

Specialty Contractors' Perspectives on Risk Importance and Allocation of Design-Build Contracts

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Use of Design-Build contracts, as project delivery system, has increased significantly in both public and private sectors in the U.S. However, this project delivery turns out to be a risky system for both owners and contractors unless the risks are properly identified, analyzed, and managed throughout the bid preparation and project execution stages. Appropriate identification, allocation, management and mitigation of project risks are essential for the success of any projects including design-build projects. The objective of this study is to allocate the design-build contract risks between the owner and the contractors based on questionnaire survey of eighty large U.S. mechanical and electrical contractors. The findings of the study revealed that a total of eight risks should be allocated to the owner. Remaining risk should be allocated either to contractors or shared. This study will help Construction Management educators who will be benefited from the understanding of effective allocation and importance of risks in design-build contracts.

Key words: Risk allocation, Owner, Design-build contract, Risk importance, Project delivery systems, Specialty contractors

Introduction

Design-build contracting is a project delivery system where the owner awards a single contract to a single entity to perform both design and construction. It provides various advantages through entailing the contractor carrying out and being responsible for both design and construction of the project. Contractually, design-build offers the owner a single point of responsibility for design and construction services (Konchar and Sanvido, 1998). All phases of a project from planning, conceptual and preliminary design, detailed design, and procurement through construction to operation are sole responsibility of the design-build contractor. Portions of the overall design or construction work can be performed by the design-build entity or subcontracted out to other companies that may or may not be part of the design-build team. Two studies involving over 600 design-build projects in the building sector showed benefits of a 30% increase in project delivery speed and 6% reduction in unit cost over the design-bid-build method of project delivery (Bennett et al. 1996; CII 1998).

The architecture, engineering, and construction industry has seen significant change in terms of project delivery systems over the past decades (Molenaar 2003; Saller 2003). However, substantial efforts by owners to downsize in-house project management manpower, costly dispute between design and construction parties, and various levels of owner experience have forced several owners toward single source design/build contracting (Dell'Isola 1987). The use of design-build has seen a dramatic increase, as indicated by growth in the private sector market share and evolution of federal, state, and local laws that now specifically authorize design-build delivery (Charles 1996; Forest 1997; Molenaar et al. 1999; Grogan 2000; Tulacz 2000). In 1996 design-build was recognized for use in over half of the 50 U.S. states and accounted for over 24% of the \$286 billion of nonresidential construction put in place ("Discussion" 1996; Tarricone 1996; Forest 1997).

The construction industry is one of the most dynamic, risky, challenging, and rewarding industries. Risk inherent in every construction project, is normally assumed by the owners unless it is transferred to or assumed by another party for fair compensation. The principal guideline in determining whether a risk should be transferred or retained, depends on the competency of the receiving party to fairly assess the risk and the expertise necessary to control or minimize it (Kangari et al. 1995). This paper identifies the risks in design-build contracts from specialty contractor's perspective of the U.S. construction industry and examines the importance of the different risk categories. The purpose of this paper is to suggest the allocation of risks towards the project partners and explain the importance of those for better management and control.

Banik (2002) stated that a total of eight design-build project risks should be allocated to the contractor, ranging from constructability of design (100%) to labor disputes (67%) whereas two risks should be allocated as share risks which ranged about 72% in favor of sharing the risk of financial failure of any party, to 71% for permits and approvals based on the general contractor perspectives. From the findings of the survey the author concluded that three risks should be allocated to the owner, which is site access (81%), differing site condition (71%) and catastrophe (81%).

Research Methodology

The research methodology was an internet-based questionnaire survey. The information on the perception of the specialty contractors regarding risks in design-build contract was collected. The survey was comprised of two sections. The first intended to provide insight into the current attitudes of U.S. specialty contractors for risk allocation, and the second examines the importance of different risk categories. The questionnaire was divided into four sections – company profile, respondent profile, project profile and risk allocation and distribution profile. The company profile was based on the type and size of the company in respect to number of permanent employees, annual revenue and type of construction involved. The respondent profile was designed to collect information about the involvement of the respondents' in the design-build contracts. The project profile was structured to determine the type of construction (residential/ commercial/ heavy civil/industrial). The risk allocation and distribution profile was administered to the respondents to identify and allocate the risks in design-build contract. The questionnaire was sent to the top 80 mechanical and electrical contractors in U.S. listed in Mechanical Contracting Association of America (MCAA) and National Electrical Contracting Association (NECA). Twenty responses were received within the stipulated time.

Company Profile

Figures 1-3 illustrate company profile composed type of project, annual revenue, and number of employees. Among the respondent companies 75% were involved in design-build projects as mechanical and electrical subcontractors. Since survey information was collected from MCAA and NECA, all the respondents are well-established companies in construction. 22.2% of the respondents had annual revenue of \$1M-\$4M and 44.4% of the respondents had annual revenue of \$5M-\$10M. The respondent company's annual revenue ranges from \$1M-\$29M. Of the responses 40.0% of the works were industrial constructions, 33.3% of the works were commercial constructions and 6.67% were heavy engineering constructions and 20.0% others.

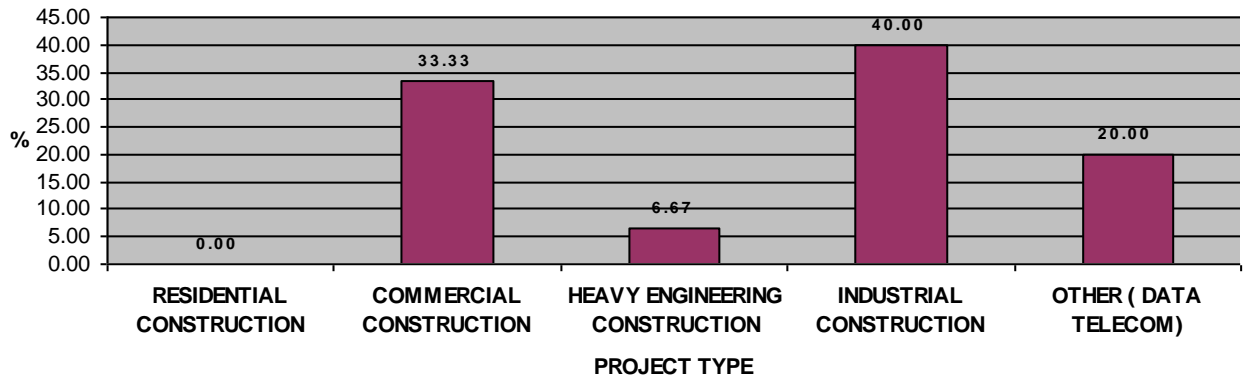


Figure 1: Type of project

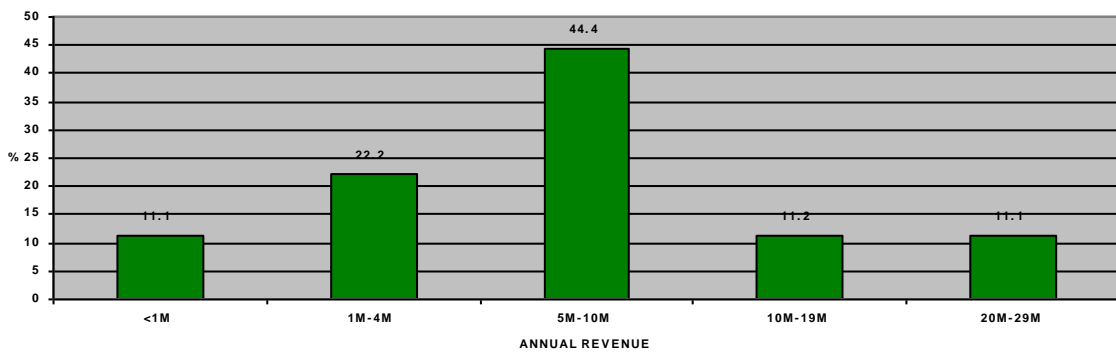


Figure 2: Annual Revenue

Data Analysis

Table 1 presents the twenty-six risk descriptions from the questionnaire, selected from previous studies (Banik, 2002, Kangari, 1995, ASCE, 1979). Because of the limitation of the size of questionnaire, some of the questions were combined into single question. The responses to each question were divided into two groups: risk allocation and risk importance. The respondent was to indicate, in general, how risks should be allocated or shared by the owner and the design-build contractor. “Owner” represents the majority of risk going to the owner, “Contractor” represents the majority of risk going to the contractor, and “Shared” represents a sharing of the risk (Column 2-4 of Table 1) between the owner and the contractor.

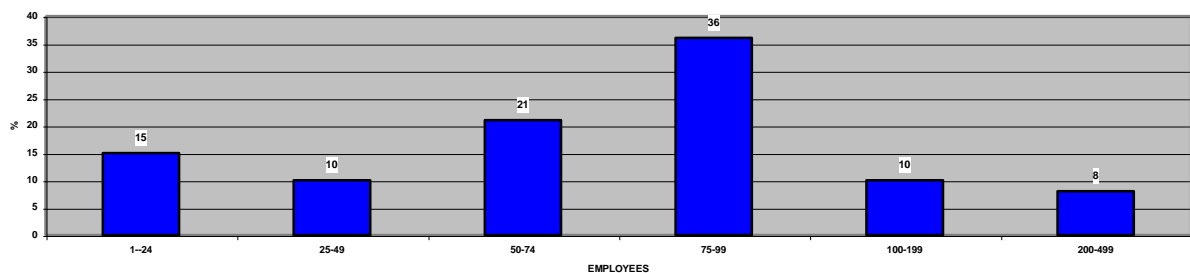


Figure 3: Employees Profile

“Risk Importance” in the questionnaire illustrates the identification of the risks as well as relative importance to each other. The questionnaire was developed to determine the relative importance of each risk category from mechanical and electrical contractor’s point of view on a 1-10 scale (column 5 of Table 1). Although the importance varies from project to project, the question will elicit a general assessment of the importance of risk. Low importance is accorded a value of 1 while the greatest importance is accorded a score of 10. The range of 1 to 3 denotes low risks that are of least important, 4 to 7 denotes medium importance, and 8 to 10 denotes high-risk categories.

Results

The survey results are summarized in Table 1. Responses to the questionnaire yielded two sets of results: risk allocation and risk importance.

Risk Allocation

The finding from the survey can be categorized as—allocation of risk to the owner, allocation of risk to the contractor or sharing of the risk. The risks most favored by the specialty subcontractors are highlighted in Table 2. These risks are listed in the order of responses for the allocation method.

According to the survey, a total of eight design-build construction project risks should be allocated to the owner of which site access/right of way obtained a response rate of 100%. These risks range from 100% to 67%, changes in work, Govt. Acts and Regulations and Acts of God. The survey result illustrates that nine risks among the twenty-six risks should be allocated to the D-B contractors. Four risk of the nine risks had 100% response rate that are defective materials, quality of work, safety and accidents, and contractor competence while defective designs and defensive engineering has response rate of 67%. The findings from the survey reveal that contract delay resolution, indemnification and hold harmless and financial failure-any party are overwhelmingly favored risk factors shared by both the owner and design-build contractor having response rate of 100%. Four risks had been undecided which couldn’t be allocated to the owner or contractor or shared according to the criteria. These undecided risks had less than 60% response rate in all categories, which means the risks were evenly distributed.

Risk Importance

The most important and least important risk categories are shown in Table 3 which was developed based on the data in column 8 to column 10 of Table 1. For a scale of one to ten, the standard deviations are relatively high varying from lowest 1.00 to highest 3.00, thus showing an industry wide lack of consensus for scaling of risk categories. According to the survey, the most important risk factors in design-build construction project are defective design (9.0), changes in work (9.0), differing site condition (cost plus basis) (9.0), delayed payment in contract (9.0). The second most important risks followed by the specialty contractors are unidentified utilities (7.60), defective materials (7.25), financial failure-any party (7.25), weather condition (6.66) and safety and accidents (6.38). On the contrary, the risk categories deemed least important ranged from 2.0 for Acts of God to 2.88 for Govt. Acts and Regulations.

Table 1: Summary of Risk Allocation and Importance

| RISK DESCRIPTION | RISK ALLOCATION, % | | | IMP. ON A SCALE OF (1-10) | | IMP. (%) | | |
|---|--------------------|----------------|-------|---------------------------|-----------|----------|-----|------|
| | OWNER | D-B CONTRACTOR | SHARE | AVG. | STD. DEV. | LOW | MED | HIGH |
| 1 | 2 | 3 | 4 | 5 | 7 | 8 | 9 | 10 |
| PERMITS AND ORDINANCES | 79 | 0 | 21 | 4.35 | 1.67 | 33 | 67 | 0 |
| SITE ACCESS/RIGHT OF WAY | 100 | 0 | 0 | 5.5 | 2 | 0 | 100 | 0 |
| DEFECTIVE DESIGN | 17 | 67 | 17 | 9 | 3 | 0 | 0 | 100 |
| CHANGES IN WORK | 67 | 0 | 33 | 9 | 3 | 0 | 0 | 100 |
| DIFFERING SITE CONDITION (COST PLUS BASIS CONTRACT) | 83 | 17 | 0 | 9 | 3 | 0 | 0 | 100 |
| DEFECTIVE MATERIALS | 0 | 100 | 0 | 7.25 | 2.5 | 0 | 50 | 50 |
| LABOR DISPUTES | 0 | 74 | 26 | 3.02 | 1.29 | 71 | 29 | 0 |
| CHANGE-ORDER-NEGOTIATIONS | 23 | 10 | 67 | 4.87 | 1.82 | 18 | 82 | 0 |
| THIRD- PARTY DELAYS | 15 | 20 | 65 | 4.35 | 1.67 | 33 | 67 | 0 |
| CONTRACT-DELAY RESOLUTION | 0 | 0 | 100 | 4.07 | 1.59 | 41 | 59 | 0 |
| DELAYED PAYMENT ON CONTRACT | 83 | 0 | 17 | 9 | 3 | 0 | 0 | 100 |
| INDEMNIFICATION AND HOLD HARMLESS | 0 | 0 | 100 | 4.35 | 1.67 | 33 | 67 | 0 |
| FINANCIAL FAILURE-ANY PARTY | 0 | 0 | 100 | 7.25 | 2.5 | 0 | 50 | 50 |
| DEFENSIVE ENGINEERING | 33 | 67 | 0 | 5.5 | 2 | 0 | 100 | 0 |
| WEATHER CONDITIONS | 33 | 17 | 50 | 6.66 | 2.33 | 0 | 67 | 33 |
| UNIDENTIFIED UTILITIES | 72 | 23 | 5 | 7.6 | 2.6 | 0 | 40 | 60 |
| ESTABLISHMENT OF A PROJECT COSTS | 8 | 80 | 12 | 5.5 | 2 | 25 | 50 | 25 |
| REDESIGN IF OVERBUDGETS | 12 | 33 | 55 | 5.5 | 2 | 0 | 100 | 0 |
| GOVT. ACTS AND REGULATIONS AND TAX RATE CHANGE | 67 | 17 | 17 | 2.88 | 1.25 | 75 | 25 | 0 |
| ENVIRONMENTAL RISKS | 33 | 17 | 50 | 5.5 | 2 | 25 | 50 | 25 |
| INFLATION | 33 | 33 | 33 | 3.75 | 1.5 | 50 | 50 | 0 |
| ACTS OF GOD | 67 | 0 | 33 | 2 | 1 | 100 | 0 | 0 |
| ACTUAL QUANTITIES OF WORK | 17 | 83 | 0 | 5.68 | 2.05 | 25 | 45 | 30 |
| QUALITY OF WORK | 0 | 100 | 0 | 5.5 | 2 | 0 | 100 | 0 |
| SAFETY AND ACCIDENTS | 0 | 100 | 0 | 6.38 | 2.25 | 0 | 75 | 25 |
| CONTRACTOR COMPETENCE | 0 | 100 | 0 | 4.35 | 1.67 | 33 | 67 | 0 |

Summary

The important findings of this survey are briefly summarized below. The contractor's current attitude toward the risks in design-build contract and importance as well as trend for the future are briefly reviewed.

Table 2: Risk allocation

| RISK ALLOCATION | RISK DESCRIPTION |
|-----------------|--|
| OWNER | SITE ACCESS/RIGHT OF WAY |
| | DIFFERING SITE CONDITION |
| | DELAYED PAYMENT ON CONTRACT |
| | PERMITS AND ORDINANCES |
| | UNIDENTIFIED UTILITIES |
| | CHANGES IN WORK |
| | ACTS OF GOD |
| | GOVT. ACTS AND REGULATIONS AND TAX RATE CHANGE |
| SHARED | CONTRACT-DELAY RESOLUTION |
| | INDEMNIFICATION AND HOLD HARMLESS |
| | FINANCIAL FAILURE-ANY PARTY |
| | THIRD- PARTY DELAYS |
| | CHANGE-ORDER-NEGOTIATIONS |
| D-B CONTRACTOR | DEFECTIVE MATERIALS |
| | ACTUAL QUANTITIES OF WORK |
| | QUALITY OF WORK |
| | SAFETY AND ACCIDENTS |
| | CONTRACTOR COMPETENCE |
| | ESTABLISHMENT OF A PROJECT COSTS |
| | LABOR DISPUTES |
| | DEFECTIVE DESIGN |
| | DEFENSIVE ENGINEERING |
| | WEATHER CONDITIONS |
| UNDECIDED | ENVIRONMENTAL RISKS |
| | INFLATION |
| | REDESIGN IF OVERBUDGETS |
| | |

Table 3: High, Medium and Low risk Categories

| LEVEL OF IMPORTANCE | RISK DESCRIPTION | |
|----------------------------------|--|---------------------------|
| MOST IMPORTANT | DEFECTIVE DESIGN | |
| | CHANGES IN WORK | |
| | DIFFERING SITE CONDITION | |
| | DELAYED PAYMENT ON CONTRACT | |
| | UNIDENTIFIED UTILITIES | |
| | DEFECTIVE MATERIALS | |
| | FINANCIAL FAILURE-ANY PARTY | |
| | MEDIUM IMPORTANT | ACTUAL QUANTITIES OF WORK |
| | | WEATHER CONDITIONS |
| | | SAFETY AND ACCIDENTS |
| SITE ACCESS/RIGHT OF WAY | | |
| DEFENSIVE ENGINEERING | | |
| ESTABLISHMENT OF A PROJECT COSTS | | |
| REDESIGN IF OVERBUDGETS | | |
| ENVIRONMENTAL RISKS | | |
| QUALITY OF WORK | | |
| CHANGE-ORDER-NEGOTIATIONS | | |
| LEAST IMPORTANT | PERMITS AND ORDINANCES | |
| | THIR- PARTY DELAYS | |
| | INDEMNIFICATION AND HOLD HARMLESS | |
| | CONTRACTOR COMPETENCE | |
| | CONTRACT-DELAY RESOLUTION | |
| | INFLATION | |
| | LABOR DISPUTES | |
| | GOVT. ACTS AND REGULATIONS AND TAX RATE CHANGE | |
| | ACTS OF GOD | |
| | | |

Permits and ordinances

The results of this survey indicate that the owner should be responsible for this risk. It also reveals that this risk is of medium importance (average 4.35) for the design-build contracts. In the traditional contracts this risk is generally allocated to the owner.

Site Access/Right of Way

The subcontractor's perception is that this is an owner's risk (100%), which is very similar to traditional contracts. The results indicated this risk as mid-level importance.

Differing Site Condition

The results overwhelmingly assigned the owner responsibility for this risk as in traditional contract. In many contracts the owner attempts to shift the risk including contract clauses. To shift the risk to the contractor, the clause must specifically disclaim the site condition that is at issue. Otherwise, the contractor should be able to recover the cost of such additional works and if materially differing site conditions are discovered after the contract is signed and before the work has commenced. The importance of this risk is one of the highest-level risks on a scale 1-10 (average 9.0).

Acts of God

The survey revealed that the risk should be owner's sole responsibility and the owner should assume the majority of the risk. This type of condition is beyond the control and without the fault or negligence of the contractor. Acts of God entitles the contractor to an extension of contract performance time, not to a contract price adjustment. The risk is determined to be of little importance.

Delayed Payment on Contract

According to the survey results owner assumes this risk. If the owner fails to pay due amounts to the design-build contractor within the contract time (which is usually payable within 30 days after the submission), then the owner shall assume the risk of bearing the interest due to delayed payment in accordance with the Payment Act. However, the owner shall not be liable for delayed payment on contract due to any discrepancy in quantities or failure to provide supporting documentation or other information required with the request for payment or as a precondition to payment under the Contract Documents, or due to any payment owner has a right to withhold or not certify under the Contract Documents. This risk considered being highly important by the specialty contractors (avg. 9.0).

Unidentified Utilities

The survey results reveal that this risk is owner's responsibility. The risks inherent in the unidentified utilities tend to owner's responsibility for the payment for unidentified utilities. The owner assumes the risk in the design-build contract for identifying the existing utilities in detail through continuous coordination with all utility companies and shall be liable for payment for such unidentified utilities according to the contract provisions. This type of risk can be reduced by clearly allocating responsibilities to perform the relocations of the utility work. The risk is considered to be the second most important risk.

Changes in Work

The survey shows the owner to be responsible for this risk and perceptions are not expected to be change. The specialty contractors rank this risk as the highest-level risk.

Contract Delay Resolution

The results denote this risk as a shared risk. The trend has shown an increase in the number of contractors who favor a risk sharing approach for the solution of problems of this type. Specialty contractors assign medium importance to this risk.

Indemnification and Hold Harmless

The results illustrate that this risk is considered to be a shared risk as like as traditional contracts. Respondents ranked this risk as a medium risk.

Financial Failure--Any Party

Survey results show this risk to be a shared one (100%). The specialty contractors considered this risk to be the second most important one. This type of risk, like inflation and tax rate change, is a result of economic conditions beyond the control of owner and the contractor.

Third-Party Delay

The responses show that this risk should be a shared risk. The specialty contractors rate this risk as medium important. The increased involvement of attorneys by the larger contractors reduces the importance of this risk and allows them to take part in negotiations/dispute resolution proceedings.

Defective Materials

This risk was found to be contractor's responsibility (100%). The contractor's are in the best position to handle this risk. This risk is considered to be one of the second most important risks by the specialty contractors.

Actual Quantities of Work

The survey responses assigned this risk to the contractors (83%). The level of importance is medium. The trend shows that the contractor will remain in favor of assuming this risk because they should be professional enough to determine accurate quantities.

Quality of Work

The survey shows that this risk is overwhelmingly favored by the specialty contractors in favor of design-build contractors (100%). Contractors are fully responsible to assure the overall quality of a construction project. Although this risk ranked medium important, contractors are expected to consider this risk as an important that is theirs alone to handle. The greater responsibilities and accountabilities implicit in the design-build contracts serve as motivation for high quality and proper performance of design-build process. Once the owner's requirements and expectations are documented in terms of programs and performances, it becomes the design-builders responsibility to produce a facility that meets those criteria.

Safety and Accidents

The survey reveals that contractors must assume this critically important risk. This risk is ranked as second most important risk. Contractors are expected to believe that they have and will continue to have sole responsibility (100%) for this risk. The design professional controls the opportunity of securing contractual indemnity from subcontractors for claims due to injuries suffered by their workers acting as a design-builder.

Labor Disputes

The results firmly assign the risk to the contractors, which are expected to continue as such. If the labor disputes anticipate at the time of contracting, it is obvious that the contractor assumes the risk in the contract provision. Avoiding labor disputes the D-B contractor shall be able to minimize project cost by delivering faster design-build project. However, this risk has lower importance, especially in the USA.

Defective Design

Survey indicates that the contractor must assume this risk (67%). The conventional wisdom consistently allocates this risk, the third most important, to the owner, and its importance remains high, especially for contractors working for a lump sum or unit price contract.

Defensive Engineering

This risk factor is for the proximity of construction undertakings to existing structures, which requires time and money to protect the existing structure. This question was designed to find out which party should be held responsible if the attempts at protection, or defensive engineering, fail and the existing structure is damaged in some way. The survey result reveals that this risk should be contractor's responsibility (67%). The importance of this risk was considered to be medium.

Weather Condition

From the survey responses it is obvious that weather condition in a design-build construction project risk is an undecided one. The specialty contractors ranked it as medium importance.

Environmental Risks

The result indicates that the environmental risk is an undecided one (50%) although in the traditional contracts it is the owner's responsibilities.

Establishment of Project Costs

The survey results reveal that establishment of costs is the contractor's responsibility (80%). The subcontractors view this risk as of medium importance.

Redesign if Overbudget

According to the survey results it is not possible to decide which party shall bear the responsibility of cost overruns. Redesign of a project is required if the original project is too expensive and not within the allocated budget, which could take from days to weeks to months. In the design-build contract both designer and D-B contractor participate in the Owner's needs and requirements discussion for a project where the D-B contractor will be the dominant team member. Therefore, it can be said that, the D-B contractor is responsible for the preliminary evaluations of the budget, which includes contractor's detailed assumptions as to labor, material and equipment. The survey responses ranked this type of risk as of medium importance.

Conclusion

Mechanical and electrical subcontractor's attitudes toward owner's risks regarding allocation and importance of risk in design-build contracts are presented. The subcontractors have allocated eight risks to the owner from the assigned twenty-six design-build risks and five risks as shared responsibility between owner and contractor. They have given priority to the defective design, changes in work, differing site condition and delayed payment to the contract based on importance, three of which are considered as owner's responsibilities. The trend shows that contractors have been more willing to assume risks that accompany contractual and legal problems in the form of risk sharing with the owner. Risks of this type include change-order negotiations, third party delays, contract delay resolutions, and indemnification and hold harmless. Nevertheless, the findings from the survey illustrate that the risks allocated to the owner are expected to be consistently owner's responsibility overwhelmingly favored by the electrical and mechanical subcontractors.

Attitudes toward risks that are determined by economic conditions were also discussed. These risks pertain to inflation rate and financial failure. The lower the inflation rate, the more risks a contractor is willing to assume. However, during periods in which a higher number of business failure occur, the contractor is less willing to assume risk, and thus allocate more responsibility to the owner.

The allocation and importance of design build risk is very similar to the previous study (Banik, 2002) although this study is based on electrical-mechanical subcontractor rather than general contractors' input.

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