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Contract Strategy for Design Management in the Design and Build System

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Abstract

Project team members in Design-build system, including owner's representatives, Design-build (D/B) contractors and architects/engineers, have to adopt new roles in managing the design of large-scale projects. The design responsibility is transferred from the owner's organisation to the D/B contractor who is responsible for the design management in the projects to be delivered by the Design-build procurement system. However, there remains the concern of design management between the designer and the constructor within the D/B organization, or between the joint venture parties of a D/B project. This paper presents a study, which reviews the issues concerning the design liability and contractual provisions for design management between the designer and D/B contractor in the said contractual arrangements of Design-build system. It disseminates the results of a questionnaire survey and structured interviews of three groups of project participants: owners, designers and D/B contractors. The roles and responsibilities of the parties involved in design and design management are less than clear in their respective engagement contracts. In order to improve the design management of Design-build projects, this paper recommended some strategic items to be considered in drafting contracts between owners/D/B contractors, D/B contractors/designers and owners/independent checkers to address the issues.

Keywords: Design-build, Design management, Contract strategy, Liability

INTRODUCTION

Design-build system (D/B) is one of the new procurement systems introduced to address the problems associated with the traditional system and innovative practices of the D/B system have been developed to cope with the growth in both the private and the public sectors (Akintoye 1994; Molenaar, Songer & Barash 1999, Masterman 1992). A design and build project can be performed by a D/B contracting organization where all services including design and construction are provided by in-house teams; or that it can be performed by a constructor who enters into contract with a designer for carrying out the design works (the designer may be novated to the constructor by the owner or employed as a separate designer); or a designer who enters into contract with a constructor for carrying out the construction works). The second situation represents most of the cases in Hong Kong where most of the constructors do not have in-house design team. Fig. 1 shows the typical contractual arrangement. The general contractor appoint external consultants and together work as a D/B contracting organization to carry out the design works on a project basis (Yu, 1998). It may be an interim solution for D/B system in an immature construction industry. However, for many economies, in particular less-developed countries, where resourceful wholly-integrated D/B contracting companies are not yet available, constructors & designers join up for specific D/B projects. Within the D/B contractor organization, there remains the concern of coordinating the design and construction. It is under this contractual arrangement of the D/B system that this study aims to investigate the design management issues.

The success of D/B procurement systems does not build on compromising design quality. If all parties adopt best practice of design management, innovative designs that incorporate constructability and practicality do exist in D/B systems (Chan, Ho and Tam 2001, Jawahar-

Nesan & Price 1997). As the design and construction processes are under the same umbrella of the D/B contractor, it is the D/B contractor's vested interest to adopt an active role in the management of design process in D/B system. Design management is to ensure that all the information is managed and distributed sensibly and responsibly at the right time (Gray and Will, 2001; Dulamimi et al., 1995). Research on design management practice has been mainly focused on information flow, scheduling and programming (LahdenperÄ & TanhuanpÄÄ 2000). Chang and Ibbs (1998) have explored contracting strategy to help design management by dividing the project work into task orders that are released to the party in phases. The benefit of flexibility with independent design and supervision in D/B systems may also be the root of the problems with the new system. With the D/B contractor assuming the single point of responsibility, it may have alleviated the owner's concern of identifying the party (design consultant or constructor) to be responsible for faults in the design and the management of design information. The problems of design liability and the responsibility for design management still exist in any project. Although these problems may be more concerning the designer (in-house or contracted) and the D/B contractor, the result in successfully addressing these problems will still be the owner's ultimate benefit. The major difficulty in design management is the need to collaborating multidisciplinary personnel and issues and the process also involves the allocation of design responsibilities among all the project participants and appreciation of contractual implication in the process (Zaneldin, Hegazy & Grierson, 2001, Hampton 2001, Chan and Chan 2001, 2000).

In the D/B organizational structure, an owner relies on a single source for the delivery of design and construction. The contractual arrangement in D/B system is drastically different to the concept in traditional procurement method. A chosen organizational structure for a project must be supported by contractual provisions formulated upon a contractual strategy

for specific project objectives. Standard forms of contract for D/B have been developed and used by reputable international institutions, such as the FIDIC. It cannot be assumed that these standard forms can be applied across the world. Critical research is still lacking for local construction industry, such as that of Hong Kong and mainland China, where integrated resourceful D/B contractors are not many. Instead of developing a standard form of contract appropriate to local situations, many local organizations including government departments, are making up their D/B contracts by amendments of or inserting annexation to the standard forms of construction contract suitable for traditional procurement methods. Compare to standard form of construction contract, even more neglected by dedicated research is the new legal relationship for the design consultants with the constructor and the owner. It needs committed research to analyze the appropriate duties/authorities of owners, design consultants, independent checkers and constructors in project administration and design management.

Objectives of This Paper

The research study aims to explore contract strategies and develop a set of key parameters as a guidance of drafting contracts between constructors/owners /design consultants to address the design management and design liability in D/B projects. This paper presents the data collected in the questionnaire survey and structured interviews and analyses the performance of design management in D/B procurement systems with the following specific objectives:

- To investigate the problems associated with contractual provisions for design management in projects using D/B systems.
- To recommend a set of contractual strategies for improvement of design management in projects using D/B systems.

CONTRACT STRATEGY

Uff (1989) suggested that the potential of construction contract as a medium has not been fully explored to improve construction efficiency and to achieve reform. Contract strategy is usually responding to drastic change or emergence of specific problems requiring solution. In addition, the contractual matter of D/B system is relatively a new issue to many local construction industries, which have their unique problems that deserve their own contract strategies. Studies (NEDO 1987, Walker 1994) suggested that management structures have significant influence on the quality achieved in a project. Contract strategy has profound effect on the management structure of a project. However, there is not much critical research focusing on the effect of legal issues to the strategy of contract (Uff 1989). Barnes (1989) had suggested some specifications to be considered for drafting a 'New Style Contract', when the New Engineering Contract (NEC) was considered in the United Kingdom (UK). It is doubtful that the suggested approaches can be applied directly to the D/B system adopted in ad hoc situations in local construction industries of less developed countries. It is a well-established principle that project risk should be placed on insurers where practical; otherwise, it should be placed on whoever gains the main economic benefit of running it (Abrahamson 1989). The form of and conditions of contract could also contribute to the management of project risk, including exposure to design liability (Perry 1995). The contract strategy in this study also aims to address the risk among all project participants, including owners, constructors, designers and independent checkers, in dealing with design management in D/B systems.

DESIGN DUTY AND LIABILITY IN DESIGN-BUILD CONTRACTS

Design Liability

Although the D/B contractor is responsible for design in D/B systems, the owner will inevitability be required to provide some design inputs. Fredrickson (1998) has suggested guidelines for determining the appropriate amount of design needed at the bidding, pricing, and construction stages of a project using D/B system. The extent of design information to be provided is an unsettled debate, which involves consideration of design liability. There is a perception within the construction industry that there are two distinct levels of liability: 'fitness for purpose' and 'reasonable skill and care'. Gaafar and Perry (1999) suggested that the legal position has been oversimplified due to the lack of legal definition of the term 'fitness for purpose'. The study warned that some existing forms of contract may not achieve the desired purpose in limiting liability and the contract parties may be misled into a false sense of security. There are still some unresolved legal issues associated with D/B system (Twomey 1989, Chan & Chan 2000). The most important practical problem encountered in a contract for D/B system is that the unavailability of insurance to cover design liability for 'fitness for purpose'.

Traditionally, a general contractor, similar to a manufacturer, is responsible for delivering a building "fit for the purpose", as the general contractor's liability is judged by the end result. For professional service including architectural/engineering design, the professionals are encouraged to explore new frontier by exercising their professional judgment with their best endeavor. Their liabilities are judged by the process and their duties are discharged with "due care and skill", not guarantee for a result. In the UK and many common law jurisdictions, the main role of a D/B contractor is comparable to that of a manufacturer and shall be responsible for delivering a building that is "fit for the purpose". This type of liability was also imposed

upon D/B contractors in Hong Kong in the first draft of the government's standard conditions for D/B contract. Upon request and protest from Hong Kong general contractors, the liability was reduced to the standard of exercising "reasonable skill and care" as that required of consultants.

Provisions in Standard Forms of Contract

It cannot be assumed the general law principles will address the complex nature of the design liability. It is necessary to state the nature of the design duty expressly in the contract conditions. The following paragraphs examine the contract conditions concerning design duty in some of the popular standard forms of construction contract:

Clause 8(2)(a) of the Institute of Civil Engineer (ICE) Design and Construct conditions of contract provides that in carrying out all his design obligations the D/B contractor shall exercise "reasonable care and diligence". In the New Engineering Contract (NEC) of the UK, where the D/B contractor undertakes design, the design is submitted to the project manager "for acceptance". Where a design duty does exist, a strict liability is imposed upon the D/B contractor, i.e. liable for "fit for purpose" (Scriven 1996). For liability less than "fit for purpose", an option clause M in the NEC may be elected which relieve the D/B contractor from liable for defects in the works due to his design as far as he proves that he has used "reasonable skill and care". Both in the ICE and NEC contracts, there is no detailed definition as to the nature of "skill and care". It is suggested the skill and care is that of a person experienced in carrying out the design and construction of projects of a similar nature to the works. The popular standard form of contract in the UK, the Joint Contract Tribunal (JCT) 1981 With Contractor's Design, defines the nature of the 'skill and care' and implies an exclusion of strict liability. The contract provides that the D/B contractor shall have in

respect of any defect or insufficiency in design the like liability to the Employer, whether under statute or otherwise, as would an architect or a professional designer. However, the FIDIC Design-Build and Turnkey Conditions 1995, an international standard form of contract, imposes a strict liability on the D/B contractor for design in Clause 5.4. In Hong Kong, the government has its own D/B contract and the design responsibility of the D/B contractor is specified in the clause 23(1), (2) and (3) of the Government Standard Conditions for Design and Build Contracts 1999 edition. The liability of the D/B contractor is limited to exercising "due care and skill" similar to that required of a professional designer.

Moreover, under the building control system of many jurisdictions, the legal responsibility of project participants in D/B systems is also an area of concern. For example, with reference to the detailed requirements in the building law in Hong Kong, the Authorised Person (an architect/surveyor/engineer registered under the Buildings Ordinance as a competent person to coordinate building works) and the Registered Contractors share many responsibilities together to comply with statutory requirements (Chan & Mok 2002). The legal responsibility of the general contractor and architect/engineer established in the building control system is based on the contractual arrangement of a project with the traditional procurement method. One of the major roles of the Authorised Person (architect/engineer), as a "statutory agent" under the buildings Ordinance, is to supervise the works of the general contractor and to check or sanction the general contractor's work for compliance with the Buildings Ordinance. In D/B system, the architect/engineer directly employed by the D/B contractor may find it difficult to discharge his statutory duties as a "statutory agent" of the Buildings Authority (HKIA 1998; Chan & Chan 1999).

The above review highlights the lack of clarity or consistency in international practice on the definition and level of design liability required of the project participants. Adding to the confusion is the differences in local building law and insurance policy for site supervision and design responsibility in projects using D/B system.

RESEARCH METHODOLOGY

A research project was carried out in Hong Kong in June 2002 to investigate various issues concerning design management in Design-build contracts that are common concerns for construction industry in many countries/economies. The construction industry of Hong Kong can be a good example with many large projects, such as the new airport and Tsing Ma Bridge, completed in recent years partly or wholly using the Design-build system. The projects are open to international competition involving major players of from all over the world working under the conditions and regulatory system of local construction industry. The results of this study with Hong Kong data may have great significance to other similar construction industry. Design management in the study means 'effective management of design process, proper allocation of design liability and cost effectiveness in design process, etc.' The present study included a questionnaire survey to collect opinions from a random sample size of about 250 construction professionals, including 50 owners, 150 designers (architects and engineers), 50 D/B contractors, who are key personnel in firms and companies known to have experience with D/B projects. The names of this sample were obtained form HKIA directory and Builder directory. Considering the size of the Hong Kong construction industry where, as an illustration, there are only about 160 architectural firms in the territory and practically all D/B contracts are public sector projects, D/B projects in Hong Kong involve a relatively focused group of construction practitioners. On this basis, the sample size is significant enough for the purposes, as long as we include most of these practitioners

in our survey. The targeted samples were requested to answer questions on the problems associated with design management in D/B projects. They were also asked to suggest contract provisions to govern the design management and to allocate design responsibilities in D/B contracts for the following parties: D/B contractors and owners, D/B contractors and designers, and, owners and independent checkers.

Based on the literature review, the relevant topics/issues are included in the questionnaire. The target samples were briefed in the questionnaire of this study that D/B projects refer to those projects that the D/B contractor is responsible for the complete design and construction. After collecting the questionnaire returns, telephone calls were made to some respondents to clarify ambiguities in their answers and the data were adjusted accordingly. 15 respondents have also indicated in their returned questionnaire willingness to be interviewed. Subsequently, structured interviews were conducted with the 15 project participants including owners, designers and builders to have detailed discussions on the preliminary findings of the questionnaire to collect qualitative data for the study. As early as the 1950s, research approaches have combined quantitative and qualitative methods (Shapiro 1955; Chan 2002). The integrated method is said to have reaped the “best of both worlds” (Csete & Albrecht 1994). In the current study, qualitative data were collected through structured interviews to support the quantitative research results of the questionnaire through “triangulation” (Jick 1979). By applying both the quantitative and qualitative methods as a triangulating strategy, the data of one research method (qualitative in this case) helps a generalization of the findings based on another research method (quantitative in this case) for the same topic.

SURVEY RESULTS AND FINDINGS

Profile of Survey Respondents

There were 42 completed and valid questionnaire sheets returned representing a response rate of 18%, which is close to normal expectation for an opinion survey. The questionnaire data was buttressed by 15 follow-up interviews with individual construction professionals who were willing to take part in the research. As the questionnaire survey results have been adjusted based on interview feedbacks, the following presents the results and findings of the survey after combining the results of both the questionnaire survey and structured interviews. The profile of survey respondents in that the majority of the respondents were D/B contractors (42%) while the owners and designers each accounted for 29% of the respondents. 90% of the respondents are senior professionals and have over five years experience in D/B systems. By running student's T-test using the SPSS software, where $t = 11.0981$, $p = 0.000$, it is statistically significant at 1% level that the respondents can represent the target populations in Hong Kong.

Extent of Design Liability Required of D/B Contractor

To what extent of design liability should a D/B contractor be responsible? From the overall result in Figure 2, although "fit for purpose" was slightly higher, the choice was not very clear. As expected, the views of designers and constructors are opposite to each other, with the constructor clearly preferred to restrict their design liability to "due care and skill". It is important to note their differing concerns on the matter. The owners were indifferent to any of the choices, because the single point of responsibility for design and construct seems to have addressed the owners' concern with the extent of design responsibility. The fact is that for most D/B projects, the D/B contracting organization is formed by independent construction company and design consultant firm to as a consortium to tackle a specific

project. The problem of design liability and design management are still major concerns among project participants. Study on the problems and solutions for design management among project participants will benefit the project owner as well. Follow-up interviews found out the fact that most of the respondents did not fully understand or realize the difference and their extent of liability in design. This support conclusion of Gaafar and Perry (1999) that design liability is not well understood by the project participants. They had to be explained during interview and Figure 2 reflects the statistics with adjustments made to the survey data after interviews.

Contractual Provisions in the Contracts between D/B Contractor and Owner

Looking at the overall results in Figure 3, most of the respondents (61% for overall), with great enthusiasm from the D/B contractors (77%), welcomed the provisions that enable the D/B contractors to offer better design and detailing after the award of contracts with some compensation as an incentive. The owner was found the best party to verify whether the D/B contractor has submitted better design concept and detailing. 47% of the participants, with owners predominantly supporting the idea, were in favour of using 2-envelops tender evaluation. This tender practice requires the tenderers to submit 2 separate envelops, with one containing the technical proposal and the other one containing the corresponding tender sum. Only the best two/three technical proposals will be considered for tender price comparison/competitiveness.

On the issues of quality and site supervision, 45% of the designers and 46% of the owners suggested including provisions, which require stringent control on the material/workmanship standards and supervision of works during construction period in the D/B contract. They were the parties who worried about the quality of work delivered by the D/B contractor, even

though the designer was working under the D/B contractor. Although independence of the designer (Architect/Engineer) carrying the role of a statutory agent was a concern under the Hong Kong building control system, only 30% of the participants suggested including provisions, which require an independent Authorized Person (AP) to carry out regular site inspections for compliance with Buildings Ordinance. This result comes to a surprise in view of the fact that in many countries such as the USA, it is a common practice to engage independent third party "checker" for D/B projects. In the structured interviews, those in favour of having an independent checker suggested that the owners should, through a separate engagement contract, directly employ the independent AP for the D/B projects.

Contractual Concerns between D/B Contractor and Designer

From the results in Figure 4, designers were concerned about the adequacy of current contract provisions in defining their design responsibility. 82% of the designers would like to have a standard form of design consultant agreement specifically developed for the local construction industry to appoint architects/engineers by the D/B contractor. The owner's group is more concerned about the extent of site inspection provided by the architect/engineer. The extent of site inspection required of an architect/engineer under a D/B contract could be different from discharging their statutory duties as the Authorized Person under the Buildings Ordinance. The owners requested site inspection responsibility of the designer to be clearly indicated in their appointment agreement with the D/B contractor.

Who should be responsible for design management? From the results of Figure 5, more than 40% of the respondents suggested that the party to be responsible for the overall design management of the project should be specified in the D/B contract. 13 out of 15 interviewees agreed that the D/B contractor was the best party to be responsible for the overall design

management process. It is because from the risk point of view, the D/B contractor has the responsibility and incentive for the overall coordinate of the construction process. He knows when the information is required to suit his construction schedule and he has the best knowledge of material and labor cost. This new role of design management poses the biggest challenge to D/B contractors, as most of the constructors were not trained to design or to manage the design process. This problem was acknowledged in the interviews with D/B contractors in Hong Kong who generally do not have training in the design process or adequate experience in design management, but they believe that given the responsibility, experience would be accumulated after managing a few D/B projects.

Contractual Provisions in the Contracts between Owner and Independent Checker

In Figure 6, more than 60% of all the respondents, with the majority from the owner group, agreed that the independent checkers should be liable for his comments/instructions given to the designers. 46% of the D/B contractor's group viewed that the independent checker should share the design responsibility with the project architect/engineer. 72% of the designer group and 47% of the D/B contractor's group suggested the independent checker should be an independent Authorized Person/Registered Structural Engineer in the role of a statutory agent to ensure compliance with the building law. The two groups with their respective responsibilities under building laws worried about the conflict in their roles under the commercial contract and duties required by statute. Generally, the issue on the fee of independent checkers was not a matter of major concern for all groups.

RECOMMENDATIONS

The following summarizes the key recommendations derived from the findings of the survey and interviews. The recommendations encapsulate the contract strategy and key parameters to be adopted in drafting various contracts between project participants to address design management in D/B projects.

Appropriate Contract to Address Design Liability of all Project Participants

In D/B contracts, the project participants have to adopt the changed roles and responsibilities. Site supervision and statutory responsibilities among project participants are the grey areas that need clarification for each local construction industry. The project participants should have a better understanding on their legal exposure in design liability, but have to concede that it is a difficult topic to master. The study results emphasize that the roles and responsibilities of the parties involved in design and design management should be clearly specified in the respective contracts between project participants to avoid misunderstanding and dispute. Although international standard forms of contract, such as the NEC and FIDIC, are available, they only provide the overall framework and general provisions to address the issues and is mainly between the owner and the D/B contractor. Models of liability with appropriately drafted clauses, which reflect the local practice and prevailing legal and insurance contexts, should be provided for the local standard forms of construction contracts and consultants' appointment agreements.

Contract between Owner and D/B contractor

Use 2-envelops tender evaluation

The major drawback of D/B procurement system is that many D/B contractors' heavy resources are wasted in tender stage to prepare a Contractor's Proposal. The owner also has

to spend on evaluating the tenders submitted by the list of D/B contractors. It is recommended that 2-envelops tender evaluation should always be used, where only the best two/three design proposals will be considered for further tendering on price comparison/competitiveness. The 2-envelopes process is that each tenderer submit a technical proposal (first envelope) and a financial bid (second envelope) simultaneously. Only those companies who are assessed as technically competent will then be considered on the financial bids. Tender award decision is based on the overall score from the technical and financial bids, each bearing different weighting according to the project nature.

Agreement between D/B Contractor and Architect/Engineer

New standard Design Consultant Agreement

It is not acceptable to modify a traditional architect/engineer standard appointment agreement for D/B contractors to appoint an architect/engineer. For each local construction industry, a new standard consultant agreement for the appointment of architects/engineers in D/B projects should be developed, with due reference to the international standard forms such as the NEC and FIDIC, but with specific considerations given to reflect the prevailing concept of design liability, local building controls, and the local legal and insurance contexts.

Party responsible for overall design management

Traditionally, the lead designer (architect/engineer) manages the design process. In D/B systems, the D/B contractor is responsible to the owner for the overall delivery of design and construction. The management of design process affects the design responsibility among participants and influences the project success. It is necessary for D/B contractors to acquire design management skills in order to communicate effectively with his design consultants. The study concluded that the D/B contractor is the best party for the leading role in the design

management of D/B projects. This is not because the D/B contractor is better qualified but it reflects the reality of risk allocation in the minds of project participants. The D/B contractor is financially at stake to deliver the project successfully and has the most resource in terms of manpower, cost and equipment to manage the construction process. He knows when the information is required to suit his construction schedule and he has the best knowledge of material and labour cost. With such risk and responsibility, it is imperative that D/B contractor should invest on training personnel to be competent on design management. Contractually, no matter who is responsible for the overall design management, the responsible person, be it the project manager, the designer or constructor of the project, should be specified in the D/B contract and the corresponding consultant appointment agreements to ensure that those managing the process are liable for their instructions.

Contract between Owner and Independent Checkers

Liability for Comment/Instruction on Design

The independent checkers shall be liable for their comments/instructions given to the designers. Independent checkers should share the design responsibility with the designers and constructors. The extent of his design liability should be summed up in a warranty to the owner with the fee commensurate to his liability. As for the contract between owner and independent checker, it was suggested that the independent checker's fee shall be allowed in the contract sum and the independent checker is paid only upon the owner's satisfaction/instruction.

Independent Checker to Address Statutory Compliance

The role and design liability of an independent checker vary according to the terms in the D/B contracts and the owner's appointment agreement, which define his design liability

under the contract and building codes. The role of a designer (architect/engineer) on site inspection is also ambiguous in D/B projects. His site supervision role under the consultant appointment agreement and the D/B contract may have a conflict with his duty to comply with statutory requirements under the local building control law. In view of such complication, it is recommended that the independent checker should be directly employed by the owner instead of by the D/B contractor as an independent agent to ensure compliance with all the requirements under the local building law, including design standards and site inspection. The share and demarcation of design responsibilities between independent checkers and designers shall be properly addressed in their respective appointment agreements with the owners. In fact, the appointment of an independent third party is a common practice in D/B projects in the USA. Each local construction industry may have different sets of building law and control framework. It is a matter of giving due reference to similar international practice but clearly address the local building control to avoid ambiguity and misunderstanding.

CONCLUSIONS

There may be literature about contractual analysis of D/B project procurement, but study focusing on the contractual issues of design management is very limited. This paper presents the part of a study, which investigates all the issues relating to design management in D/B systems. Although the line of design liability between the owner and the D/B contractor is straightforward, the issues of design management and liability are more complicated and are matters of concern for many other project participants. The study has reviewed the contractual issues in literature and identified the appropriate contractual strategies, which have then been verified through statistical analyses of survey and qualitative analyses of

structural interviews. In view of the local differences with regard to legal and insurance contexts for design liability, a set of key parameters are recommended as guidance for preparing a well coordinated set of construction contracts and corresponding consultant appointment agreements to address design management in D/B systems.

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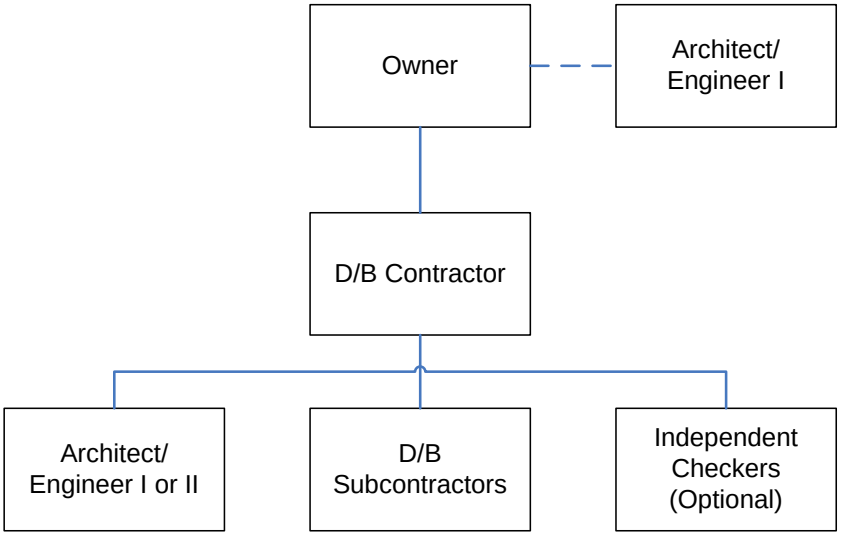

Figure 1 Typical contractual arrangement of D/B procurement system in Hong Kong

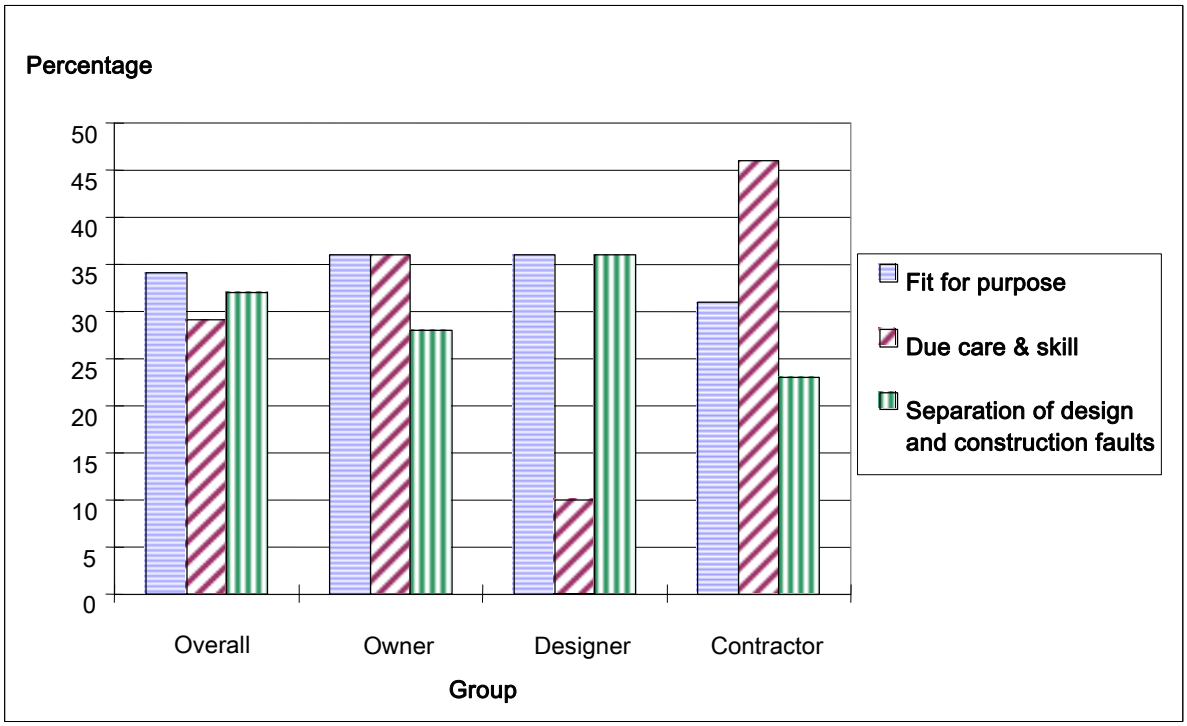

Figure 2 Extent of Design Liability of D/B Contractor

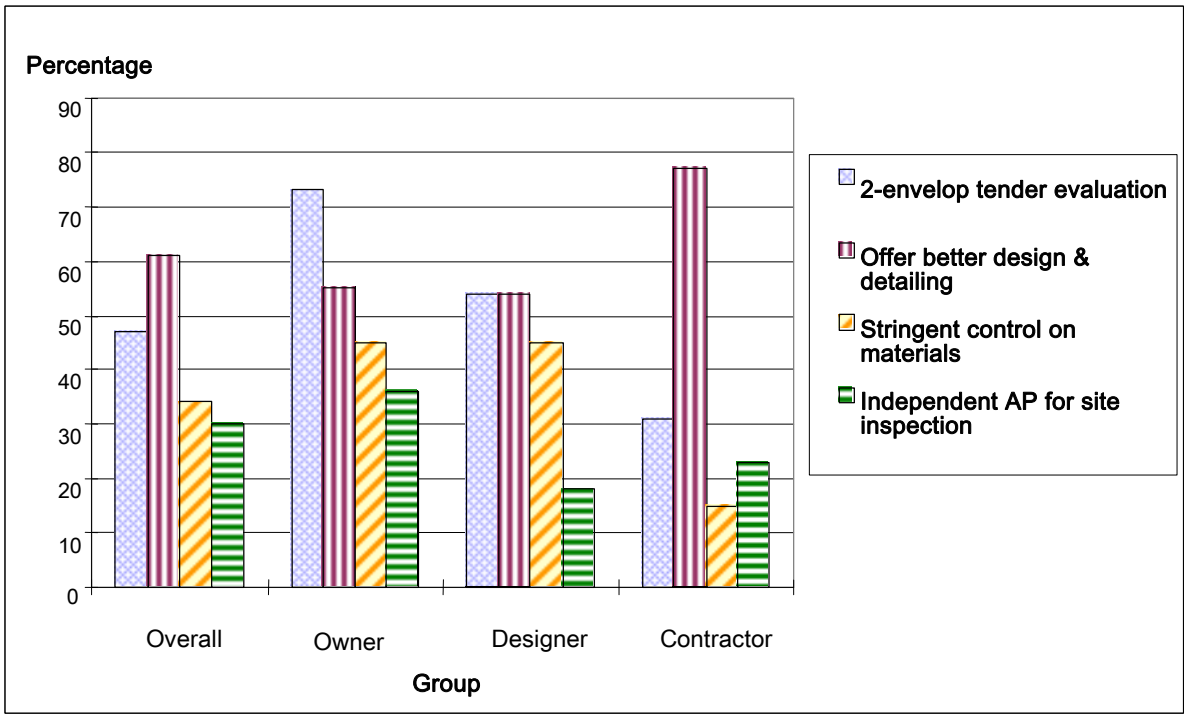

Figure 3 Contractual provisions to be included in the contracts between the D/B contractor and Owner to improve design management process in D/B projects

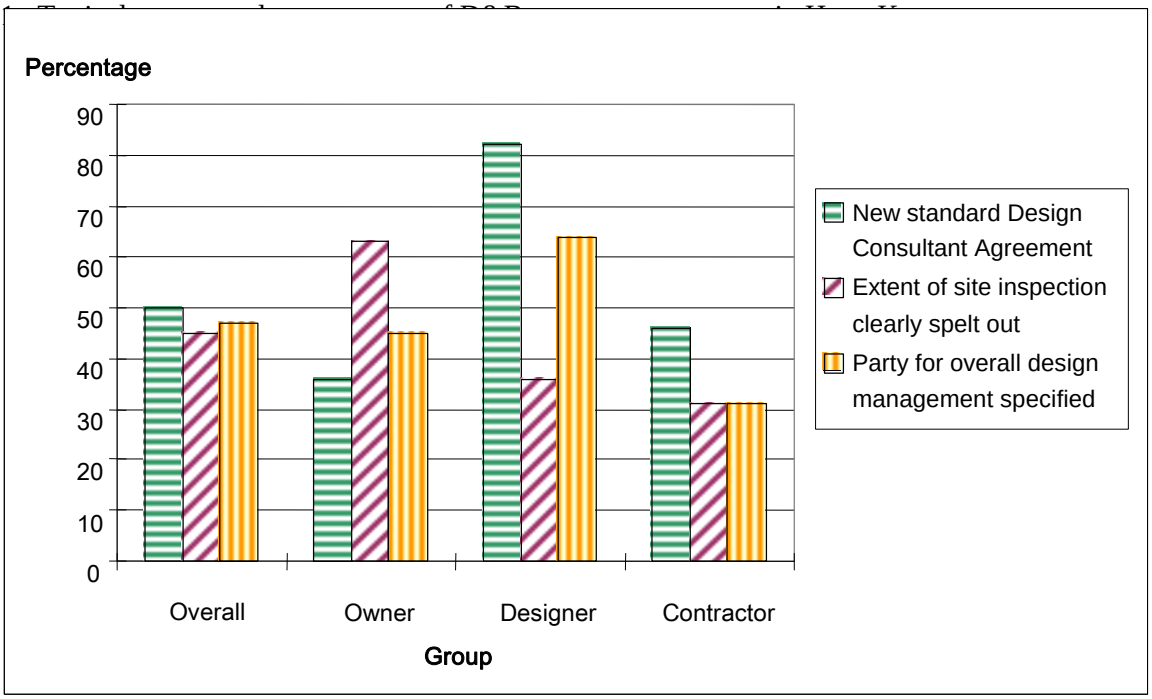

Figure 4 Contractual concerns in the Agreement between the D/B contractor and the Designer (architect/engineer)

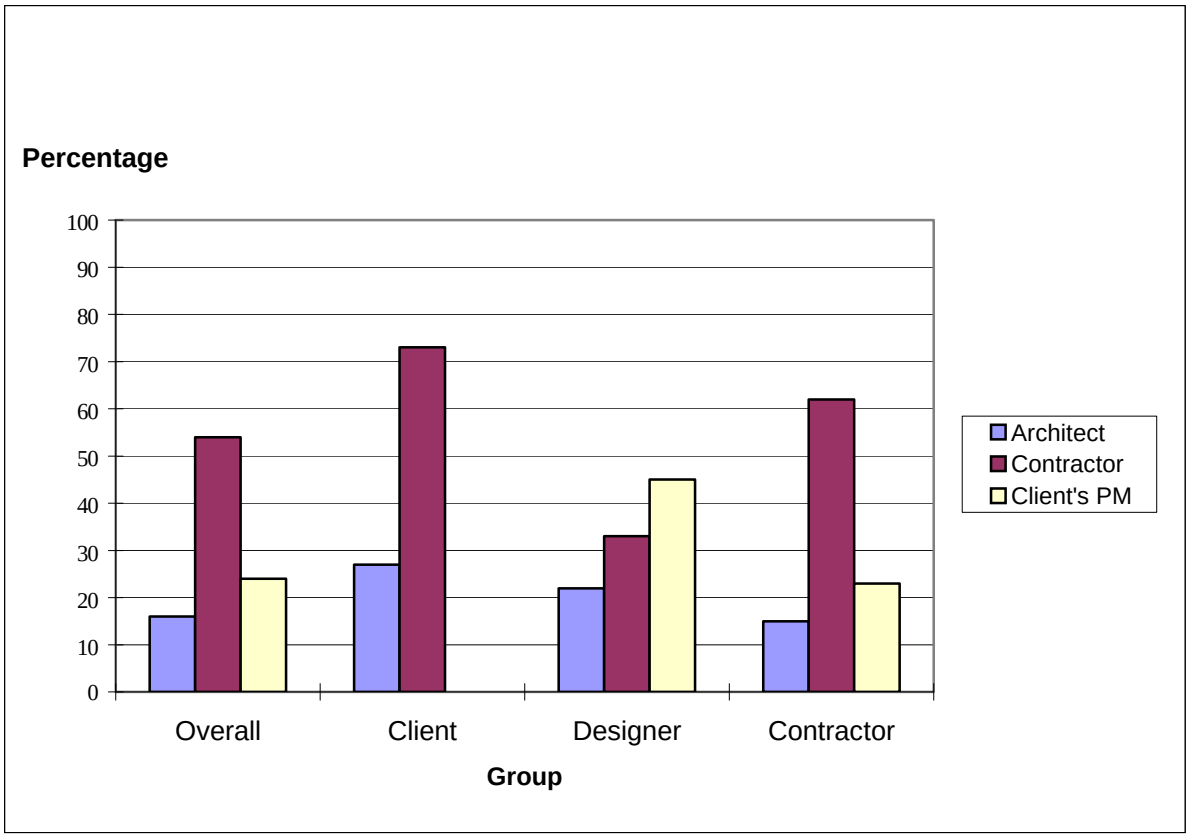

Figure 5 Who is the best party to be responsible for overall design management process?

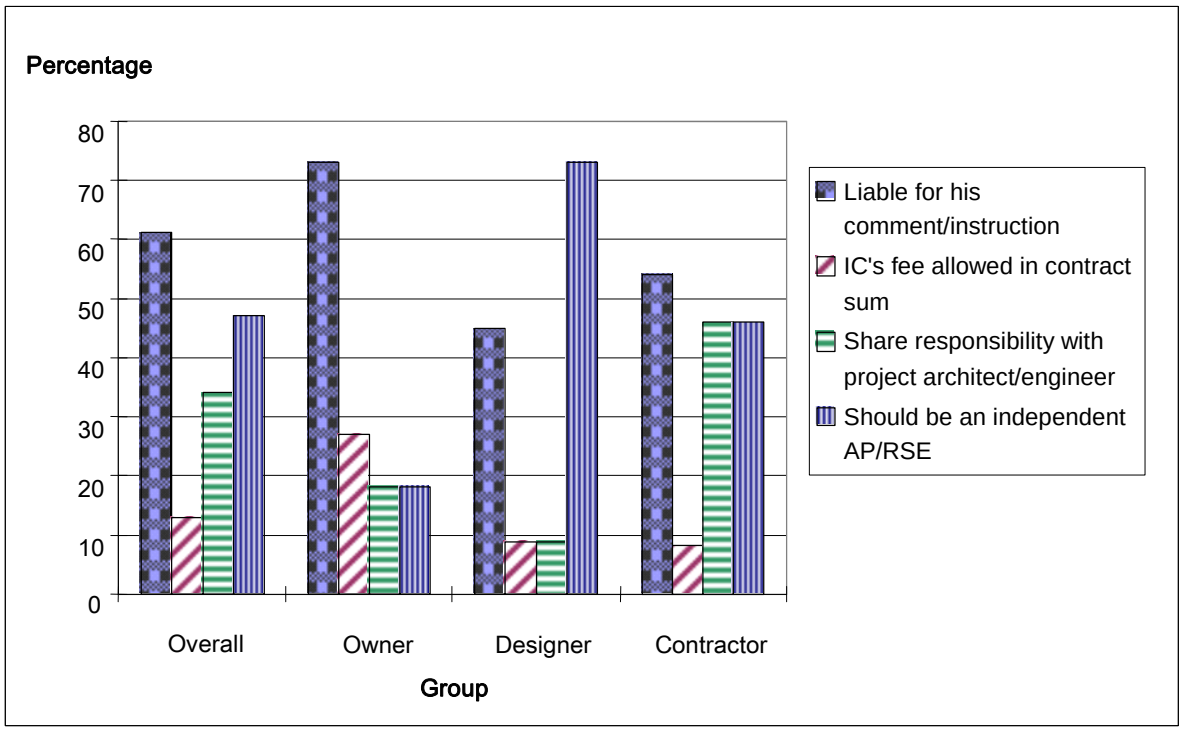

Figure 6 Contractual provisions to be included in the contracts between Owner and independent checker to improve design management process in D/B projects