with the highest total weighted score will be chosen for the BOT concession.

The multiattribute analysis equation for tender evaluation can be expressed (assuming that there are no subcriterion packages within each main criterion package) as

$$TWS_k=\sum_{i=1}^{m} w_i \sum_{j=1}^{n_i} AS_{ij} \qquad (2)$$

where TWS_k = total weighted score for tender k; W_i = weighting index to main criterion package i; AS_{ij} = awarded score to subcriterion j, which is within main criterion package i; m = number of main criterion packages; and n_i = number of subcriteria within main criterion package i.

Kepner-Tregoe Decision Analysis Technique

The Kepner-Tregoe decision analysis technique (Kepner and Tregoe 1981) has been used by some public clients, such as the Hong Kong government and the New South Wales state government, in BOT tender evaluation. Decision stages of this technique include: formulating a decision statement, identifying and weighting decision objectives (in terms of "MUST" and "WANT" criteria), generating alternatives, evaluating alternatives against the MUST and WANT criteria, and selecting the most suitable alternative. The decision statement provides the focus for the following steps and sets limits in the selection. The MUST and WANT criteria help to identify specific requirements of the decision. Each MUST or WANT criterion may also be subdivided into its own set of subcriteria.

It was succinctly described that "the MUSTs decide who gets to play, but the WANTs decide who wins" (Kepner and Tregoe 1981). The MUST criteria are mandatory and measurable, functioning as a screen to eliminate failure-prone alternatives. After screening through each MUST criterion by a yes-or-no judgment,

J. Constr. Eng. Manage. 2002.128:155-163.

Table 3. Commonly used Decision Statements and MUST and WANT Criteria in Concessionaire Selection [based on Tiong and Alum (1997)]

Commonly used statement	Commonly used MUST criteria	Commonly used WANT criteria
1. Select the tender that offers the best overall value for money. 2. Select the tender that offers the most attractive financial package and most effective technical solution. 3. Select the tender that is generally best researched in the technical and financial aspects of project.	1. Tenders must be complete and must comply with the tender guidelines. 2. Proposed concessionaire must have proven capacity (financial and technical) and experience in construction and operation of similar projects. 3. Proposed concessionaire must have local company in its team.	1. Degree of attractiveness of financial package 2. Financial returns to government and benefits to community 3. Relative soundness of technical solution for project implementation 4. Relative experience and expertise of promoter in similar projects 5. Degree of environmental impact

the remaining alternatives will be judged on their relative performance against WANT criteria using the above-mentioned simple scoring system or multiattribute analysis. A WANT criterion may be mandatory but cannot be classified as a MUST for one or two reasons: (1) it may not be measurable and therefore cannot give a yes-or-no judgment; and (2) it is intended to be a relative measure of performance instead of a yes-or-no judgment. The WANT criteria give the evaluator a comparative picture of the remaining alternatives. For example, if the simple scoring system is used, the most important WANT criterion may be allocated a highest weight, say, of 10. All other criteria would then be weighed against the first, from 10 (equally important) down to a possible 1 (not important). The MUST/WANT criteria should also be examined for potential dangers inherent in unfairly or unrealistically ''loaded criteria,'' i.e., those that guarantee a smooth passage for a certain alternative at the expense of all others. Commonly used decision statements and MUST and WANT criteria in the concessionaire selection of BOT-type projects are shown in Table 3.

The Kepner-Tregoe technique takes into consideration client objectives, project attributes, and the characteristics of BOT schemes and expresses these objectives, attributes, and characteristics in terms of various MUST and WANT criteria. This technique also incorporates the evaluation methods of binary decision, simple scoring system, and multiattribute analysis. Literature review, correspondence, interviews, and discussions with professionals who have been involved in BOT projects (especially those from Hong Kong) indicated that the Kepner-Tregoe technique is a suitable method for BOT concessionaire selection. This is confirmed by Tiong and Alum (1997), who have modified the Kepner-Tregoe technique for BOT tender evaluation. Furthermore, through a questionnaire survey, they have obtained the opinions of 30 government officials and their advisors on the validity of this technique for BOT tender evaluation. The survey results indicate that this technique is a practical tool for BOT tender evaluation.

However, it is obvious that the Kepner-Tregoe technique is much more complicated than the simple scoring method, the NPV method, or the multiattribute analysis. It takes time and effort to determine the appropriate decision statement, MUST/WANT criteria, and the relative importance of the WANT criteria. Furthermore, this technique may eliminate a tender that fails to meet only one MUST criterion but well satisfies all other MUST and WANT criteria and retains a tender that may only barely satisfy all MUST criteria and have poor scores for all WANT criteria.

For better use of the Kepner-Tregoe technique, brainstorming and group decision methods can be deployed to formulate a realistic decision statement and identify appropriate MUST and WANT criteria. In addition, utility theory, fuzzy sets theory, Moody's precedence charts (Moody 1983), and pair-wise comparison techniques can help weight the WANT criteria and judge alternative tender proposals against these weighted WANT criteria.

Kepner-Tregoe Technique used in Hong Kong's Tunnel Projects

Based on past experiences, the Hong Kong government has recently formulated a well-structured concessionaire selection framework supported by the Kepner-Tregoe decision analysis technique. This framework had been used in the selection of concessionaires for two new BOT tunnel projects, the WHC and R3CPS. Taking the WHC as an example, the decision statement as well as MUST and WANT criteria used in tender evaluation are discussed in the following sections.

Conforming and Alternative Proposals

In the project brief (Hong Kong Government 1992) and related supplemental documents of the WHC, the Hong Kong government establishes details of the engineering, land, operational, and related requirements of the project to be developed through the BOT scheme. The government invites tender proposals based on this scheme. All tenderers must submit at least one conforming proposal (i.e., conforming to the preestablished requirements of the BOT scheme, although they may involve different financial and commercial terms) numbered according to the tenderer's preference, if more than one. Minor departures of the conforming proposal that do not materially affect the design, construction method, or operational characteristics of the scheme are allowed. However, these departures must be clearly identified and fully described. In particular, the financial, programming, and any other practical implications of a departure must be fully explained.

The government is also prepared to evaluate alternative proposals that differ in whole or in part from the conforming proposals. However, alternative proposals will only be considered if they are on a BOT basis and if the tunnel is of dual-three lane configuration.

Furthermore, the government may consider a hybrid scheme incorporating features from any conforming proposals and any alternative proposals submitted, subject to agreement with the tenderers involved.

Decision Statement, MUST and WANT Criteria

The decision statement in the concessionaire selection of the WHC can be summarized as follows: to select from the private

Table 4. MUST Criteria as Derived from Western Harbor Crossing (WHC) Project Brief

	MUST criteria	Comments on criterion significance
1.	Project scope must include WHC to be developed through BOT scheme and section of Route 7 that tenderer shall design, construct, and transfer at no cost following construction to government that shall control and maintain.	This criterion ensures compliance with BOT project procurement strategy and the required additional facilities to public client.
2.	WHC must be dual three-lane immersed tube road tunnel together with associated approaches, toll plaza, interchange, electrical and mechanical installations, buildings, and all related operational facilities. All these facilities should be contained within the tunnel area.	This criterion defines the project scope and land limitation that must be satisfied in the conforming proposal.
3.	Proposed tender must meet the transport, engineering, and operational requirements of government.	This criterion is in light of the requirements of Hong Kong government on transport projects.
4.	Proposed tender must contain a toll adjustment mechanism based broadly on the principles specified by the government.	Toll/tariff levels of infrastructure projects have strong effects on life of the public. Governments want some kind of control on the initial establishment and future adjustments of tolls/tariffs.
5.	Importation of labor from outside Hong Kong is not allowed except under certain special deserving circumstances. Illegal immigrants should be prevented from being employed.	This criterion is required by the Hong Kong immigration policy. It also increases the employment opportunities of local people.
6.	Government will have right to use passage tax to meet traffic management objectives.	This reflects the government's stand to improve related traffic services through the revenues of the project itself.
7.	Tenderers must demonstrate that they have sound financial backing and are capable of bearing financial risks of significant variation in costs of construction and operation and in the revenues over concession period.	This criterion ensures that the concessionaire has financial ability to construct and operate project, and to control various financial risks that might appear over the long operation period.
8.	Government does not take equity in the project.	This reflects the government's financial constraints or intention to transfer financial risks to the private sector.
9.	Proposed financing must be without recourse to government.	This ensures true nonrecourse project development.
10.	Tunnel area will not carry land title. There is no property development associated with the concession.	This ensures the unified land management by the government. However, for projects without robust traffic volume, the concession can carry land title to increase financial viability.
11.	Tenderer must take measures to ameliorate air, noise, water quality, and visual impacts associated with the project.	This criterion reflects government's environmental concerns
12.	Concessionaire company shall be a limited liability company.	This is a typical worldwide requirement.

sector a financially and technically strong consortium that will successfully develop the project and provide quality services to the public through a BOT arrangement and in turn obtain a "reasonable but not excessive" return on its investments.

MUST criteria in general terms for the conforming proposal are derived from the project brief and shown in Table 4. Comments on their significance have been made by the writers for clarification and for facilitating the generalization/consideration of suitable criteria for other projects. The MUST criteria for alternative proposals are listed in the following:

1. The proposed tender must demonstrate with full supporting evidence that the alternative proposal is technically feasible, that the construction program is reliable, and that there are engineering, financial, programming, and/or operational advantages over the conforming scheme.
2. The WHC must be a tunnel developed on the basis of a BOT arrangement.
3. The tunnel must be of a dual-three lane configuration.
4. The project must adopt the same corridor as used in the conforming scheme; i.e., the tunnel must connect Sai Ying Pun on Hong Kong Island and the proposed West Kowloon Reclamation on the Kowloon side.

WANT criteria in general terms for the conforming and alternative proposals are the same and are derived from the project brief and shown in Table 5, again with comments on their significance that have been juxtaposed by the writers in order to facilitate consideration for other scenarios.

Weights and Points Assigned to WANT Criteria

A tender evaluation committee determines the weights and maximum achievable score points of each WANT criteria. In tender evaluation, the above-mentioned general WANT criteria are further expended and defined into many criterion items. The tender evaluation committee is divided into three panels: (1) financial and general; (2) land and engineering; and (3) operation and transportation. The tender evaluation committee accordingly groups all criterion items into three main packages: (1) financial and general; (2) land and engineering; and (3) operation and transportation. The three packages are assigned different weights according to their relative importance as determined by the evaluation committee; for example, they may possibly be assigned 60%, 20%, and 20% of the total weight (100%), respectively. Within each of the three main packages there are a number of subpackages, which are also assigned weights by the corresponding panel according to their relative importance (Table 6). For example, nine subpackages may be included in the main package of land and engineering. They are: (1) environmental proposals; (2) construction and program; (3) security; (4) consortium ability; (5) utilities and drainage; (6) land issues; (7) immersed tube; (8)

J. Constr. Eng. Manage. 2002.128:155-163.

Table 5. WANT Criteria as Derived from Western Harbor Crossing (WHC) Project Brief

WANT criteria	Comments on criterion significance
1. Level and stability of proposed toll regime.	Toll levels, stability, and future adjustments are crucial criteria in BOT concessionaire selection. Low toll levels ensure a low total project life cycle cost to public.
2. Proposed methodology for toll adjustments.	Same comments as on criterion 1.
3. Robustness of proposed works program in meeting government's target date of completion.	Robust works schedule ensures early completion of project construction and early service provision to the public.
4. Financial strength of the tenderer and its shareholders, resources they will be able to devote to project, and their ability to formulate and support an appropriate financing package for project development.	Infrastructure projects usually have enormous construction costs. Strong financial strength of concessionaire is a prerequisite. This will also enable concessionaire to obtain loans for smooth development of the project.
5. Structure of proposed financing package including levels of debt and equity, hedging arrangements for any interest rate and/or currency risks, and level of shareholders' support.	High ratio of equity to debt and long-term low-interest rate financing can reduce financial costs. Shareholders' financial support, additional loan facilities, and other financial risk hedging measures ensure effective control of risks, e.g., those related to construction cost overrun, interest, and currency exchange risks.
6. Proposed corporate and financial structures of concessionaire company.	Suitable corporate and financing structures are crucial to effective management of financial risks.
7. Quality of engineering design, environmental considerations, and construction methods, including traffic control, surveillance, tunnel electrical, mechanical, ventilation, and lighting systems.	Quality design and construction ensures long project life and dependable project. This reduces operation and maintenance costs over long operation period. Less environmental impact is also an important criterion that is increasingly emphasized.
8. Proposed tunnel operation, maintenance, and inspection requirements.	This criterion ensures safe and smooth operation, maintenance, and inspection procedures.
9. Ability to manage, maintain, and operate effectively and efficiently.	This criterion ensures the selection of an experienced and capable operator.
10. Benefits to government and community.	This criterion seeks to obtain maximum benefits to government and community.

Table 6. Example of Main Package and Subpackage Criteria and Their Possible Weights

Main package criteria	Weight (%)	Subpackage cirteria	Weight (%)
I. Financial and general assessment	60	1. The consortium (strength, experience, corporate/financial structure	20
		2. Financial proposals	20
		3. Toll regime	30
		4. The timetable	15
		5. Impact on the government	15
		Total (1–5)	100
II. Engineering assessment	20	1. Environmental proposals	12
		2. Construction and program	14
		3. Security	4
		4. Consortium ability	16
		5. Utilities and drainage	7
		6. Land issues	5
		7. Immersed tube	18
		8. Structures	10
		9. Quality	14
		Total (1–9)	100
III. Operation and transport planning assessment	20	1. Highway layout and design	20
		2. Traffic engineering	20
		3. Electric and mechanical systems	20
		4. Tunnel operation	20
		5. Transport planning	10
Total weights of main packages	100	Total (1–5)	100

J. Constr. Eng. Manage. 2002.128:155-163.

Table 7. Examples of Criteria within Subpackages and Their Maximum Assigned points

Subpackage and criteria	Maximum achievable score points
I. Construction and program	
1. Realistic and robust construction plan and program	10
2. Least interference to marine traffic	5
3. Tie in with completion of associated roads	5
4. Proven method of construction	8
5. Casting basin proposals	9
6. Least disruption to interfacing projects	7
7. Best proposals for safety on site	7
8. Consideration of plant, material, and labor requirements	6
9. Provisional works arrangements	3
10. Insurance	2
II. Consortium ability	
1. Franchisee with proven experience/expertise	3
2. Contractor grouping with proven experience/expertise	10
3. Best proposals for project management	6
4. E & M subcontractor with proven experience/expertise	7
5. Environmental consultants with proven expertise	4
6. Main consultants with proven experience	9
7. Subconsultants with proven experience	5
8. Organization of consortium	8

structures and (9) quality. These nine subpackages may possibly be assigned weights of 12%, 14%, 4%, 16%, 7%, 5%, 18%, 10%, and 14%, respectively. Each subpackage incorporates various criterion items, which are allocated maximum achievable score points by the individual panel. These maximum points reflect the relative importance of the criterion items within that subpackage. Table 7 shows an example of the maximum achievable score points of the criterion items, respectively, under the subpackages of: (1) construction and program; and (2) consortium ability. The most important criterion item within a subpackage is assigned maximum score points of 10—for example, the criterion of ''realistic and robust construction plan and program'' in the subpackage of ''construction and program.'' The relative importance of each of the other criterion items of the subpackage is compared with this most important criterion and then assigned respective maximum achievable score points.

BOT Tender Assessment in Hong Kong

Overall Tender Assessment Process

The overall tender assessment process for the WHC is illustrated in Fig. 1. The whole process is carried out in confidence. The government does not provide the assessment results or reasons in support of its assessments to any tenderer or third party. In addition, the whole process is monitored by the Independent Commission Against Corruption (ICAC), which has played a major role over many years in minimizing corruption levels in Hong Kong.

Tender Evaluation Committee

The government sets up a tender evaluation committee, which is under the leadership of the Secretary for Transport and includes three panels: financial and general, land and engineering, and operation and transportation. Members of each panel come from relevant government policy branches and departments that are assisted by legal, technical, and financial consultants where appropriate. The evaluation covers both financial and technical aspects. Each panel is responsible for its own area of expertise and assesses whether the submitted tender proposals can meet the government's requirements.

Rapid Tender Appraisal and Shortlisting

The evaluation committee conducts a rapid tender appraisal based on MUST criteria and general WANT criteria, aiming to shortlist a number of tenderers for further clarification, detailed assessment, and negotiation.

Prior to tender evaluation, meetings are held between the government and its engineers/consultants and each individual tenderer and its engineers/consultants. These meetings provide the tenderer with an opportunity to present the details and merits of its tender and allow the government to seek clarification from the tenderer on any information or ambiguity contained in its proposal. The tenderers are required to provide prompt responses on all technical and financial issues and to ensure that all the necessary expertise is readily available to provide such responses during the shortlisting stage. No new information will be admitted or considered unless such information is requested in writing by the government. No commercial aspects will be discussed and no negotiation will take place at these meetings that are aimed at an exchange of views only.

The shortlisted tenderers are then required to submit a draft construction contract, designer's appointment agreement, checker's appointment agreement, relevant warranty agreements, and any other key contracts for review.

Negotiations with Shortlisted Tenderers

The shortlisting stage is followed by negotiations between the government and the shortlisted tenderers. The shortlisted tenderers are required to have all the necessary expertise and personnel readily available for negotiations, which are conducted according

J. Constr. Eng. Manage. 2002.128:155-163.

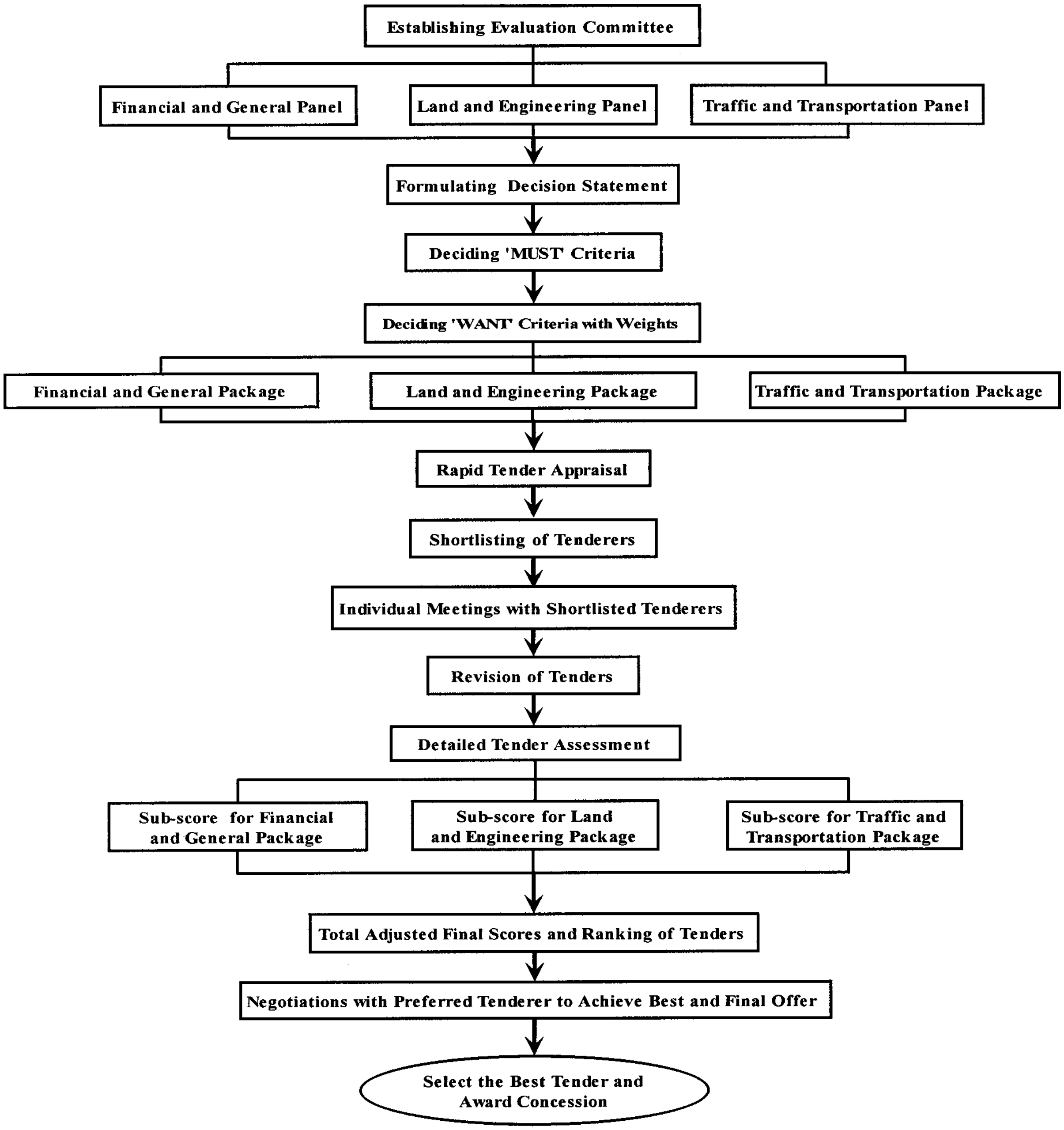

Fig. 1. Concessionaire selection of BOT tunnel projects in Hong Kong

to a tight timetable. Failure to respond in a timely fashion to government's invitation to negotiation may lead to disqualification of the tenderer.

The shortlisted tenderers are then required to submit one or more revised proposals in accordance with the requirements raised by the government during the negotiations. Although shortlisted tenderers may also revise, of their own volition, their conforming and/or alternative proposals, the government reserves the right not to consider any such revisions, and may invite other shortlisted tenderers to further submit similar revised proposals. Tender assessments are updated as the negotiation process proceeds and follows tenderers' submission of revised proposals.

Detailed Tender Assessment

At this stage, each shortlisted tender is assessed in detail against various WANT criteria. Panel members award points for each criterion to each tender based on its merits in respect of the project. Then, for each criterion, the points awarded by different panel members are averaged and adjusted by a consensus of the panel members to achieve a score for that criterion. The score for a particular evaluation subpackage under a main evaluation package is the sum of the averaged points awarded to each criterion within that subpackage. The score for a main package is the sum of the weighted scores for all the subpackages within that main package. The total final score of a tender is the aggregate of the weighted scores for all the three main packages. The tender with the highest total final score is selected as the preferred tender. This may be quantitatively summarized in the following equation for calculating the total final score of a tender:

$$TFS_k=\sum_{i=1}^{m} WM_i\sum_{j=1}^{n_i} WS_j\sum_{l=1}^{h_j} AS_{ijl} \tag{3}$$

where TFS_k = total final score for tender k; WM_i = weighting index to main evaluation package i; WS_j = weighting index to evaluation subpackage j; AS_{ijl} = averaged score for criterion l of subpackage j within main package i; m = number of main evaluation packages; n_i = number of subpackages within main package i; and h_j = number of criteria within subpackage j.

Negotiations with Preferred Tenderer

Once the final tender assessment is completed, the Hong Kong Executive Committee is asked to endorse the selection of the preferred tenderer. Then the government conducts further negotiations with the preferred tenderer on the final terms and conditions of the concession agreement to achieve the "best and final offer" from the preferred tenderer. These negotiations are also necessary for the preparation of the draft bill (ordinance) that will enable the project to be developed through the BOT scheme.

Conclusion

Compared with traditional design-bid-build projects, there is a significant realignment of risks and responsibilities among project participants. The concessionaire of a BOT project undertakes far more responsibilities and deeper risks than a contractor in a traditional project. The selection of an appropriate concessionaire is absolutely crucial to the success of any BOT project. Therefore, it is necessary to formulate a workable and efficient selection framework. At present, many countries lack such experience and expertise. Even the relatively limited experience and knowledge on BOT projects are scattered among some clients, concessionaires, consultants, and individual professionals. It is useful to solicit this expert knowledge, consolidate it, and code it into a knowledge base within an appropriate framework to improve future BOT procurement process.

Negotiated tendering, invited tendering, and open competitive tendering have been used in the international concessionaire selection practices, among which the open competitive tendering is a trend. The NPV method, simple scoring system, multiattribute analysis, and Kepner-Tregoe decision-making analysis technique have been used in open competitive BOT tender evaluation. In prequalification and tender evaluation, the potential concessionaires should be assessed against package criteria that include financial, technical, managerial, safety/health, and environmental aspects.

Literature review, correspondence, interviews, and discussions with professionals who have been involved in BOT projects indicated that the Kepner-Tregoe decision analysis technique is a suitable method that can be adapted for BOT concessionaire selection. This technique uses MUST and WANT criteria that are determined by the decision statement to judge alternatives. Based on many years of experience in the development of BOT tunnel projects, the Hong Kong government has recently formulated a well-structured concessionaire selection framework, supported by the Kepner-Tregoe technique. BOT characteristics, client objectives, and project attributes are taken into consideration in this framework. Strengths of this approach and advantages of this framework can be shared by other clients in their procurement of similar types of projects, while improvements may be injected for example in the selection of the best and final offer and increased transparency in the selection process.

For the better use of the Kepner-Tregoe technique, other supplemental decision-making tools (e.g., brainstorming, group decision methods, and Moody's precedence charts) can be incorporated to facilitate the generation of a realistic decision statement, the identification of appropriate MUST/WANT criteria, the derivation of their corresponding weights and maximum achievable score points, and the judgment of alternative tender proposals against the MUST and WANT criteria.

The Kepner-Tregoe technique is much more complicated than the simple scoring method, NPV method, or even the multiattribute analysis. It takes time and effort to determine appropriate decision statement, MUST/WANT criteria, and the relative importance of the WANT criteria. Furthermore, it is recognized that it is forever impossible to determine empirically whether the selection made was better than the one not made, because the project can only be done once.

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J. Constr. Eng. Manage. 2002.128:155-163.