RISK MANAGEMENT PERCEPTIONS AND TRENDS OF U.S. CONSTRUCTION

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ABSTRACT: This paper discusses the current attitude of large U.S. construction firms toward risk, and determines how these contractors conduct construction risk management. The paper is based on a survey of the top 100 large U.S. contractors. After discussion of the current views, the results are compared with a risk survey conducted by ASCE. The study shows that in recent years, 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. The survey also found that contractors currently assume the risk associated with actual quantities of work, a notable difference from the findings of the ASCE survey. Finally, the attitude of contractors toward the practice of defensive engineering is determined. This is significant, as no previous survey has addressed or sought to quantify allocation or importance of this task.

INTRODUCTION

Risk management is an important part of the decision-making process in a construction company. Risk can affect productivity, performance, quality, and budget of a construction project. Risk in a construction project, however, can not be eliminated, but it can be minimized or transferred from one party to another. Some important questions that will be addressed in this paper are as follows: should these risks be shared? and if so, in what proportion and by whom? what are the trends in risk allocation? and what is the current view of risk in the industry?

The construction industry is one of the most dynamic, risky, challenging, and rewarding fields. 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 is whether the receiving party has both the competence to fairly assess the risk and the expertise necessary to control or minimize it.

The objective of this paper is to present the perception of the typical large U.S. contractor towards construction risk based on a survey conducted of the top 100 construction contractors. The results of this survey should further clarify the current perceptions of contractors regarding construction contracts and the current circumstances in the industry.

The data collected from these questionnaires is compared to data collected from a similar survey conducted in 1979 by the American Society of Civil Engineers (ASCE) ("Construction" 1979). The purpose of this comparison is to identify any trends in construction risk that will facilitate risk management. The goal is to further improve understanding of construction risks as perceived by large U.S. contractors in 1993, and compare them to the perception in 1979 in an attempt to project trends in construction risk management. The issues that concern the U.S. contractor are not new; however, certain issues have become more critical important as the construction industry has become increasingly litigious. A thorough understanding of current attitudes and trends will aid contractors in risk management.

The survey on which this paper is based is comprised of two sections. The first is intended to provide insight into the current attitudes of U.S. contractors for construction risk allocation, and the second examines the importance of different risk categories. By carefully studying these results, an understanding will be gained of the current situation in the construction industry from a contractor's viewpoint. This also allows a comparison with prior studies on risk management conducted by Erikson (1979), Bullock (1989), Ammiano (1988), Knise (1988), Burtch (1979), Casey (1979), McKim (1992), Lifson (1982), Smith et al. (1991), Nocharli and Haynes (1991), and Malpas (1990).

PRESENTATION OF QUESTIONNAIRE

The questionnaire utilized by this survey is based on the survey conducted by ASCE ("Construction" 1979) during a conference on construction risk and liability sharing held in Scottsdale, Ariz. in January 1979. The purpose of the survey was concerned with the identification and allocation of risk. The survey also investigated contractual arrangements and minimizing risks (i.e., mitigating losses). These additional topics will be covered in a future survey. The goal of the questionnaire were twofold: to obtain as much relative information as possible and to ensure the greatest possible participation by keeping the questionnaire short enough so as not to lose the contractors' interest.

The surveys were sent out to the top 100 U.S. contractors based on the list identified by the *ENR*'s top 400 contractors list ("Top" 1992). A total of 49 responses were received from the mailing of 100 questionnaires.

COMMENTS ON QUESTIONNAIRE

Column 1 of Table 1 presents the 23 risk descriptions from the questionnaire, which were in no particular order. The design of the questionnaire limited the size to one page, so some of the questions on the ASCE survey were combined into one question. Most questions are similar to the ASCE questions, while a fraction are the consolidation of two or more questions.

The only question that has no counterpart in the ASCE survey is Defensive Engineering. The proximity of some construction undertakings to existing structures may require 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 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 contractor and the owner. "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 (columns 2–4 of Table 1).

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TABLE 1. Summary of Risk Allocation and Importance

Risk description (1)	Risk Allocation: Owner (2)	Shared (3)	Contractor (4)	Importance—average on a scale of 1–10 (5)	Standard deviation (6)	Importance: Low 1–3 (7)	Mid 4–7 (8)	High 8–10 (9)
Permits and ordinances	81%	13%	6%	4.7	3.0	42%	32%	26%
Site access/right of way	83%	15%	2%	5.6	3.0	30%	38%	32%
Labor, equipment, and material availability	2%	10%	88%	6.4	2.6	13%	35%	52%
Labor and equipment productivity	2%	0%	98%	7.6	2.6	10%	21%	69%
Defective design	83%	9%	8%	8.0	2.2	4%	24%	72%
Changes in work	77%	21%	2%	6.9	2.4	9%	40%	51%
Differing site conditions (lump-sum contract)	94%	6%	0%	6.9	2.5	15%	32%	53%
Acts of God	58%	40%	2%	4.4	2.5	38%	48%	14%
Defective materials	2%	20%	78%	5.1	2.7	31%	47%	22%
Changes in government regulations (lump sum)	79%	19%	2%	4.1	2.7	51%	34%	15%
Labor disputes	2%	28%	70%	5.5	2.5	28%	40%	32%
Safety	0%	19%	81%	8.3	2.1	4%	25%	71%
Inflation (lump-sum or unit-price contracts)	6%	24%	70%	4.7	1.9	25%	69%	6%
Contractor competence	15%	14%	71%	7.5	2.5	11%	26%	63%
Change-order negotiations	9%	87%	4%	6.4	3.3	9%	56%	35%
Third-party delays	40%	53%	7%	6.2	2.2	11%	59%	30%
Contract-delay resolution	23%	73%	4%	6.8	2.3	8%	46%	46%
Delayed payment on contract	79%	15%	6%	7.5	2.5	8%	33%	59%
Quality of work	0%	10%	90%	8.2	2.2	6%	15%	79%
Indemnification and hold harmless	8%	79%	13%	6.5	2.4	13%	51%	36%
Financial failure—any party	4%	89%	7%	7.3	2.6	13%	34%	53%
Actual quantities of work	19%	11%	70%	5.8	2.5	21%	45%	34%
Defensive engineering	35%	54%	11%	4.6	1.8	25%	67%	8%

TABLE 2. Summary of ASCE Identification of Risk and Risk Allocation (Construction Risks and Liability 1979)

Risk description (1)	Importance: Not very (2)	Important (3)	Very (4)	Risk Allocation: Owner (5)	25 (6)	50 (7)	75 (8)	Contractor (9)
Permits and ordinances	33%	30%	37%	74%	—	22%	—	4%
Delayed site access or right of way	29%	33%	38%	100%	—	—	—	—
Availability of labor, material, and equipment	12%	48%	40%	4%	4%	4%	9%	79%
Productivity of labor	10%	31%	59%	—	—	—	4%	96%
Productivity of equipment	42%	40%	18%	—	—	—	—	100%
Defective design	25%	40%	35%	100%	—	—	—	—
Changes in work	17%	42%	41%	74%	13%	13%	—	—
Subsurface conditions:	—	—	—	—	—	—	—	—
Geology	8%	26%	66%	61%	4%	31%	—	4%
Ground water	9%	47%	44%	56%	4%	31%	—	9%
Acts of God	40%	49%	11%	78%	—	17%	—	5%
Suitability, availability, and accessibility of materials	36%	44%	20%	13%	—	22%	13%	52%
Government acts, regulations, and tax-rate changes[a]	64%	29%	7%	—	—	—	—	—
Government acts and regulations	—	—	—	70%	—	26%	—	4%
Tax-rate changes	—	—	—	70%	—	22%	—	8%
Labor disputes	17%	51%	32%	—	—	14%	14%	72%
Accidents/Safety	48%	40%	12%	—	—	4%	9%	87%
Inflation	6%	19%	75%	17%	22%	52%	—	9%
Contractor competence	7%	42%	51%	—	—	9%	—	91%
Change-order negotiations	16%	38%	46%	39%	—	61%	—	—
Environmental	15%	30%	55%	83%	4%	9%	—	4%
Public disorder	45%	48%	7%	86%	5%	9%	—	—
Delayed dispute resolution	9%	31%	60%	52%	9%	39%	—	—
Delayed payment on contract and extras	17%	36%	47%	87%	4%	9%	—	—
Mistakes/defective work	30%	50%	20%	4%	—	9%	—	87%
Indemnification and hold harmless	27%	32%	41%	71%	—	24%	—	5%
Owner, contractor, subcontractor, supplier failure	25%	52%	23%	—	—	45%	15%	40%
Actual quantities of work	53%	38%	9%	62%	4%	26%	4%	4%

[a]Divided for purposes of risk allocation.

Although there are exceptions in every situation, the allocation responses represent the average.

The identification of risk was included in the questionnaire under the heading of "importance," (column 5 of Table 1). The question was designed to determine the relative importance of each risk category from a contractor's viewpoint. Although 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 risk that is not important, 4 to 7 denotes important risk categories, and 8 to 10 denotes very important risk categories.

The results of this survey are summarized in Table 1. The findings from the ASCE survey are displayed in Table 2 (note that the ASCE questionnaire summary report displayed the risk allocation results in totals and by profession; this allowed the extraction of contractor responses).

SURVEY RESULTS

Allocation of Risk

The responses to the survey can be placed into the following categories: allocation of the risk to the contractor, allocation of risk to the owner, or a sharing of the risk. The risk factors in which the respondents overwhelmingly favored using these methods are highlighted in Table 3.

These risks are listed in the order of responses for the allocation method. For example, as shown in Table 1, labor and equipment productivity had 98% responses in favor of the contractor assuming the risk, while labor disputes had 70%. For a risk to be fully appropriated to an allocation method, it requires at least a 70% response rate.

According to the survey, a total of seven construction risks should be allocated to the owner, ranging from differing site conditions with a 94% to changes in work with a 77% response rate as shown in Table 1. Responses in favor of sharing the risk ranged from 89% in favor of sharing the risk of financial failure of any party, to 73% for contract delay resolution risk. Only three questions pertaining to risk allocation had mixed results. A majority of their responses to these three questions were within the range of risk sharing to allocation to the owner.

TABLE 3. Risk Allocation

Risk allocation (1)	Risk description (2)
Contractor	Labor and equipment productivity
	Quality of work
	Labor, equipment, and material availability
	Safety
	Defective material
	Contractor competence
	Inflation
	Actual quantities of work
	Labor disputes
Owner	Differing site conditions
	Defective design
	Site access/right of way
	Permits and ordinances
	Changes in government regulations
	Delayed payment on contract
	Changes in work
Shared	Financial failure—any party
	Change-order negotiations
	Indemnification and hold harmless
	Contract-delay resolution
Undecided	Acts of God
	Third-party delays
	Defensive engineering

TABLE 4. Most and Least Important Risk Categories

Level of importance (1)	Risk description (2)
Most important	Safety
	Quality of work
	Defective design
	Labor and equipment productivity
	(tie) Contractor competence/delayed payment
Least important	Changes in government regulations
	Acts of God
	Defensive engineering
	(tie) Permits and ordinances/inflation

Importance of Risk

The five most/least important risk categories are shown in Table 4. For a scale of one to ten, the standard deviations are relatively high, thus showing an industrywide lack of consensus for scaling of risk categories. Some companies have probably been hindered by some risks more often than others, and thereby place more importance on ensuring that problems of the same type don't recur. As illustrated in column 5 of Table 1, the risk categories deemed most important ranged from 8.3 for safety to 7.5 for both contractor competence and delayed payment on contract. The risk categories deemed least important ranged from 4.1 for changes in government regulations to 4.7 for inflation, and permits and ordinances.

ASCE VERSUS PROPOSED SURVEYS

Risk Allocation

The ASCE survey found that contractors were less willing to accept, or even share risk, preferring that the owner accept responsibility for construction risk. The findings of the present paper, however, show that contractors are more willing to accept and share risk. Similarities of responses to risk allocation in both surveys will be discussed first, followed by the differences.

The first risk allocation category that will be discussed concerns the construction risks that are agreed to be solely the responsibility of the contractor, as found in both surveys. The most overwhelming agreed upon risk subject dealt with the productivity of labor and equipment. The responses in both surveys recorded near 98% in favor of the contractor assuming this risk. The remainder of the contractor risks had responses in favor of at least 70% that the contractor be the party to assume the risk.

Responses to the ASCE survey designated 10 risk categories, two of which were designated unanimously, as the sole responsibility of the owner, while responses to this survey designated only seven. Of these seven factors, only one—differing site conditions—was not designated in the ASCE survey, which showed a large majority of contractors responding that this risk should be shared.

Responses to the two surveys showed marked differences in opinion regarding third-party delays, acts of God, indemnification, and actual quantities of work. In the ASCE survey, 62% of respondents considered actual quantities of work the risk of the owner whereas respondents to the current survey considered this risk as belonging to the contractor. Unlike the ASCE survey, in which indemnification is the sole risk of the owner, this survey designated it as a shared risk. Similarly, third-party delays and acts of God have shifted from owner responsibility to somewhere between shared and owner responsibility. In all these four risk categories, allocation of

TABLE 5. Risk Allocation Shift Towards Owner and Contractor

Risk allocation shift (1)	Risk description (2)
Toward owner	Differing site conditions
	Financial failure—any party
Toward contractor	Acts of God
	Defective materials
	Inflation
	Change-order negotiations
	Third-party delays
	Contract-delay resolutions
	Indemnification and hold harmless
	Actual quantities of work

TABLE 6. Comparison of Risk Importance

Risk description (1)	Level of Risk Importance	
	ASCE survey (2)	Present survey (3)
Permits and ordinances	High	Low
Site access/right of way	High	Mid
Labor, equipment, and material availability	Mid	High
Labor and equipment productivity	High	High
Defective design	Mid	High
Changes in work	Mid	High
Differing site conditions	High	High
Acts of God	Mid	Mid
Defective materials	Mid	Mid
Changes in government regulations	Low	Low
Labor disputes	Mid	Mid
Safety	Low	High
Inflation	High	Mid
Contractor competence	High	High
Change-order negotiations	High	Mid
Third-party delays	Mid	Mid
Contract-delay resolution	High	Mid/High
Delayed payment on contract	High	High
Quality of work	Mid	High
Indemnification and hold harmless	High	Mid
Financial failure—any party	Mid	High
Actual quantities of work	Low	Mid

TABLE 7. Shifts to Higher and Lower Importance

Risk shifts (1)	Risk description (2)
Higher importance	Safety
	Labor, equipment, and material availability
	Defective design
	Changes in work
	Quality of work
	Financial failure—any party
	Actual quantities of work
Lower importance	Permits and ordinances
	Site access/right of way
	Inflation
	Change-order negotiations
	Contract-delay resolution
	Indemnification and hold harmless

responsibility is shifting away from the owner toward the contractor. Neither survey agreed that any one risk should be a shared responsibility. However, the ASCE survey designated inflation as a shared risk whereas this survey considered it a contractor risk.

The study also shows that the attitude of the respondents had shifted towards owner and contractor for the 10 risk categories highlighted in Table 5. This shift has been mainly toward the contractors assuming responsibility by a margin of eight to two. This shows that contractors believe that they are more capable of handling risk in all but two of the eight risk categories, in which the shift was in favor of the owner assuming more responsibility.

The survey revealed that contractors have, in recent years been more willing to become involved in dispute resolution. This is evidenced by the allocation shift in change order negotiations, third-party delays, contract delay resolution, and indemnification and hold harmless. The shift towards contractors regarding the risk of Inflation probably has a great deal to do with the change in the inflation rate. The risks regarding acts of God and defective materials have decreased, as they can now be covered by insurance.

The risks in which allocation has shifted towards the owner are those that are more difficult for the contractor to control or protect himself from. For example, extensive differing site conditions or a defaulting party can ruin a contractor who is trying to perform under a lump-sum contract.

Importance of Risk

The overall comparison, shown in Table 6, illustrates the following ranges of responses: 1–3 is low (not very important), 4–7 is mid (important), and 8–10 is high (very important). The results show that nine risk categories remained in the same range, while seven categories shifted to a higher range, and six fell to a lower range. The construction risks that experienced shifts in importance are summarized in Table 7.

Four of the risks that shifted to greater importance are ones that the contractors have allocated to themselves, two have been allocated to the owners, and only one, financial failure, is a risk that was designated as shared. Safety experienced the greatest shift towards importance, from a rating of low on the ASCE survey to a rating of high on this survey. Permits and ordinances experienced the greatest shift away from importance, as it was designated an owner risk. Contract delay resolution experienced a slight shift, from a rating of high importance, to a rating of between high and mid importance.

ANALYSIS OF TRENDS

As a result of the findings discussed thus far, this section examines the trends that are occurring in the area of construction risk management. The construction risks that have consistently been allocated to either the owner or the contractor are reviewed. In both surveys, eight of the 23 risks received consistent responses in allocation. The risks that are consistently allocated to the contractor and the owner are listed in Table 8.

The first three risks listed in Table 8 are those that contractors consistently favor assuming. Not only did contractors overwhelmingly designate them as their responsibilities, in both surveys, but current writings by contractors and academics also support this position. For the first two risks, this view is supported in papers written by the Steering Committee ("Executive Summary" 1979), as part of the ASCE survey;

TABLE 8. Risks Consistently Allocated to Contractors or Owners

Risks consistently allocated (1)	Risk description (2)
Contractor	Labor, equipment, and material availability
	Labor and equipment productivity
	Quality of work
Owner	Permits and ordinances
	Site access/right of way
	Defective design
	Changes in work
	Changes in government regulation

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Bullock (1989); and Casey (1979). Quality of work is acknowledged as a contractor risk by Erikson (1979), Casey (1979), and Knise (1988). No dissenting views were uncovered for any of these risks. Therefore, it is expected that contractors will continue to consider the construction risks resulting from quality of work; labor, material, and equipment availability; and labor and equipment productivity their responsibilities.

The last five risks are those that contractors consistently allocate to the owner. Again, no dissenting opinions were found. The Steering Committee (Executive Summary 1979) agreed that all of these risks should be shouldered by the owner, and concurring views can be found in the writings of Bullock (1989), Casey (1979), Nocharli (1991), and Smith et al. (1991). Erikson (1979) described changes in government regulation as an "uncontrollable risk." Thus, he made no attempt to allocate risk in this situation; however, the remainder of the risks were allocated to the owner.

All of the construction risks presented thus far have been identified as possessing a trend of consistency. Contractors have perceived these risks as belonging to either themselves or owners and no changes have been recognized for these attitudes.

The balance of the construction risks examined by the present paper were found to possess differing views and shifts in allocation. Highlights of the views are reviewed in Table 9. The allocation column contains symbols that refer to authors who have a concurring views with respective responses. The ASCE survey is denoted by "A" and the present survey is denoted by "S." The purpose of Table 9 is to allow the reader to quickly inspect the views of selected authors as illustrated by the symbols in the table.

If the surveys contain stronger views for one type of risk allocation, the symbol will double. For example, if the contractors responding to this survey had strong views in both the owner assuming the major portion of a risk and the risk being shared, the corresponding symbol "S-S" would occur in column 3 (owner and contractor), between owner and shared allocation. The following section attempts to explain the shift in attitudes about risk responsibilities.

Contractor competence is conceded industrywide as a risk to be borne by the contractor. The dissenting view that is shown in Table 9 was recorded by Erikson (1979). The same attitude was found for delayed payment on contract, that it is the responsibility of the owner, except in Erikson (1979).

Soil testing equipment, such as the dilatometer, which became available commercially in the United States has become more sophisticated in recent years (Kulhawy and Mayne 1990). With this technology, the owner can conduct a more thorough examination of subsurface conditions. In addition, contractors believe that owners should utilize a differing site condition contract clause similar to the one found in the Federal Acquisition Regulation (Bullock 1989). These factors transfer the risk of differing site conditions from the contractor to owner.

Recent economic conditions also tend to force a certain attitude toward risk. As a result of recessions, the number of business failures generally increases. Such situations can explain the desire to share the risk of financial failure and inflation. As the probability of failure increases, contractors understandably prefer to share this uncontrollable risk, thereby limiting vulnerability. However, as inflation has been decreasing, so has the threat of this risk; therefore, the contractor is more willing to assume this risk.

Many large construction firms today retain lawyers or maintain them in their home office. Thus, they feel more confident to engage in negotiations. The resulting trend is that contractors are likely to consider change order negotiations and contract delay resolution as well as indemnification as construction risks that are suitable to be shared. Although they may take on more financial responsibility, they are in a position to expedite resolution of legal matters. The same attitude certainly carry over to the risk associated with third-party delays as well.

The use of insurance has also increased, which can explain why contractors are more willing to assume certain risks. Contractors of today can adequately insure themselves from uncontrollable risks, such as defective materials and defensive engineering. For the same reason, the risks involving acts of God were easier for the contractor to handle. The view in that respect still contains some owner allocation, since a time extension is usually required.

The risks that accompany safety and labor disputes are overwhelming considered to be contractor responsibility. Only one conflicting opinion was located for each category. The lone views can not be considered to accurately reflect the current status of contractor feelings. Therefore, this study shows that, in the past, contractors have felt that these risks should be assumed by them, and that same attitude persists today.

TABLE 9. Allocation Views of Selected Authors

Risk description (1)	Allocation of Risk: Owner (2)	Owner and contractor (3)	Shared (4)	Contractor and owner (5)	Contractor (6)
Differing site conditions	2, 3, 5, 7, S	A-A	—	—	—
Acts of God	A	S-S	—	—	—
Defective materials	—	—	—	A-A	2, S
Labor disputes	4	—	—	—	5, 7, A, S
Safety	—	—	2	—	1, 4, 5, 6, A, S
Inflation	4	—	7, A	—	S
Contractor competence	—	—	5	—	2, A, S
Change-order negotiations	—	A-A	3, 5, S	—	—
Third-party delays	2, 4, A	S-S	—	—	—
Contract-delay resolution	—	A-A, 7-7	5, S	—	—
Delayed payment on contract	2, 7, A, S	5-5	—	—	—
Indemnification and hold harmless	5, A	—	S	—	—
Financial failure—any party	—	—	4, S	A-A	—
Actual quantities of work	—	A-A	—	—	S
Defensive engineering	—	S-S	5	—	6

Note: A = ASCE survey; S = Survey by this paper; 1 = Ammiano (1988); 2 = Burtch (1979); 3 = Bullock (1989); 4 = Casey (1979); 5 = Erikson (1979); 6 = Knise (1988); 7 = Executive Summary (1979); and double symbol = stronger views for one type of risk allocation.

The shift in opinion surrounding actual quantities of work has been dramatic. The ASCE survey found the allocation to be located between the owner and shared, while the respondents in this assigned risk to the contractor. This represents a trend in the attitudes of contractors to assume more of the risk for the quantities of work in the bidding process as well as in the submitting of in-progress work payment schedules. This attitude is important in the performance of a lump-sum contract, since the price is based on a certain amount of work. On the other hand, this survey found that changes in work and change-order negotiations are felt to be owner risks, thereby representing a trend in which contractors are not as concerned with obtaining payment for a change in the work. Therefore, by taking the responsibility for submitting in-progress payments, they are not as concerned about receiving payments.

The risk that underwent the larger shift towards greater importance was the safety. This is due to the fact that contractors are more concerned about the welfare of workers whose livelihood is construction. The risks involved labor, material and equipment availability, quality of work, and actual quantities of work, have all been allocated to the contractor as well. As allocation to the contractor increases, so will, the importance accorded to the risk.

The recessionary period that the country has been experiencing could account for the trend toward greater importance accorded to financial failure risk. More firms are currently failing, thereby causing greater concern. As the economy of country improves, the importance of this risk will likely decrease.

When a contractor is performing under a lump-sum contract, a defective design or owner changes could seriously affect the contractor. This is a view to greater importance that can be explained by only having contractors relate to the importance on this survey, rather than incorporating a broad spectrum from the construction industry as a whole.

In summary, certain construction risks have always been and will probably continue to be considered the domain of either the contractor or the owner, as presented in Table 8. The only trend for these risks is that they will always be considered allocated to one of the two parties.

Other risks that are consistently allocated are safety and labor disputes, and contractor competence. Since contractors are better able to control these risks or take action to curtail or prevent their occurrences, they consistently allocate these risks to themselves. The trend of these construction risk suggests that they will remain in the hands of the contractor. Actual quantities of work and defective materials have shifted from the owner to the contractor, and the writer believes that this trend will continue.

The trend is for contractual/legal matters to be shared risks, in light of contractors' current practice of retaining or maintaining legal personnel on their payrolls. This covers the risks of change-order negotiations, third-party delays, contract delays resolution, and indemnification and hold harmless.

The risks concerning the economic condition of the country will always be in a state of flux. In the near future, therefore, it is predicted that the views of contractors concerning inflation and financial failure will remain the same. As the country pulls out of the recession, the allocation of risk will shift toward the contractor; as the inflation rate begins to climb, the allocation will revert back to a sharing mode. Differing site conditions and delayed payment on contract risks will continue to favor the owners, as they are in the most favorable position to assume the burden of this risk.

Finally, the trend is for acts of God and defensive engineering to be shared risks. They are for the most part uncontrollable, but they can be adequately covered by insurance. However, some risk will still be allocated to the owner since contractors will be in need of a time extension so that liquidated damages will not be incurred.

SUMMARY

The important findings of this survey are briefly summarized below. The current attitude toward allocation and importance of the risk as well as the trend for the future are briefly reviewed for each risk.

Permits and Ordinances

The results of this survey indicate that the owner should be responsible for this risk. Contractors do not think of this risk as important. The relative importance placed it as fifth to the last. This risk has been consistently allocated to the owner and will continue to do so.

Site Access/Right of Way

The current view of contractors is that this risk needs to be delegated to the owner. The constant view of contractors is that this is an owner risk, so the allocation of risk shifting is not foreseen. This is a risk which the results indicated a mid-level importance.

Labor, Equipment, and Material Availability

The results indicated that this risk belongs to the contractor. The prevailing attitude always allocates availability to the contractor, and that allocation is expected to remain constant. The importance of this risk places it in the upper middle range.

Labor and Equipment Productivity

Productivity is the risk that scored the highest in allocation to the contractor, and this view presents itself as being a constant. The importance to contractors positions itself as the third greatest risk.

Defective Design

Survey indicates that the owner must assume this risk. 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.

Changes in Work

The survey shows the owner to be responsible for this risk, and attitudes are not expected to change. This risk ranked in the upper mid range.

Differing Site Conditions

The results overwhelming assigned the owner responsible for this risk, in contrast to the attitude expressed by the contractors in the ASCE survey. The trend toward having the owner assume more of the risk is expected to continue. The importance was fairly high, and this is an attitude that has remained constant.

Acts of God

The survey revealed that this risk should be either a shared or owner responsibility. The attitude the owner should assume the majority of the risk has softened, perhaps with the more widespread use of insurance. The tendency to allocate

risk somewhere between owner and shared responsibility will continue. This risk was determined to be of little importance.

Defective Materials

Although of relatively minor importance, this risk was found to be the responsibility of the contractor. The trend concerning allocation has shifted toward the contractors. Since they are most certainly in the best position to handle this risk.

Changes in Government Regulation

Results of the survey find that owners best handle this risk. The risk was found to have the lowest importance. This risk is expected to remain that of the owner.

Labor Disputes

The results assign contractors responsible for this risk, and it is expected to continue as such. However, its importance only lies in the mid range.

Safety

The survey shows that contractors must assume this critically important risk. Assigning it the highest importance rating, contractors believe that they have and will continue to have sole responsibility for this risk in the future.

Inflation

The survey shows that this risk depends on the economic condition of the country. As the inflation rate increases, the owner tends to assume more of the risk and the importance rating soars; as the inflation rate decreases, the contractors are more willing to assume the risk and the importance decreases. Currently, the inflation rate is low, so contractors are more willing to accept the risk that accompanies it.

Contractor Competence

The survey shows that contractors have traditionally assumed this risk, as evidenced in both surveys. Contractors are expected to continue to assume responsibility for their competence and ranked the risk as having low importance.

Change-Order Negotiations

The survey indicates a shift from owner to shared risk. It is expected to remain a shared risk, the level of importance being in the upper mid range.

Third-Party Delays

The results denote a shift from owner to shared risk. The increased employment of lawyers by the larger contractors reduces the importance of this risk and allows them to take part in a negotiation/dispute resolution proceedings.

Contract Delay Resolution

The results again denote a shift from owner to shared risk. The trend is expected to show an increase in the number of contractors who favor a risk sharing approach for the solution of problems of this type. Contractors assign high importance to this risk.

Delayed Payment on Contract

The results indicate that owners assume this risk, and that they will continue to do so. This risk is considered to be important by contractors, as it ranked fifth in relative importance.

Quality of Work

The survey show that contractors consistently assign this task to themselves. They also rank it extremely high in importance, second only to safety. The trend concerning quality is clear: contractors are expected to consider this an important risk that is theirs alone to handle.

Indemnification and Hold Harmless

The results show this risk to be considered a shared responsibility. Not unlike other categories that fall under a heading of contractual/legal, contractors have changed from allocating this risk to the owner to considering it a shared risk, and it is expected to remain shared in the future. Respondents placed this risk in the upper half of all risks in level of importance.

Financial Failure—Any Party

The survey shows that this risk, like inflation, is a result of economic conditions. While in a recessionary period, the importance increases and the contractor desires a risk sharing approach, in a period with a strong economy, the importance declines and the contractor is much more willing to accept the risk that accompanies financial failure.

Actual Quantities of Work

The survey shows total shift in attitude, with the ASCE survey assigning this risk to the owner, while this survey assigned it to the contractor. This trend will persist, that contractors will remain in favor of assuming this risk. The importance also rose slightly.

Defensive Engineering

The survey indicates that this risk is best shared; however, determining a trend for this risk is difficult since no previous survey have addressed this task. The importance of this task was considered to be low, and there is a general consensus among contractors as to it's unimportance, as the standard deviation was the lowest of the survey.

CONCLUSIONS

Current views of contractors regarding allocation and importance of risk were presented. An analysis of trends for the future of risk management was also presented. The most consistent attitudes concerning allocation of construction risk were presented in Table 8. Attitudes toward risk allocation that have shifted were also presented in this survey. In recent years, 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 delays resolutions, and indemnification and hold harmless.

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

The survey also found that contractors currently assume the risk associated with actual quantities of work, a notable difference from the findings of the ASCE survey. The risks associated with acts of God were also found to have shifted

towards the contractor, although not nearly to such an extent. Finally, the attitude of contractors toward the practice of defensive engineering was determined. This is significant, as no previous survey has addressed or sought to quantify allocation or importance of this task.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future studies that relate the views of contractors to risk management need to be conducted. The studies should focus specifically on the topics of contractual/legal and economics as these risks are among the most volatile, and subject to change. Shifts in risk allocation and importance of financial failure should be checked under a differing set of economic conditions. Contractual and legal risk attitudes should also be reexamined periodically to determine their current status.

Certain risks might not need to be examined in such detail, such as the ones listed in Table 8, as well as differing site conditions, labor disputes, safety, contractor competence, and delayed payment on contract. These risks were consistently allocated to the contractor and owner in both surveys and all literature sources, with the exception of one dissenting opinion. Therefore, it is expected that these risk allocations will remain the same unless wide-scale changes take place in the construction industry.

Three risk attitudes should be reexamined in future studies: acts of God, which underwent a slight shift of allocation to the contractor, should be reexamined to determine if this risk is still in a state of flux; actual quantities of work should undergo similar reexamination; and defensive engineering, examined for the first time, needs to be reexamined to determine a trend.

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