

**TABLE 10. Summary of Risk Importance: Author Sample versus Discussor Sample**

Risk description (1)	Difference in averages (2)	Author Sample		Discussor Sample				
		Average (3)	Standard deviation (4)	Average (5)	Standard deviation (6)	Low (1-3) (%) (7)	Medium (4-7) (%) (8)	High (8-10) (%) (9)
Permits and ordinances	-0.7	4.7	3.0	4.0	3.0	50	38	12
Delayed site access/right of way	-0.9	5.6	3.0	4.8	3.6	62	—	38
Labor, equipment, and material availability	—	6.4	2.6	6.4	2.3	13	62	25
Labor and equipment productivity	-0.7	7.6	2.6	6.9	2.3	13	25	62
Defective design	-2.3	8.0	2.2	5.8	3.4	25	37	38
Changes in work	-0.4	6.9	2.4	6.5	1.7	—	87	13
Differing site conditions (lump-sum contract)	-0.9	6.9	2.5	6.0	2.4	13	62	25
Acts of God	-0.5	4.4	2.5	3.9	2.9	62	25	13
Defective materials	-0.4	5.1	2.7	4.8	2.1	12	75	13
Changes in government regulations (lump sum)	-0.5	4.1	2.7	3.6	2.0	50	50	—
Labor disputes	-0.8	5.5	2.5	4.8	1.7	12	88	—
Safety	-2.7	8.3	2.1	5.6	1.3	—	87	13
Inflation (lump sum)	-1.1	4.7	1.9	3.6	1.7	62	38	—
Contractor competence	-3.3	7.5	2.5	4.3	3.4	50	25	25
Change-order negotiations	0.1	6.4	3.3	6.5	2.9	12	38	50
Third-party delays	0.7	6.2	2.2	6.9	2.0	—	50	50
Contract-delay resolution	-2.3	6.8	2.3	4.5	1.7	25	75	—
Delayed payment on contract	-1.8	7.5	2.5	5.8	1.2	—	87	13
Quality of work	-2.5	8.2	2.2	5.8	2.3	13	62	25
Indemnification and hold harmless	0.1	6.5	2.4	6.6	2.7	12	38	50
Financial failure: either party	-4.1	7.3	2.6	3.3	3.0	75	12	13
Actual quantities of work	-0.8	5.8	2.5	5.0	2.0	12	75	13
Defensive engineering	-0.1	4.6	1.8	4.5	1.8	25	62	13

**TABLE 11. Summary of Risk Allocation: Author Sample versus Discussor Sample**

Risk description (1)	Author Risk Allocation (Sample = 49)			Discussor Risk Allocation (Sample = 8)		
	Owner (%) (2)	Shared (%) (3)	Contractor (%) (4)	Owner (%) (5)	Shared (%) (6)	Contractor (%) (7)
Permits and ordinances	81	13	6	75	25	—
Delayed site access/right of way	83	15	2	87	—	13
Labor, equipment, and material availability	2	10	88	—	—	100
Labor and equipment productivity	2	—	98	—	—	100
Defective design	83	9	8	75	12	13
Changes in work	77	21	2	50	50	—
Differing site conditions (lump-sum contract)	94	6	—	100	—	—
Acts of God	58	40	2	38	62	—
Defective materials	2	20	78	—	13	87
Changes in government regulations (lump sum)	79	19	2	87	13	—
Labor disputes	2	28	70	—	13	87
Safety	—	19	81	—	50	50
Inflation (lump sum)	6	24	70	—	—	100
Contractor competence	15	14	71	38	—	62
Change-order negotiations	9	87	4	—	75	25
Third-party delays	40	53	7	38	37	25
Contract-delay resolution	23	73	4	37	50	13
Delayed payment on contract	79	15	6	100	—	—
Quality of work	—	10	90	—	—	100
Indemnification and hold harmless	8	79	13	12	75	13
Financial failure: either party	4	89	7	—	75	25
Actual quantities of work	19	11	70	—	25	75
Defensive engineering	35	54	11	12	13	75

## RISK MANAGEMENT PERCEPTIONS AND TRENDS OF U.S. CONSTRUCTION<sup>a</sup>

**Discussion by Joseph P. Connolly,<sup>2</sup>  
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The author's paper considers a topic that is important to the construction industry. Both contractors and owners can benefit

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from understanding how each perceives risk. As the author notes, determining the cost of risk is a critical activity for contractors. Traditionally, risk allocation is proposed in the contract documents, and the contractor must then cost the risks or negotiate changes in their allocation.

In 23 years with a top 100 contractor, the discussor has found that different construction sectors (infrastructure, petrochemical/oil and gas, power, etc.) view risk management in different ways. And this partisan risk management philosophy influences a sector's contracting strategies.

Some of the literature seems to have recognized these differences, and several papers [see Gordon, (1994)] have provided frameworks for viewing their respective sector approach to contracting strategies.

The author's sample of top 100 contractors of 1993 would

be expected to include multiple sectors, as would the previous ASCE survey. The discussor thinks the differences between the two surveys are influenced by sector differences in the populations, as well as by trends.

As a test of this assertion of sector differences in risk perception, the discussor surveyed eight senior project managers involved in risk assessment and bidding in the petrochemical/oil and gas sector (top 100 contractor size) using the author's format/form. Their responses are presented in Table 10 (risk importance) and Table 11 (risk allocation), which also include the relevant information from the author's paper.

The risk importance (Table 10) results would indicate there is sector variation: the discussor's sample shows significantly different individual risk importance values when compared with the author's study. The results are not as obvious for risk allocation (Table 11).

The discussor is not comfortable with developing conclusions based on a sector sample of eight and a generic sample of 49, since there are too many variables, but will comment as follows:

- With respect to risk importance, the risks associated with change orders, third-party delays, and indemnification and hold harmless are currently the most contentious areas in petrochemical/oil and gas sector contracting, and there are few failures in top 100 contractors and counterpart owners in this sector.
- With respect to risk allocation, sector defensive engineering is generally allocated to the contractor (reasonable control of cause and mitigation).

Risk importance (from a contractor's viewpoint) and allocation would be expected to be related, but these sample populations don't allow multifactorial analysis to test that hypothesis.

The author indicated a future survey will cover contractual arrangements and minimizing risks. The discussor would also like to see the author's efforts extended into sector impact on risk management.

#### APPENDIX. REFERENCE

Gordon, C. M. (1994). "Choosing appropriate construction contracting method." *J. Constr. Engrg. and Mgmt.*, ASCE, 120(1), 196-210.