EFFECTIVE WORDING TO IMPROVE RISK ALLOCATION IN LUMP SUM CONTRACTS

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ABSTRACT: This is the second paper addressing the results of an investigation into the subjective nature of contract interpretation. The first paper presented the findings of the investigation which showed how contracting parties interpret contract clauses differently. This paper reports the testing of a revised Canadian Standard Lump Sum Contract against its predecessor. The intent of this study was to measure the improvement of the wording-not in legal terms, but in terms of what the potential signatory to, or administrator of, the contract understood. The measure, as in the previous study, was the extent to which there was a "meeting of the minds" in interpretation of who was bearing particular risks. Unlike many contracts used today that are written by the owner or its representative, this standard form contract was drafted by a committee representing contractors and consultants, but not owners. An interesting observation was that owners were generally prepared to assume more risk than they perceived was being allocated to them while contractors wanted less risk.

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CHANGING CONTRACT CLAUSES

When disputes between contracting parties are caused by different contract clause interpretation, a method frequently used to avoid future conflict is to revise the clause wording. The author of contract usually "tightens up" the words in an effort to more clearly allocate risk. Often this takes the form of an exculpatory clause to ensure that such a risk is clearly allocated to the contractor. This method, however, may not make for a better agreement, will not necessarily decrease the incidence of dispute, or may not even meet the needs of all contracting parties.

The standard form lump sum contract used in this study (CCDC2) was being revised by the organization charged with managing and maintaining the document. Changes were being made to the words of some of the contract risk allocating clauses. Seven of the 18 contract clauses of CCDC2-1982 ("Stipulated" 1982), referred to in Hartman and Snelgrove (1996) and Hartman et al. (unpublished paper, 1997) (will be referred as "old clauses" in this paper), were being significantly changed or modified. These seven clauses of CCDC2-1994 ("Stipulated" 1994), referred to as "revised" clauses (quoted in Appendix I) were addressed in this part of the survey.

These seven revised clauses included:

- Authority of the consultant
- Other contractors
- Changes in the work—1
- Changes in the work—2
- Subsurface Conditions
- Disputes
- Damages and mutual responsibilities

Survey Demographics

The survey was distributed to a cross section of senior practitioners within the project and construction industry in southern Alberta, Canada. The sampling was based on peer selection of experts from the industry who were routinely in the business of administrating and working with construction contracts. Out of the 33 candidate participants invited, 31 took part in the study. The survey respondents were drawn from the following groups: 13 consultants (42%); eight contractors (26%); and 10 owners (32%).

Measurement

The survey undertaken for this research measured the degree to which each clause was interpreted in the same way by the three contracting party groups. These measurements for the revised standard form contract clauses were then compared with the old clauses. The comparison between the old and the revised clauses would allow us to determine whether the revised clauses are better at conveying specific intent for risk allocation to the respondents than the old clauses were.

The survey asked the respondents to indicate where the old and the revised clause allocated risk. Measurement was accomplished, as described in Hartman and Snelgrove (1996), by assigning numerical values to a range of risk apportionment options, as illustrated in Fig. 1. The respondents were also asked to indicate to whom they wanted the risk that was addressed by each clause allocated. This is referred to as "preferred" risk allocation. Fig. 1 shows that the choices for risk allocation ranged from 100% assumed by the owner through a continuum to 100% assumed by the contractor. This broad scale was used to give the respondents sufficient range for proportioning risk between it being equally shared by both parties and being 100% assumed by one or the other of the parties. It also allowed sufficient range for averaging results and, in turn, permitted us to evaluate trends in the opinions of risk apportionment as interpreted from the contract clauses by the various parties to the contract.

Measurement 1—Risk Allocation of Revised Clauses

Fig. 2 illustrates the "average" risk allocations for the seven revised clauses as perceived by each contracting party group. The Figure reveals that, except for the damages and mutual responsibility clause, the owner interprets the revised clauses

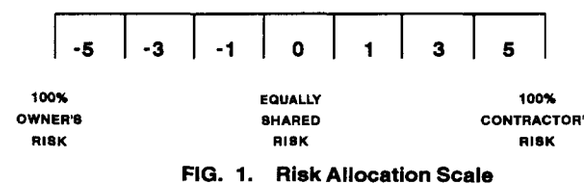

FIG. 1. Risk Allocation Scale

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as sharing risk with the contractor, while the contractor interprets the clause as allocating more risk to itself. This is similar to the findings for the old clauses studied in Hartman and Snelgrove (1996). The damages and mutual responsibility clause is different from the other clauses. Here, the owner interprets it as allocating more risk to the contractor than the owner. The consultant's interpretation display no perceptible pattern and appears to fall randomly among the results of the two primary contracting parties.

The results of this study will be directly compared to the survey responses given for the old clauses that were discussed in Hartman and Snelgrove (1996). This comparison will determine whether the revised clause is better than the old clause at conveying a common understanding of risk allocation to all respondents and will follow later in this paper.

The revised clauses (Appendix I) that the contracting party groups read with similar interpretation of risk allocation as shown in Fig. 2 are:

- Damages and mutual responsibility
- Other contractors
- Changes in the work—2

Measurement 2—Diffusion of Revised Clauses

The standard deviation, which measures the diffusion of results across the risk scale by contracting party group, are shown in Table 1. Some consistency in interpretation of the revised clauses may be concluded from a review of the data in the table. The following clauses may be concluded from a review of the data in the table. The following clauses (Appendix I) have, relatively speaking, consistently low standard deviation with respect to the three contracting party groups:

- Authority of consultant (0.70, 0.89, and 0.87)
- Changes in the work—1 (1.22, 1.08, and 1.20)

This consistency, measured as relatively low standard deviations, reflects a high degree of commonality in interpretation of risk assignment within the three contracting party groups.

The most difficult clauses, in terms of a lack of consensus of interpretation among the contracting party groups, are:

- Damages and mutual responsibilities (1.57, 1.58, and 2.48)
- Changes in the work—2 (1.20, 1.64, and 1.43)
- Subsurface conditions (1.56, 1.32, and 1.26)

This consistency of relatively high standard deviations reflects a comparatively low degree of commonality in interpretation of risk assignment within all three contracting party groups. These clauses may lead to dispute between contracting party groups.

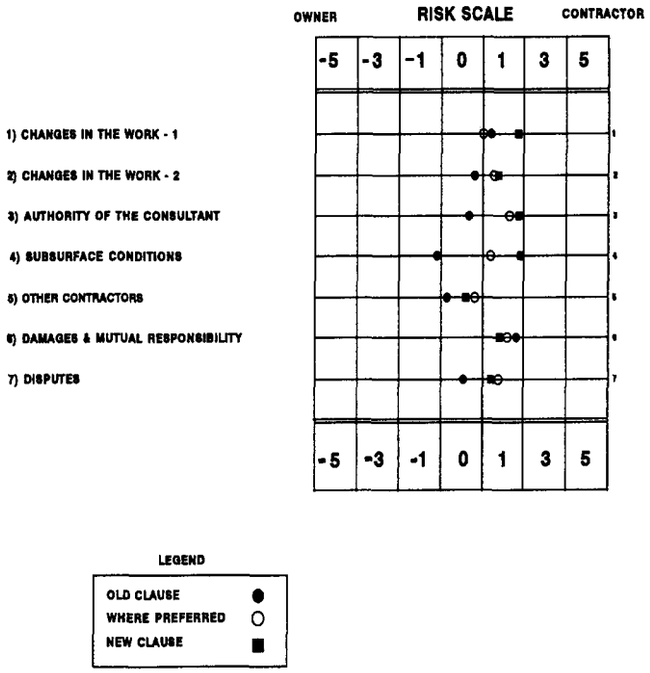

FIG. 2. Revised Clause Risk Allocation

TABLE 1. Clause Ranking

Clause title (1)	Owner Standard deviation (2)	Owner Rank (3)	Contractor Standard deviation (4)	Contractor Rank (5)	Consultant Standard deviation (6)	Consultant Rank (7)
Disputes	0.77	1	1.91	7	1.32	6
Authority of consultant	0.87	2	0.70	1	0.89	1
Changes in work—2	1.20	3	1.64	6	1.43	7
Changes in work—1	1.20	4	1.22	2	1.08	4
Other contractors	1.41	6	1.45	4	0.99	2
Subsurface conditions	1.56	7	1.32	3	1.26	5
Damages and mutual responsibility	1.57	8	1.58	5	2.48	8

COMBINED MEASURES FOR THE REVISED CLAUSES

Fig. 3 combines the two measures of difference and diffusion. It is desirable to have both measures of differences and diffusion close to the graph origin. Being close to the origin implies that all contracting party groups and all survey respondents agree on the allocation of risk among the contracting parties as specified in the contract clause. The figure shows that there are no clauses that fall close to the origin. All clauses fall outside the reasonable confinements of the "#1" and "#2" categories. Therefore the revised contract clauses may have a high likelihood of causing dispute during contract application. However, this preliminary conclusion will be ex-

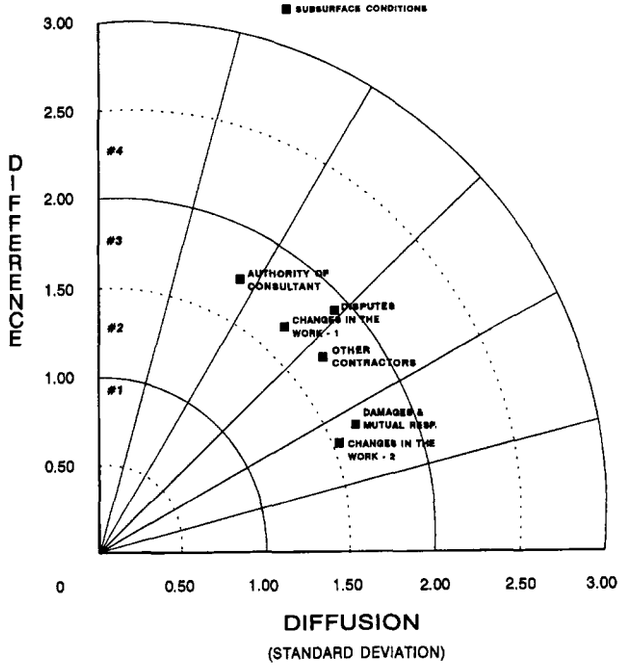

FIG. 3. Summary Revised Clauses

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amined more closely to determine whether the revised clauses are interpreted in a more consistent way by the respondents than the old clause. In other words, the question posed in the survey was: are the revised clauses an improvement?

IMPROVEMENTS IN INTERPRETATION

Despite the fact that the revised contract clauses did not fall within the "#1" and "#2" categories identified in Fig. 3, survey results were examined further to determine whether the revised clauses offered any improvement in perceived risk allocation compared to the findings of the original or old contract clauses, as reported in Hartman and Snelgrove (1996), of this series of papers.

Three comparisons were made to determine whether the revised clause is an improvement over the old clauses. These comparisons were as follows:

1. The value of the difference for the old clause measurements of interpretation were compared to the revised clauses to see if they fell closer to the preferred allocation of risk
2. The diffusion measurement of the revised clauses were compared to those of the old clauses to see if the were better than this measure for the old clauses
3. The clause interpretation measurements for the revised contract clause of both difference and diffusion were checked to see if they fell closer to the origin than the old contract clause

PREFERRED ALLOCATION—DIFFERENCE

Figs. 4–6 plot the average risk allocation perceived for the old contract clauses, the revised contract clauses, and the preferred risk allocation for the owners, contractors, and consultants. Based on the assumption that contract clauses are improved or interpreted more closely to the preferred location for risk apportionment as measured on the risk scale, a measure can be made to determine if any contract party group interprets the revised clause as an improvement over the old clause. This will be discussed for each of the three contract party groups.

Contractor

Fig. 4 shows the contractor's interpretation of risk allocation. The preferred risk allocations generally show the owner assuming significantly more risk than perceived in the old contract clauses. This is consistent with the risk-averse attitude of all parties. The difference here is that contractor's preferences would move risk to the owner; whereas owners and consultants prefer to see the risk with the contractor. It also shows that the contractor's perceptions of risk allocation in the old contract clauses are that the clauses are generally interpreted against the contractor.

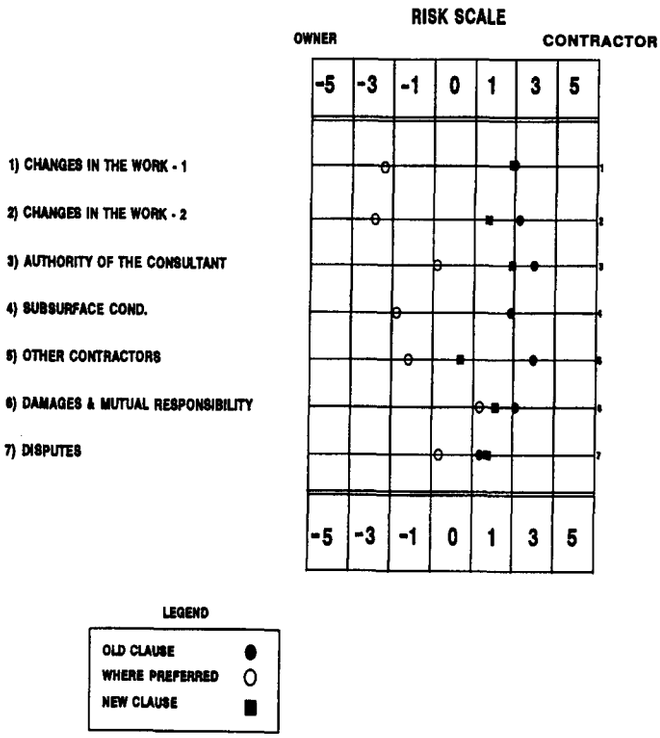

FIG. 4. Contractor's Perspective

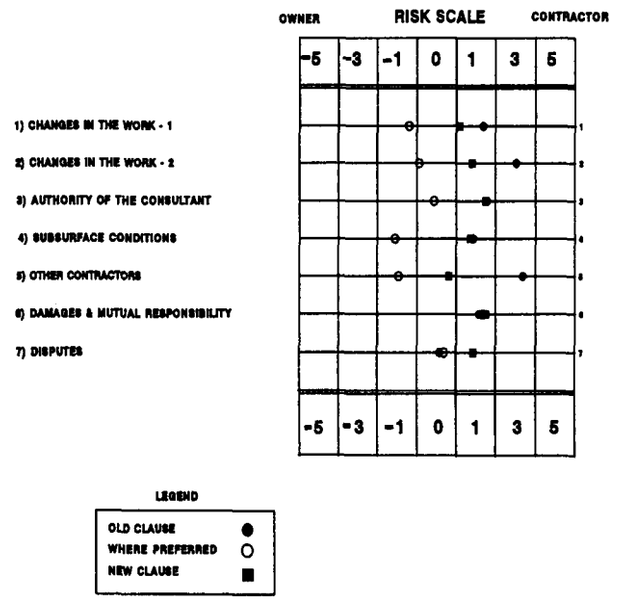

FIG. 5. Consultant's Perspective

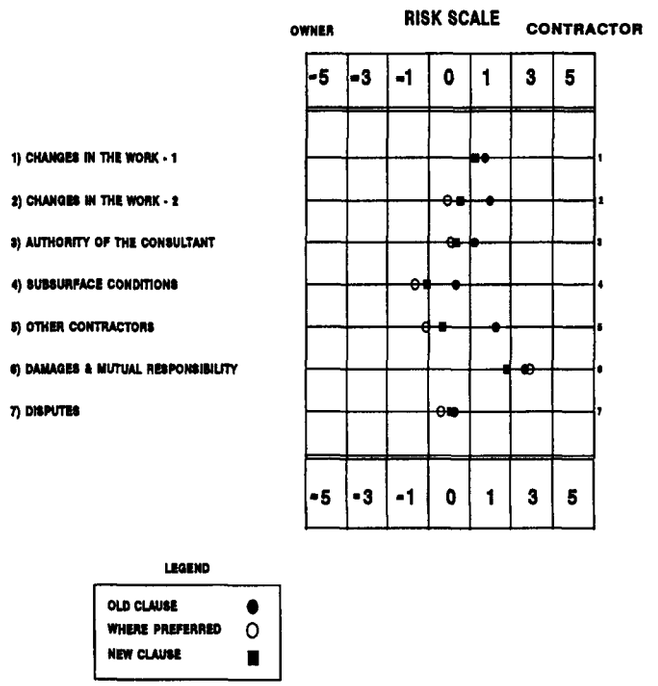

FIG. 6. Owner's Perspective

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It can be seen, with the exception of one clause, that all revised clauses were considered an improvement when compared to the old clauses as they were interpreted more closely to the preferred risk allocation. However, all of the old and revised contract clauses fell significantly short of meeting the contractor's preferred risk allocation. The most improved clauses considered to be the clauses that made the largest proportional move towards the preferred risk allocation were:

- Damages and mutual responsibilities
- Changes in the work—2
- Authority of consultant

The damages and mutual responsibility clause has improved significantly and is very close to the preferred risk allocation. On the other hand, the other clauses, though they did improve in terms of common interpretation, still are interpreted quite differently to the preferred allocation and may, therefore, still cause problems with the contractor during contract implementation. The least improved clauses, considered to be the contract clauses in which the interpretation moved the risk allocation further from that preferred by the contractor or had little or no effect on the interpretation, were:

- Disputes (clause moved further from preferred risk)
- Subsurface conditions
- Changes in the work—1

Consultant

Fig. 5 illustrates the consultant's perceptions. The plotted results indicate, as previously discussed in Hartman and Snelgrove (1996), that the consultant feels more risk should be allocated to the owner.

Using the same measures as described above for the contractor, the improved clauses are listed as follows:

- Other contractors
- Changes in the work—1
- Changes in the work—2
- Damages and mutual responsibility (no change)

As with the results for the contractor, the damages and mutual responsibility clause was essentially interpreted at the preferred risk allocation for both old and revised contract clauses. The other revised contract clauses were interpreted closer to the preferred allocation than the old but still require significant improvement to meet the needs of the consultant group.

The revised clauses (Appendix I) that moved away from the preferred allocation of risks or were not significantly interpreted differently to the old clauses were:

- Disputes (clause moved further from preferred risk)
- Authority of consultant (no change)
- Subsurface conditions (no change)

Owner

Fig. 6 shows that owners prefer to accept or are prepared to assume more risk than is currently allocated to them by the old contract clauses. The owner, however, is prepared to do this to a lesser degree than the contractor wishes, as illustrated in Fig. 4—perhaps not a surprising result. The revised contract clauses (Appendix I) that were interpreted close to the preferred risk allocation are listed here.

- Changes in the work—1
- Changes in the work—2
- Authority of the consultant
- Subsurface conditions
- Other contractors
- Disputes

The damages and mutual responsibility clause was the only clause that moved from the preferred allocation, albeit insignificantly.

CLAUSE INTERPRETATION—DIFFUSION

The previous section reviewed seven old and revised contract clauses, compared them to the preferred risk allocation of each contracting party group, and then determined whether the revised contract clauses were better than the old contract clauses based on the stated criteria. Many clauses were improved by rewriting or revising the words—in other words, the clauses were interpreted as allocating risk more closely to how participants preferred to see risk allocated. However, to have a successful contract clause, the respondents within each contract party group must also have the same interpretation. In other words, they need to agree on where the risk should be allocated to have a true agreement in the legal sense. As previously discussed, this is measured by the diffusion or the standard deviation of the survey responses to each clause within each contract party group.

The dispersion of results within each contracting party are examined and summarized in Table 2. Table 2 lists the standard deviations of respondents' interpretations of risk allocation for the seven old and revised clauses. The percentages indicate the degree of improvement in the respondents's agreement on the allocation of risk. In other words, a decrease in standard deviation indicates that the respondents within a contract party group are more "in tune" with one another on how they interpreted risk allocation. Negative percentages indicate that the standard deviation increased with the interpretation of the revised contract clause relative to the old clause. An increased standard deviation indicates that respondents are in less agreement with the interpretation and revised clause. It is therefore, arguably, more ambiguous than the old contract clause.

Trends that can be observed from Table 2 are listed as follows:

TABLE 2. Summary of Dispersion

	Owner			Contractor			Consultant		
Clause (1)	Old (2)	New (3)	Percent (%) (4)	Old (5)	New (6)	Percent (%) (7)	Old (8)	New (9)	Percent (%) (10)
Changes in work—1	1.40	1.20	14	1.49	1.22	18	1.14	1.08	5
Changes in work—2	1.45	1.20	18	1.76	1.64	6	0.83	1.43	−76
Authority of consultant	1.28	0.87	32	0.93	0.70	25	1.10	0.89	19
Subsurface conditions	1.97	1.56	21	1.22	1.32	−8	1.52	1.26	18
Other contractors	1.59	1.41	11	0.93	1.45	−56	0.86	0.99	−16
Damages and mutual responsibility	1.94	1.57	19	1.12	1.58	−29	1.65	1.48	5
Disputes	0.54	0.77	−43	1.29	1.91	−48	1.24	1.32	−6

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- The revised contract clause for disputes (Appendix I) was perceived as being less clear by all contracting parties. That is to say, the diffusion results, or disagreement within each contract party group, have increased for the revised clauses compared to the old clause.
- The owner respondents' interpretations were the most improved with the revised contract clauses. This assessment is based on the owner respondents being in greater agreement in interpreting the revised clauses compared to their interpretation of the old clauses. This is measured by the decrease in the standard deviation of the owner respondents' interpretations of risk assignment by the revised clause. On the other hand, the contractors' interpretations were more broadly distributed for the revised clauses. This suggests that there was more uncertainty when these clauses were read by contractors.

The survey results analyzed in the foregoing indicate that some clauses may benefit from further improvement in wording. Whole contracting parties have differing understandings of how clauses allocate risk, and disputes can be expected continually to occur between them.

DIFFERENCE—DIFFUSION GRAPH

Owners, contractors, and consultants need to interpret risk allocation by a particular clause in the same way to avoid disputes during contract administration. This degree of commonality interpretation can be assessed by comparing the measures for differences and diffusion for the old and revised contract clauses on the differences/diffusion graph. These two measures are brought together in Figs. 7–9. If a measure for a revised contract clause falls closer to the origin than to the equivalent old clause measure, then the revised clause is considered an improvement.

These graphs illustrate the effect of changing the words in contract clauses in an effort to "improve" the quality of the contract. Fig. 7 shows two revised clauses that appear to provide more precise interpretation than the old clauses. This is because the measurements for both diffusion and differences for the new clauses were closer to the graph origin. However, there is still potential for improvement (i.e., movement toward the graph origin). It should be recognized that clause interpretation is an imperfect art, so scores at the graph origin are not likely to occur. Fig. 8 shows two clauses that appear to be less clear after revision. The revised clauses' risk assignment was more broadly spread than the old clauses'. However, the old clauses were not consistently interpreted either. All clauses, old and revised, were measured as somewhat unclear as no risk measurement (diffusion or difference) was close to the origin of the graph.

Fig. 9 illustrates that clauses have a high degree of uncertainty, as there is no consensus on a preferred risk allocation. The measures of difference and diffusion are so large that significant difference of opinion exists among the respondents on where risk should be allocated. This implies that significant

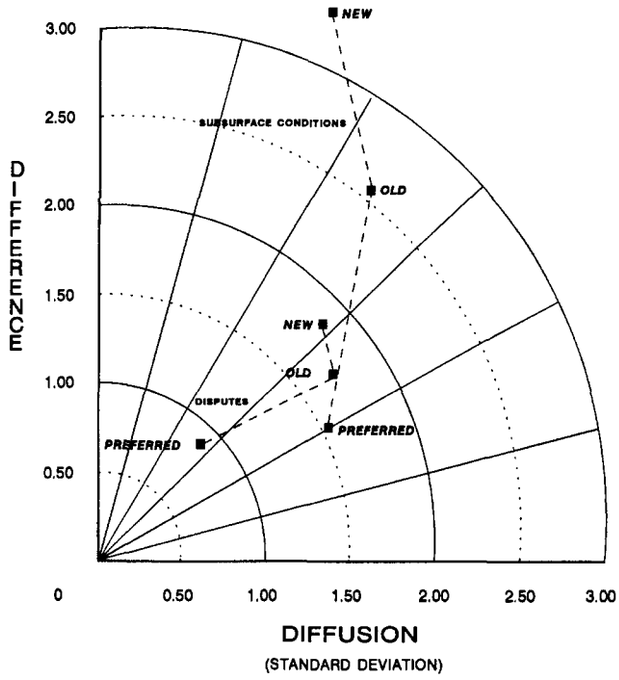

FIG. 8. Summary of Results

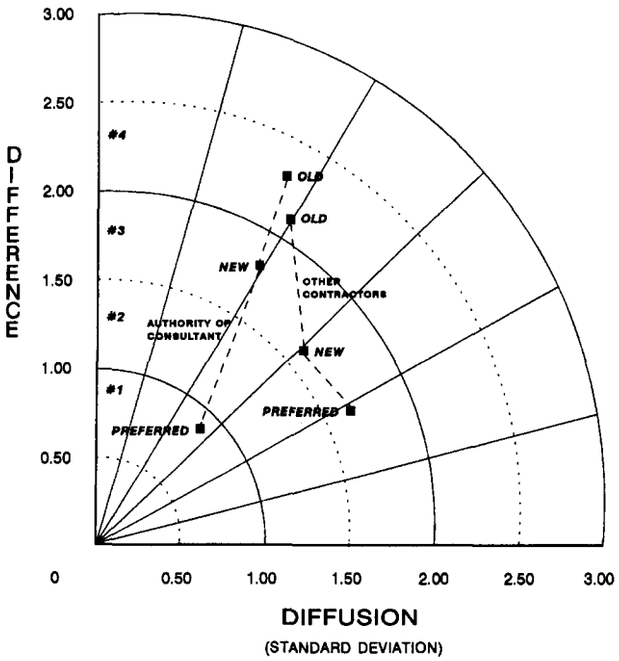

FIG. 7. Summary of Results

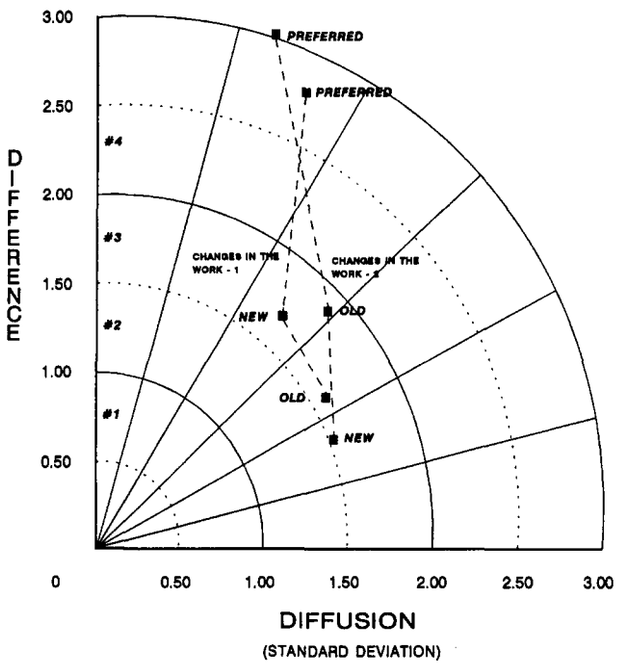

FIG. 9. Summary of Results

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work is required between contracting parties to confirm or negotiate an understanding of where the particular risk addressed by the contract clause should be allocated.

SUMMARY OF FINDINGS

This pilot study, as presented in these two papers, illustrated a method of measuring the subjective process of contract clause interpretation. The survey measured the ability of specific construction contract clauses to convey a unique understanding to all contracting parties in terms of the degree to which risk was apportioned between them. It has been quantified, with few exceptions, that fundamentally each contracting party interpreted allocating clauses differently. Therefore the likelihood of agreement between the contracting party groups on the degree of risk apportionment during contract administration is relatively small. It was also shown that not only are there differences in opinion between contracting parties on clause interpretation, but that individual respondents within a contracting party group do not necessarily agree with each other.

The measuring technique allowed identification of some trends or characteristics of the specific contract clauses under study, and perhaps some general trends in contract clause interpretation. Some trends were identified on contract clause interpretation. These included the following:

- Few clauses were interpreted the same way by all parties involved in a contract when measured in terms of risk allocation.
- On average contractors perceived more risk allocated to themselves than either the owner or consultants did.
- On average, owners—though tending to allocate more risk to the contractor than to themselves—interpreted clauses with more of a "risk sharing" attitude than either the contractor or the consultants.
- Converse to the previous point, owners expect to assume more risk than the contractors perceived.
- On average, consultants' interpretation of risk assignment showed no particular pattern, their interpretation falling randomly among the owners' and contractors' responses.
- Risk interpretation by the respondents, in many of the clauses, was spread across a significant portion of the risk scale (higher diffusion). Therefore there is little agreement among owners, contractors, or consultants within specific contract party groups on the interpretation of contract clauses in terms of the effective allocation of risk.
- Few clauses displayed low measurements of dispersion and difference, and fewer clauses were interpreted at the preferred risk allocation. Therefore, few clauses were considered idealized in terms of either clarity of risk allocation between contracting parties or allocating risk where parties wanted it.
- Despite diverse clause interpretations, there was measurably greater agreement between the parties and respondents as to where the risk should be allocated. Overall most respondents wanted to share risk and not necessarily allocate risk specifically to one or the other contracting party. However, there was some diffusion of opinion on the degree of risk sharing that should occur.
- Changing the wording of contract clauses showed some improvement in making better the consistency of interpretation among respondents. This improvement was measured in the contracting parties' interpretation of risk allocation of the revised clauses showing lower measurements of both difference and diffusion. Further, on average, these measures were closer to the preferred allocation, as measured on the risk scale. However, this improvement, as demonstrated with the revised contract clauses, was considered to be marginal and is not expected to significantly decrease the potential for dispute between contracting parties on the allocation of risk.
- Specific to the standard form contract that was used in this study, both the original and the revised contract clauses do not convey the same degree of risk apportionment to the contracting parties. This ambiguity allows contracting parties to interpret contract risk differently across the risk scale. This capability is conducive to dispute between contracting parties—this means that latent disputes may exist. Such a dispute will not become apparent until the risk event triggers the use of the contract clause.

CONSEQUENCES OF FINDINGS

The findings relative to the specific contract clauses used in the survey are important. Of greater importance is the methodology developed for this study and its potential as a tool to help reduce the incidence of contractual disagreement. The ability to provide a yardstick to measure the subjective interpretation of contract or risk allocation clauses allows us to determine whether a latent error or potential dispute within the words of a contract exists. Clauses of high ambiguity or confusion can be proactively reacted to by the contracting parties to mitigate the potential for dispute after contract execution. This proactive approach of measurement, understanding, negotiating, and agreeing to contract intent results in aligned expectations between the contracting parties.

The reliance that a contracting party or individual can place on their own interpretation of a written contract clause as being correct—and by implementation, the same as others—is questionable. What is thought to be a fair interpretation to one party may not necessarily be fair or meaningful to the other. Previously, if interpretation was even questioned, no mechanism existed for effectively measuring and detecting differences prior to a disputed risk event occurring.

To protect against such uncertainty, contracting parties may increase defensive measures. These measures include contractors increasing their bid price, extensive use of exculpatory clauses, or equally likely contracting parties attempting to reallocate risks to other parties, such as subcontractors and suppliers, during the construction and contract administration phase of the project. Reallocation is accomplished by passing risk onto subcontractors or suppliers, claiming for extra payment due to a risk occurrence, holding back payment, renegotiation of contract or payment terms, or, in the extreme, by litigation. Therefore, nonaligned beliefs or misunderstanding of risk allocation between contracting parties can affect the working relationship between contracting parties and potentially jeopardize project success from the outset of contract formation. In most cases, disputes will arise and these disputes will increase cost during or at the end of a project. Therefore, there is a significant risk in any contracting party relying on its own unilateral contract interpretation.

Based on the finding described in the three papers in this series, the writers conclude that standard form or "boiler plate" contract clauses used to assign risk duties and responsibilities created potential challenges:

1. Such clauses are not sufficient to clearly and explicitly assign risks among contracting parties in an unequivocal manner.
2. They do not currently address the preferences of the contracting parties, as terms and conditions of the agreement are not, in the true sense of the word, an "agreement." That is, the contracting parties should have, in a legal sense, "a meeting of the minds" while, in fact, there is

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not necessarily a common understanding of the intent of one or more clauses in that contract.
3. Standard clauses do not meet the needs of its users in as much as the interpreted allocation of risk does not coincide with the preferred allocation.
4. To exacerbate the previous point, parties infrequently agreed to a common preferred allocation.

These results showed that not only was there inconsistent interpretation of risk apportionment of contract clauses, but there was not necessarily any agreement on how those risks should have been assigned in the first place. What we measured was the effectiveness of the contract language. As a result, it was concluded that contract language alone is insufficient to clearly indicate a specific degree of risk apportionment between contracting parties.

CONCLUSIONS AND RECOMMENDATIONS

It is apparent from the results of this pilot survey that there is little agreement between contracting parties on how risk liability is assigned in standard contract clauses. Therefore, such contact clauses do require some discussion between the contracting parties to achieve a true meeting of the minds. If necessary, appropriate modification or, preferably, clarification may be needed for the clauses to become effective in allocating risk. Clause clarification implies that contracting parties must agree on the intent of the clause prior to formal execution of contract documents. To achieve this, there must firstly be some fundamental agreement among the practitioners as to where risk should be. Secondly, where interpretation is different, there must be a process that encourages discussion and negotiation of who is to assume the risk or how the risk should be shared. Common understanding can only be realized with open and honest communications between the contracting parties prior to contract execution. Contract stakeholders have to be allowed to contribute to risk allocation on an equal basis to have buy-in to the risk allocating process and its results. Such a process allows contracting parties the opportunity to understand the limits of the risk apportioned to each party. Without such understanding, conflicting interests between parties or respondents will continue and dispute occurrence will not decrease.

In addition, it would also be prudent to include a process of identifying and allocating risks within the contract during its execution. This gives the opportunity for contracting parties to continually address unknown risks as they become apparent. Continual discussion of and feedback on risks maintains trust and keeps a line of communication working throughout the project. This, in turn, makes risk management a dynamic process throughout contract administration rather than a static process.

An "unqualified" contract is one that has not been validated through discussion and agreement of the real meaning of each clause. Presently, many contracting parties rely on such unqualified contracts to resolve situations of risk occurrence—no discussion of risk apportionment occurs until after the risk event has taken place. Contracting parties then interpret contract clauses independently of one another. The likelihood of conflicting interpretations exists—hence disputes arise. Contracting parties must define contract intent in a dynamic, interactive manner prior to the advent of a risk event and preferably prior to finalizing the contract. This dynamic process increases the prospect of a common vision and intent and, thus, interpretation. This dynamic clarification of intent or interpretation should be a mandatory part of the contract formation process.

The findings of this study are consistent with Hartman's previous findings, which were arrived at by a different process (Hartman 1993). Hartman's research examined the risk apportionment problem from the contract claims perspective rather than contract clause interpretation. Hartman, as a result of his work, proposed a dynamic process of risk apportionment. He suggested that risk apportionment between contracting parties should be based on an interactive process prior to formal contract execution. The process relied on each contracting party identifying and evaluating the cost associated with assuming specific risk events. Once identified and evaluated, contracting parties negotiated the complete allocation of each risk to one specific party. The writers of this paper believe that Hartman's process of identifying and negotiating of risk allocation should be used. But based on the findings of this study, they suggest that the original process could be modified or improved. The survey results clearly indicate that most respondents prefer to share risk to some degree, rather than complete allocation to one specific party, as recommended by Hartman (1993). Sharing risks suggests that risks should be managed as a team and not necessarily be delegated or preassigned completely to one party. Preassignment of risks may work for identified or known risks, but as soon as an unassigned risk becomes apparent, parties have to rely on the old process of unilateral contract clause interpretation, with its attendant potential for dispute.

Sharing risks implies that risk management should be a dynamic process—risk allocation may change relative to circumstance and situations of the contracting parties and the state of the project. Risk is apportioned to suit the best outcome of the project—not to conflicting interpretations of contract words. Therefore dynamic risk management means contracting parties proactively and jointly addressing known risks and methods of mitigation. It also means working together at mitigation risks that have not even been proactively identified, planned for, and mitigated. Each contracting party must be willing to compromise their individual prejudices and biases in favor of the team and the project to deal with risk in a "win/win" manner.

Dynamic risk management can only occur if contracting parties believe that risks are best managed by a team effort involving all stakeholders. The process of sharing risk implies that all contracting parties take responsibility for effective mitigation of all risk events. It also implies that contracting parties will possess the same "vision" of risk management and project execution. With its new ability to measure the subjective nature of contract clause interpretation, it will be easier for all contract parties to work together to take a proactive approach to resolve or reduce the problem of construction disputes.

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APPENDIX I.

In this section we present seven revised clauses from The CCDC2 1994 (draft version) being studied in this research. The same seven clauses from The CCDC2 1982 have been quoted in Hartman and Snelgrove (1996) and Hartman et al. (unpublished paper, 1997).

CHANGES IN THE WORK—PART 1

The Owner, through the Consultant, without invalidating the Contract, may make changes in the work consisting of addi-

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tions, deletions, or other revisions to the Work by a Change Order or a Change Directive.

The contractor shall not perform a change in the Work without a Change Order of Change Directive.

(a) When a change in the Work is proposed or required, the Consultant shall provide a notice describing the proposed change in the Work to the Contractor. The Contractor shall present, in a form acceptable to the Consultant, the method of adjustment or an amount of adjustment for the Contract Price and the extent of the adjustment in the Contract Time, if any, for the proposed change in the Work.

(b) When the Owner and Contractor agree upon the adjustments in the Contract Price and Contract Time or upon the method to be used to determine the adjustment, such agreement shall be effective immediately and shall be recorded in a Change Order. The value of the work performed resulting from a Change Order shall be included for payment in a regular certificate for payment.

CHANGES IN THE WORK—PART 2

(a) Change Directive—If the Owner requires the Contractor to proceed with a change in the Work prior to the Owner and the Contractor agreeing upon the adjustment in Contract Price and Contract Time, the Owner, through the Consultant, shall issue a Change Directive.

(b) Upon receipt of a Change Directive, the Contractor shall proceed promptly with the change in the Work. The adjustment in the Contract price for a change carried out by way of a Change Directive shall be determined on the basis of the costs of the expenditures and savings of performing the Work attributable to the change, including in the case of a net increase only in the Contract Price an allowance for overhead and profit. In the case where a change in the Work results in a net decrease in the Contract Price, the amount of the credit shall be the net cost, without deduction for overhead or profit, unless otherwise provided for in the Contract Documents. When both additions and deletions covering related work or substitutions are involved in a change in the Work, the allowance for overhead and profit shall be calculated on the basis of the net increase, if any, with respect to that change in the Work.

(c) The Contractor shall keep and present, in such form as the Consultant may require, an itemized accounting of the costs of expenditures and savings referred to in (b), together with supporting data. Unless otherwise provided in the Contract Documents, costs of performing the Work attributable to the change shall be limited to the actual costs of all of the following:

- wages and benefits paid for labor in the direct employ of the Contractor under applicable collective bargaining agreements, or under a salary or wage schedule agreed upon by the Owner and Contractor;
- salaries, wages and benefits of the Contractor's personnel, when stationed at the field office, in whatever capacity employed: salaries, wages and benefits of the Contractor's personnel engaged at shops, or on the road, in expediting the production of transportation of materials or equipment, for that portion of their time spent;
- contributions, assessments or taxes incurred for such items as unemployment insurance, workers' compensation, and Canada or Quebec Pension Plan, insofar as such cost are based on wages, salaries, or other remuneration paid to employees of the Contractor and included in the cost of the work under the first two items above;
- the portion of travel and subsistence expenses of the Contractor's personnel when stationed at the field office incurred while travelling in discharge of duties.
- the cost of all materials, products, supplies and equipment, including costs of transport thereof;
- the cost of materials, products, supplies, equipment, temporary services and facilities, and hand tools not owned by the workers, including transportation and maintenance thereof, which are consumed and cost less salvage Value on such items used, but not consumed, which remain the property of the Contractor;
- rental costs of all tools, machinery, and equipment, exclusive of hand tools whether rented from the Contractor or others, including installation, minor repairs and replacements, dismantling, removal, transportation and delivery costs thereof;
- deposits lost;
- the amounts of all subcontracts and the costs to the Contractor that result from any Subcontractor that result from any Subcontractor's insolvency of failure to perform;
- the cost of quality assurance such as independent inspection and testing services;
- charges levied by authorities having jurisdiction at the Place of the Work;
- royalties, patent license fee, and damages for infringement of patents and costs of defending suits therefore subject always to the Contractor's obligations to indemnify the Owner pursuant to GC 18 Patent Fees;
- premiums for all bonds and insurance which the Contractor is required, by the Contract Documents, to purchase and maintain;
- taxes and duties for which the Contractor is liable;
- losses and expenses sustained by the Contractor for matters which are the subject of insurance under the policies prescribed under Insurance when such losses and expenses are not recoverable because the amounts are in excess of collectible amounts or within the deductible amounts;
- charges for telegrams, telexes, telephones, courier services, expressage and petty cash items incurred;
- the cost of removal and disposal of waste products and debris;
- costs incurred due to emergencies affecting the safety of persons or property;
- legal costs, incurred by the Contractor in accordance with the Contracting Documents

(d) Pending determination of the final amount of a Change Directive, the undisputed value of the Work Change Directive, the undisputed value of the Work Change Directive, the undisputed value of the Work performed in a Change Directive may be included in application for payment. If the Owner and Contractor do not agree on the proposed adjustment in the Contract Time or the method of determining it, the adjustment shall be referred to the Consultant for determination. If at any time after the start of the Work being carried out by way of a Change Directive, the Owner and the Contractor reach agreement on the adjustment to the Contract Price and to the Contract Time, this agreement shall be recorded in a Change Order.

AUTHORITY OF THE CONSULTANT

The Consultant will be in the first instance, the interpreter of the requirements of the Contract Documents and shall make findings as to the performance thereunder by both parties to the Contract. Interpretations and findings of the Consultant shall be consistent with the intent of the Contract Documents. When making such interpretations and findings the Consultant will not show partiality to either the Owner or the Contractor.

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SUBSURFACE CONDITIONS

If conditions are discovered at the Place of the Work which are:

(a) subsurface or otherwise concealed physical conditions which existed before the commencement of the Work or differ materially from those indicated in the Contract Documents; or

(b) unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents;

Then the observing party shall notify the other party in writing before conditions are disturbed and in no event later than 7 days after first observance of the conditions.

The consultant shall promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost or time required to preform the Work, shall issue appropriate instructions for changes in the work in accordance with GC 12—CHANGES IN THE WORK.

If the Consultant finds that the conditions at the Place of the Work are not materially different or that no change in the Contract Price or the Contract Time is justified, the Consultant shall report the reasons for this finding to the Owner and the Contractor in writing.

Claims by either party in opposition to the findings of the Consultant must be made in accordance with GC 4—CONSULTANT and GC 8—DISPUTES.

OTHER CONTRACTORS

Where a change in the Work is required as a result of the coordination and connection of the Work of other contractors or Owner's own forces with the Work of the Contract, the changes shall be authorized and valued in accordance with GC—12 CHANGES IN THE WORK

DAMAGES AND MUTUAL RESPONSIBILITY

If the Contractor has caused damage to the Work of an Other Contractor on the Project, the Contractor agrees upon due notice to settle with the Other Contractor by negotiation or arbitration. If the Other Contractor sues the Owner on account of damage alleged to have been so sustained, the Owner shall notify the Contractor and may require the Contractor to defend the action at the Contractor's expense. The Contractor shall satisfy a final order or judgment against the Owner and pay the costs incurred by the Owner arising from such action.

DISPUTES

Within 30 days after the Contract has been awarded, the parties shall appoint a Project Mediator in accordance with the CCDC Construction Mediation Rules, as amended from time to time, to provide any mediation services required by the parties under Contract.

After a period of 14 days following receipt of a responding party's reply under GC 8.3 (8.3 specifies that the consultant will review and interpret the Contract Documents) the parties shall request the Project Mediator to assist the parties to reach agreement on any unresolved dispute. If the dispute has not been resolved within 14 days after the Project Mediator was requested, or within such further period agreed to by the parties, the Project Mediator shall terminate the mediated negotiations by giving written notice to the parties. By giving a written notice to the other party, no later than 14 days after the date of termination of the mediated negotiations, either party may refer the dispute to be finally resolved by arbitration before a single arbitrator under the rule adopted by the parties.

It is agreed that arbitration is binding only if the notice to arbitrate is given within the specified 14 day period. On expiration of the 14 day period, the arbitration agreement is not binding on the parties.

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