Identification of Critical Dispute Characteristics (CDCs) during Construction Project Operations

A Dissertation
Presented to
the Academic Faculty

By

Kyoo-Chul (KC) Shin

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
in Civil and Environmental Engineering

Georgia Institute of Technology

Nov. 2000

Identification of Critical Dispute Characteristics (CDCs) during Construction Project Operations

Approved

Dr. Jorge Vanegas, Co-Chair

Dr. Keith Molenaar, Co-Chair

Dr. Paul Chinowsky

Dr. Rita Gregory

Dr. Sridhar Narasimhan

11/8/2000

Date Approved

ACKNOWLEDGEMENTS

This dissertation is a partial but the most significant portion of my achievement during the Ph.D. research process in the Construction Engineering and Management (CEM) program at Georgia Institute of Technology. I might have worked diligently in each stage, but would never have completed the research and dissertation without my advisory committee faculties' advise, guidance, stimulation, inspiration, encouragement, as well as my perseverance to endure the trying times.

I appreciate my advisors, Dr. Jorge Vanegas whose inspiration always leads me out of haze; Dr. Keith Molenaar whose academic scrutiny drove me into a corner of no-way-out but carved me as a sincere researcher; Dr. Paul Chinowsky whose guidance opens the door to the world of management from strategy to information technology issues; Dr. Rita Gregory whose encouragement made me fly high where the sky is the limit in research development; and Dr. Sridhar Narasimhan whose advice led me to explore the management issues outside the world of CEM from knowledge to e-commerce issues. Without their contribution to my research process, I may not have completed the research in this dissertation.

I sincerely acknowledge the research scholarship from my company, Hyundai Engineering and Construction Co., Ltd., for the whole Ph.D. research period. The research scholarship helped me to explore not only the new knowledge in CEM but also develop my life-long vision and mission professionally.

I appreciate the support from my family including my wife Yang-Hee Cho who successfully managed our family life in the United States; Sue who has grown up cheerfully among good friends; Jin who can prove how easily one can become a bilingual kid; and my parents Chung-Ha Shin and In-Soon Ahn whose support is beyond any description in a few words.

My colleague students also supported and encouraged me and each other during the research period including: Stephen Mulva who spent countless times at Junior's Grill with me to discuss every topic around the research to challenge our intellectual curiosity; Dr. Annie Pearce who encouraged me always to keep on track like a bright lantern in a stormy night; Jose Loria who guided us through Mayan culture at Rocky Mountain which was intellectually unforgettable; Anna Jones-Crabtree who demonstrated her capability of goodwill in the research process; Francisco Maldonado-Fortunet who always showed an admirable intellectual challenge. I appreciate and acknowledge all the colleagues who shared their knowledge and experiences in the CEM master program during the last four years. I extend my special thanks to many Korean civil colleagues who shared a great time and discussion including Jin-Ook Kang and Ju-Taek Oh selected by 'frequency' criteria. I want to acknowledge other colleague students in management, Jai-Yeol Son and Sung-Sin Kim for their help at important moments. I also extend my thanks to James Dietz who helped me to complete this dissertation in better shape professionally.

Above all these acknowledgments, I want to thank the Lord who gave me a chance to reflect on who I am and what I have to do. I sincerely pray that I can use all my capabilities for helping others instead of using it for myself.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF TABLES in APPENDIX A

SUMMARY

Stakeholders in construction projects, owners, designers, and constructors, currently have limited means of managing disputes during a construction project execution once project operations begin. This research defines Critical Dispute Characteristics (CDCs). CDCs are project characteristics defined by retrospectively analyzing dispute cases in construction litigation that provide understanding of disputes and dispute potential. The CDCs are the basis for a framework and methodology that will allow the analysis of project performance from a dispute issue perspective.

There is a need to develop new tools to assist stakeholders in monitoring construction project disputes. These tools must be able to proactively diagnose the potential for disputes in a project and prescribe possible preventive actions. As a foundation for the development of such tools, this research project: (1) defines a framework and methodology to analyze retrospectively dispute cases in construction litigation, as a profiling method for the characterization of dispute characteristics, and (2) establishes a fundamental set of CDCs. These CDCs provide the cornerstone for the future development of an integrated monitoring, diagnosis, and prescription system to identify potential disputes among project stakeholders during project execution, and provide possible alternative courses of action to prevent them.

The fundamental hypothesis of this research is: "*There are potential disputes during construction operations that are identifiable in advance by their characteristics.*" This hypothesis implies the following specific research question: *"Is it possible to identify dispute characteristics before the disputes take place?"* The specific hypotheses under this research question are that: *"Dispute characteristics can be defined. The CDCs among all dispute characteristics can be defined."*

This research proves that most dispute cases in projects reveal specific, identifiable causes of disputes through their dispute characteristics. This starting point paves the way for the eventual development of a diagnosis and prescription tool that will identify what actions a project can take to avoid disputes based on their initial characteristics. Therefore, potential disputes can be identified from the defined dispute characteristics that result from this research. Without a proper procedure for categorizing dispute characteristics into usable form, precedence knowledge cannot be utilized because there is no methodology to relate it to potential disputes. The concepts of exploring precedence knowledge in past disputes and defining CDCs for potential disputes are developed through the text analysis of construction dispute cases.

Through retrospective data analysis of dispute cases from federal appellate court cases, 14 CDCs are defined. The dispute cases are selected according to the presence of dispute keywords in the summary of a particular judgment statement. Additionally, dispute keywords are selected from the previously mentioned keywords in the literature review. Using content analysis methodology, the final set of 14 CDCs is defined by their frequency and context within a set of 80 keywords. The CDCs are defect, change, scope,

cost, adjustment, bond, schedule, disputes, condition, undiscovered, definition, liability, warranty, and fraud. The importance of these 14 CDCs, and the relationships among them, are analyzed from various perspectives in construction operations.

This research project advances knowledge of disputes in construction operations by converting precedence disputes into a source of valuable knowledge for current dispute identification. The contribution of the research is the development of a framework and methodology to define disputes characteristics. The process of analyzing precedence knowledge in construction operations adapts and extends the concept of knowledge management in general management issues. This research develops a better understanding of disputes in construction operations for all construction stakeholders, including owners, architects, engineers, contractors, and other project-related professionals.

CHAPTER I. INTRODUCTION AND RESEARCH OVERVIEW

1.1 Introduction

In a judgment, a judge stated that "*Major construction projects generate major construction litigation. Management of either is perilous.*" [Morse/Diesel Inc. v. Trinity Industries Inc., 67 F.3d 435, (2nd Cir. 1995) in Appendix A]. In the judge's view, managing a construction project is as perilous as managing litigation, and many construction professionals take both for granted.

As construction projects have become larger and more complex, the volume of disputes and litigation has grown substantially. One may speculate as to the reasons, but there is evidence that some of the factors influencing the serious and substantial increase in the number of claims are the complexity of the projects now being undertaken, and the price structure of the industry that does not permit the absorption of unanticipated additional cost [Levin, 1998].

Construction litigation is, in many cases, the result of disputes that arise during construction operations. Dispute is defined as an argument about an issue concerning project operations, usually resulting from a debate over differences in two or more parties' understanding of a situation [Vorster, 1993].

Disputes can be generated by any construction stakeholders, including owners, architects, engineers, contractors, and other project-related professionals. These

professionals make every effort to efficiently manage construction projects with regard to cost, time, quality, safety, and construction engineering. However, managing disputes has historically not been a major focus of their managerial duties during project operations. To change such conventional managerial practices in construction operations, dispute issue has been a topic of numerous institutional efforts and research studies. The concept of a dispute review board has been investigated by the American Society of Civil Engineers (ASCE) [ASCE, 1991]. The publishing of an alternative dispute resolution guide and the creation of a Dispute Avoidance and Resolution Task force (DART) have been activities of the American Arbitration Association [AAA, 1994; Gaede, 1993; Groton, 1993b]. A partnering guide has been written by the Associated General Contractors (AGC), while dispute-related research studies have been conducted by the Construction Industry Institute (CII) [AGC, 1995; Vorster, 1993; Diekmann, 1994; Thompson, 1996].

Dispute has been the subject of *prevention, prediction, avoidance,* and *resolution* in project operations [ASCE, 1991; Groton, 1991; Diekmann, 1994; Jergeas, 1994; Revay, 1993; Vorster, 1993]. Among these approaches to dispute issues, there are two different views – reactive and proactive – with regard to dealing with disputes during project operations. *Resolution* is considered to be a reactive approach because it occurs once a dispute has already happened. *Avoidance*, even though it appears to be proactive, often simply does not acknowledge or deal with the dispute, rather only tries to get rid of the dispute. Similarly *prevention* and *prediction* are also not proactive enough to get rid of

disputes in project operations. Therefore, these approaches are not sufficient to deal with dispute issues in project operations since disputes occur far too often.

Proactive management of potential disputes is required to diagnose dispute issues properly during project operations. A fundamental premise in this dissertation is that disputes need to be considered as a major project issue that must be managed whether they occur or not.

This chapter summarizes the process of defining dispute characteristics. The chapter introduces: (1) the research context, general problems, and a point of departure, (2) the research goal, hypothesis, and research questions, (3) the research framework and scope, (4) the research methodology (which covers the stages of strategy, methodology design, and execution) and (5) the research results and contributions. The chapter concludes with a reader's guide to this dissertation.

1.2 Research Context- Problems and Point of Departure

1.2.1 Research Problem

Historically, the construction industry has been devastated by excessive numbers of costly and time-consuming legal disputes. Today, it is common for problems to linger on, unresolved, for months or years, and to occur all too often. Disputes and litigation are so prevalent that the courts have become backlogged. Sometimes it can take more time to settle disputes than it took to actually build the project. In economic terms, litigation costs outweigh the benefits, often making litigation a "no-win" situation [Diekmann, 1994].

Disputes frequently occur during the course of construction projects, but the work on site needs to be performed nonetheless according to the contract. The concept of construction contracts is focused on work progress as specified in the standard contract documents [AGC, 1997; AIA, 1997; EJCDC, 1996].

Currently, project stakeholders have limited means of managing disputes during construction project operations. Construction management is more focused on conventional issues of cost, time, quality, safety, and resources of material and manpower. In dispute issues, managerial efforts during the project operations are more focused on developing dispute resolution processes [ASCE, 1991; CPR, 1994; Gaede, 1993; Groton, 1991; Vorster, 1993]. This approach is reactive to dispute issues because resolution efforts are not made until the dispute occurs. Furthermore, conventional efforts to

resolve disputes rely on individuals' knowledge and experience without making proper use of precedence knowledge.

Many construction disputes can be resolved easily among parties using goodwill. However, some disputes proceed unresolved until the completion of the project. Unresolved disputes are forwarded to the various dispute resolution processes, such as Alternative Dispute Resolution (ADR) methods including mediation and arbitration, or litigation. This situation commonly occurs in many projects because there are no proper means to resolve these disputes within the practice of project management. Due to the fact that these common practices of dispute resolution are reactive and unproductive, this research proposes a new framework and methodology to analyze dispute cases with dispute characteristics–a foundation for an increasingly proactive form of project management.

1.2.2 Point of Departure

Managing disputes should become a part of "normal" project management during project operations because disputes in construction projects are commonplace. Dispute resolution needs to occur immediately on the project site whenever possible. To achieve this objective, potential disputes need to be identified at the earliest possible time in a project.

However, disputes cannot be effectively identified in project operations without a proper framework of proven methodology and data. Personal knowledge and experience

have been the predominant methods of predicting disputes in conventional project operations. These practices are not sufficient to manage potential disputes in highly complex and competitive project operations. Therefore, this research aims to prove that most dispute cases reveal specific, identifiable causes of dispute through their dispute characteristics.

This research defines Critical Dispute Characteristics (CDCs) – project characteristics defined by retrospectively analyzing dispute cases in construction litigation. This process aids in the understanding of disputes and dispute potential. The CDCs are developed as part of a framework and methodology that will permit analysis of project performance from a dispute issue perspective.

The concept of this research began with the following two key notions:

(1) Dispute knowledge needs to be explicated into *precedence knowledge* so that it may be better utilized in *dispute diagnosis and prescription*, and

(2) In order to avoid reactive dispute resolution practices, an appropriate point in a project life cycle must be identified to proceed with improved *proactive dispute management*.

Dispute identification and the role of dispute knowledge

In Figure 1, the dispute identification process is categorized by disputes that bear precedence knowledge versus those that do not. If there is no available precedence knowledge, as shown in upper diagram of Figure 1, it is difficult to manage the dispute.

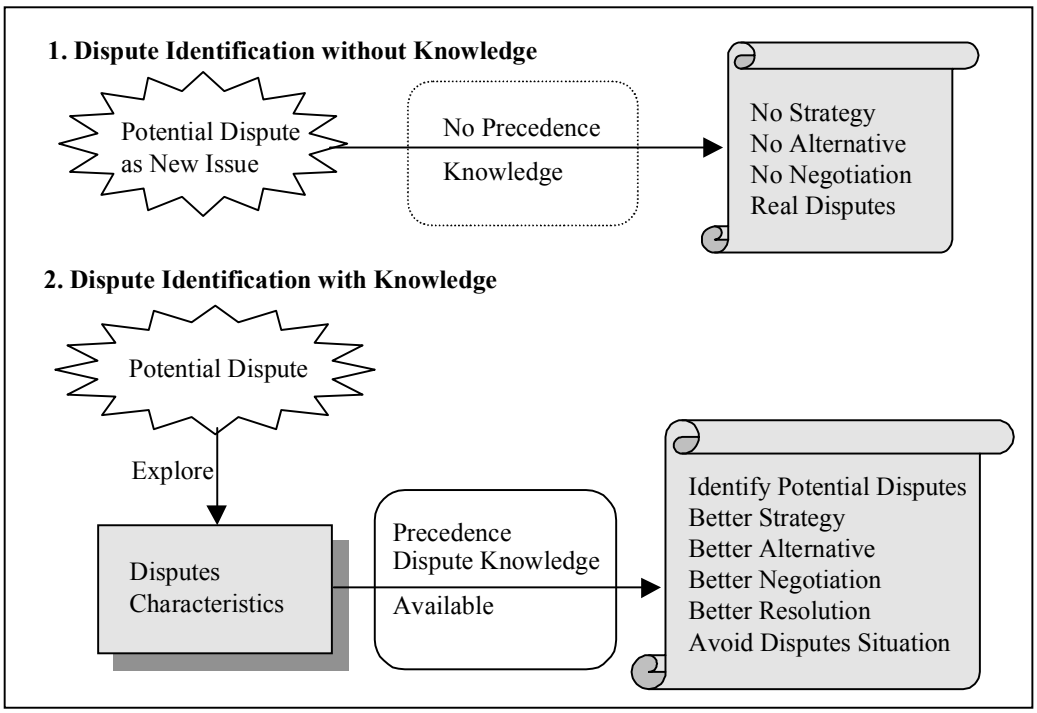


Figure 1. Disputes identification and the role of dispute knowledge

Therefore, it is difficult to develop a strategy to control disputes in project operations. Without a proper strategy, negotiation of the dispute issue may be difficult. There may be no alternative proposals in negotiation offered by the involved parties. Negotiation may not be fruitful because there is no knowledge in the context of dispute situation to serve as a basis for negotiation.

Without the knowledge of similar precedence dispute cases, even minor disputes can lead to high–risk situations because they can be transformed into "real" disputes. The concept of "*alternative proposals in negotiation*" for voluntary dispute resolution

such as mediation, posits that it is more important than third–party judgment such as arbitration and litigation [Fisher, 1991].

On the contrary, dispute knowledge can be created in the following situation as shown in the lower diagram of Figure 1. When precedence dispute knowledge is available, potential disputes can be identified through dispute characteristics. But for this to happen, dispute characteristics need to be clearly defined as Critical Dispute Characteristics (CDCs). Without a proper framework and methodology for categorizing dispute characteristics into a usable form, precedence knowledge cannot be utilized since there is no methodology to relate it to potential disputes.

When dispute knowledge is available from precedence dispute cases, the following can be expected: it is possible to identify potential disputes by defined dispute characteristics and precedence knowledge; better strategies for dispute resolution can be incorporated into project management; better alternatives can be available to parties in negotiation; and it can be possible to achieve a more harmonious resolution for all involved parties.

Dispute resolution practices in the project life cycle

Dispute resolution practices in the project life cycle are summarized in Figure 2. Dispute resolution in both current practices and proposed practice are compared in the project life cycle. The issue in these two diagrams is identifying the appropriate stage to start dispute management.

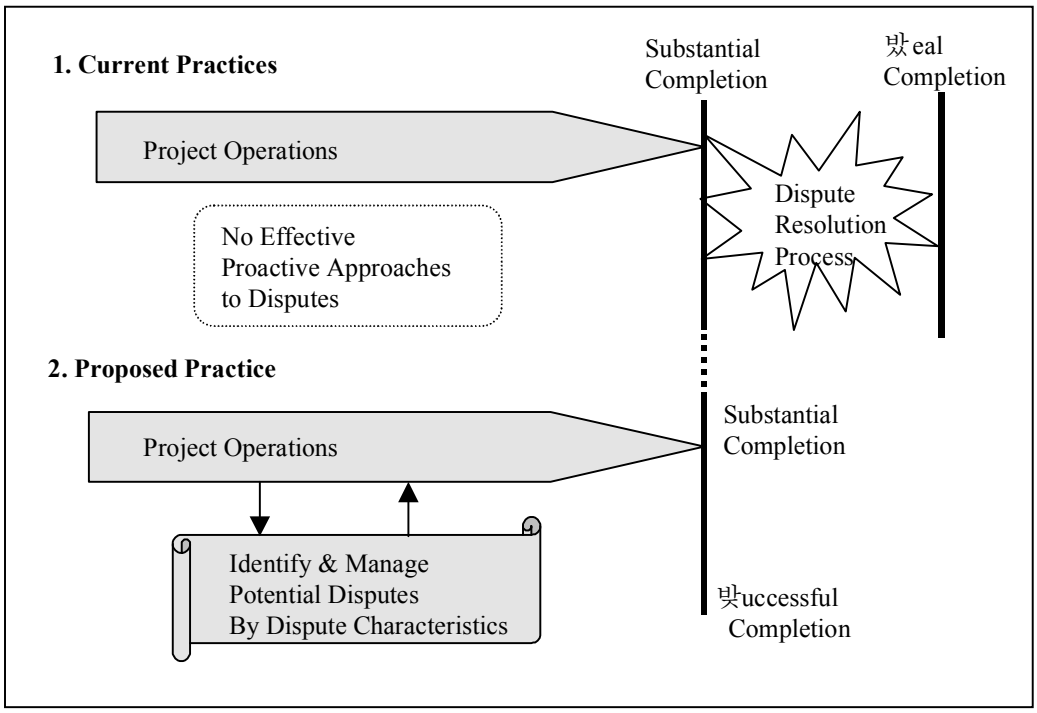


Figure 2. Dispute resolution practices in the project life cycle.

Current practices of dispute resolution in a project life cycle are depicted in the upper diagram of Figure 2. Current project management is more focused on the conventional construction operations than on dispute issues. To date, there has been no effective approach to manage the dispute issues proactively. The guiding practice in standard contract forms is to perform work first in spite of facing any disputes [AGC, 1997; AIA, 1997]. This is one way to substantially complete the project considering the complexity of construction operations. However, this is not necessarily the best procedure for the disputing parties to achieve mutual success in the project.

If there are no effective proactive approaches to resolve potential disputes during project operations, there might be a hostile dispute resolution process after substantial completion. Substantial completion is contractual definition of completion of the construction project where the owner can occupy or utilize the project for its intended use [Sweet, 1994]. However, even when the project is ready to be utilized, the "real completion" is often still far off for the project stakeholders unless all disputes are resolved. "Real completion" is often the stage when all the outstanding disputes are resolved as depicted in the upper diagram of Figure 2.

The proposed practice of dispute resolution is depicted in the lower diagram of Figure 2. The proposed practice is to identify and manage potential disputes by their characteristics during project operations. Therefore, dispute resolution efforts can be made during project operations. Disputes can be managed effectively for possible resolution with precedence dispute knowledge. In this case, substantial completion and "real completion" lose their distinction as terms. They both mean "successful completion." Most disputes can be resolved by parties with proper dispute knowledge if precedence dispute knowledge is related to a potential dispute.

Comparison of dispute resolution practices

The diagrams of Figure 2 are developed further in Figures 3 and 4. These two figures show detailed activities of the dispute resolution as they affect current and proposed dispute resolution practices, respectively.

Figure 3 presents current dispute resolution practice, which is focused on the reactive dispute resolution after the dispute is created. Dispute resolution efforts are also placed within later stages of the project life cycle. Figure 4 presents a concept of dispute management and dispute resolution efforts during the project life cycle. Figures 3 and 4 are explained in detail in Chapter 2 in terms of the role of dispute characteristics.

The focus of this research is to help project stakeholders by defining dispute characteristics. Results will be utilized to analyze project operations from a dispute issue perspective which in turn will be used to recognize potential disputes early in a project's life cycle. In addition, voluntary resolution processes may be more beneficial and less damaging to involved parties. This research also aims to form the foundation for the framework and methodology needed to advance the knowledge of disputes in construction operations, providing the foundation for creating new knowledge from precedence dispute cases.

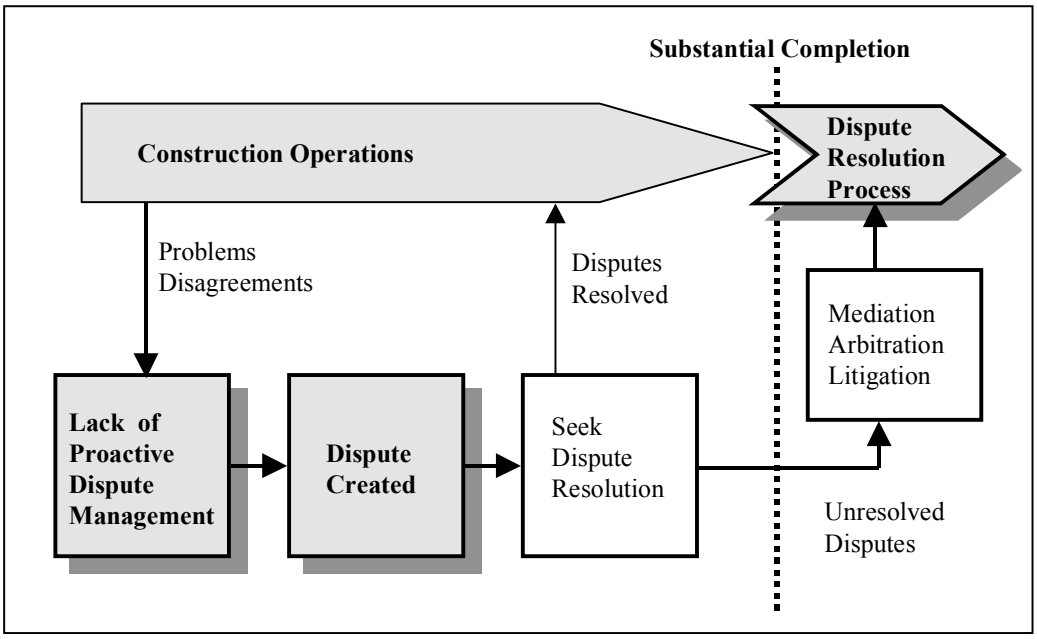


Figure 3. Current dispute resolution practice

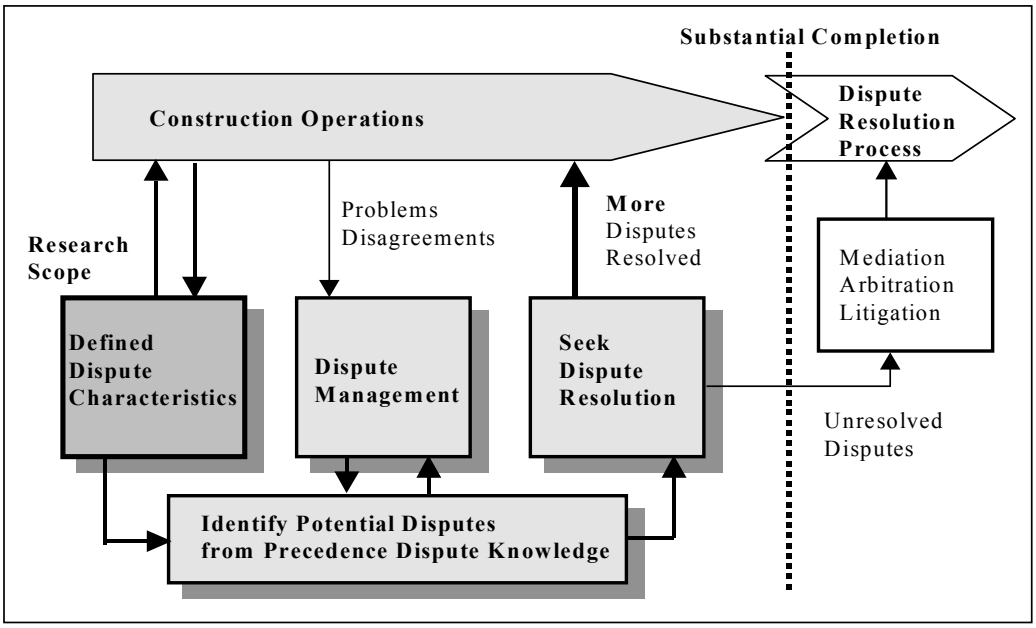


Figure 4. Proposed dispute resolution practice

1.3 Research Goal - Hypothesis & Question

1.3.1 Research Hypothesis

This research begins with the notion that *lessons learned from past dispute cases can be utilized to identify dispute characteristics on current projects*. If the causes of past disputes are identified through their characteristics in a dispute case record, the subsequent potential disputes can be identified in advance. This research focuses on the use of past lessons learned as precedence knowledge in defining dispute characteristics for every stakeholder in current projects.

The fundamental hypothesis of this research is: *"There are potential disputes during construction operations that are identifiable in advance by their characteristics."* This fundamental hypothesis is formulated for the goal of proposed *dispute management system (DMS)* in future research as outlined in Figure 5. The specific hypotheses under the present research question are: *"Dispute characteristics can be defined. The CDCs among all dispute characteristics can be defined."* Together, these hypotheses are formulated in the present and future research framework of defining *Critical Dispute Characteristics* and *DMS* as depicted in Figure 5.

Many dispute cases from various types of projects reveal specific causes of disputes. These causes are to be developed as dispute characteristics. The specific research hypothesis given above will be acceptable if the CDCs can be appropriately identified and defined among all known dispute characteristics contained within previous dispute

cases. The next section describes how this distinction is made between dispute characteristics and CDCs.

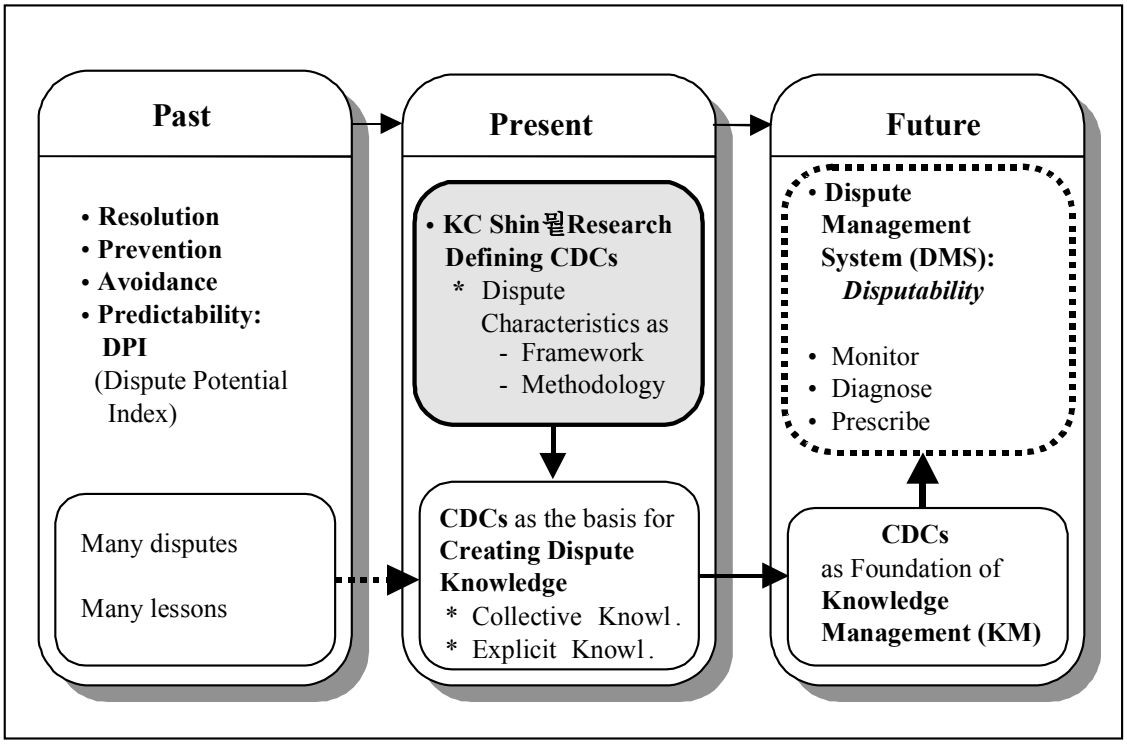


Figure 5. Context of present and future research in CDCs and DMS

The outline for research on CDCs and for development of a future dispute management system (DMS) is presented in Figure 5. In this context of present and future research, the specific hypothesis identified previously will be tested in this research. Further, the contents of Figure 5 are explained in greater detail in the research contribution section.

1.3.2 Research Questions

The research hypothesis implies the following specific question : *"Is it possible to identify dispute characteristics before the disputes take place?"*

The research question is developed from the notion that dispute characteristics are indicators of disputes in a current project. In following sections, classification of disputes and dispute characteristics are made to define the terminology in this research.

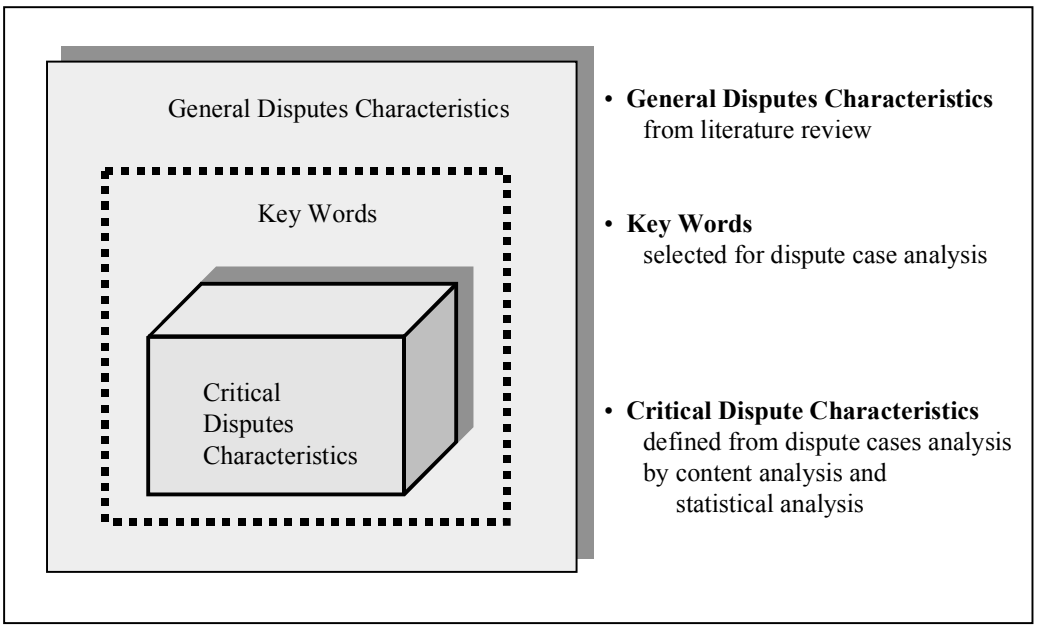


Figure 6. Classification of dispute characteristics

Dispute characteristics are classified in three levels as depicted in Figure 6: *General dispute characteristics* (GDCs), *Keywords*, and *Critical dispute characteristics* (CDCs).

General dispute characteristics are a set of classified dispute characteristics from a literature review. Many causes of disputes are found from a literature review [Diekmann, 1994; Arditi, 1999]. The causes of disputes are classified into known-dispute characteristics. A set of GDCs is built by classifying those known-dispute characteristics.

Keywords are a subset of GDCs. A set of keywords is used to measure their frequency in selected retrospective dispute cases. The process of selecting the final set of key words is elaborated in Chapter 4.

Critical dispute characteristics are project characteristics defined by analyzing retrospective dispute cases in construction project operations. CDCs are finalized by measuring their frequency through content analysis and statistical analysis. This research aims to define the role of CDCs as common causes of disputes.

Under the concept of classification of disputes and characteristics, this research presents a framework and methodology of defining CDCs from retrospective dispute cases.

1.4 Research Framework

1.4.1 Overview

The goal of this research is to define dispute characteristics during construction operations. In this section, the framework and scope of this research are summarized. The research framework aims to achieve this goal, through developing layers of conceptual frameworks in the research process. The concepts of this research framework are described in following key words: *disputes, characteristics*, and *identification*. Definitions and contexts for these key words are elaborated in the following sections.

1.4.2 Outline of the Research Framework

Major components in the research framework are illustrated in Figure 7 [Vanegas, 2000]. Initially, *research context* is explained by the pool of problems, needs, and opportunities. Based on this research context, disputes in construction operations provide the driver of this research.

The point of departure in this research is to develop a framework and methodology to analyze dispute cases for CDCs as a foundation of knowledge management in construction operations and construction organizations. The evolution of knowledge management within the general management domain is compared and contrasted with that in construction research and operation.

The *research question* implies the specific task of *identifying dispute characteristics from retrospective dispute cases analysis.* This research question is developed further in the research strategy and the methodology design.

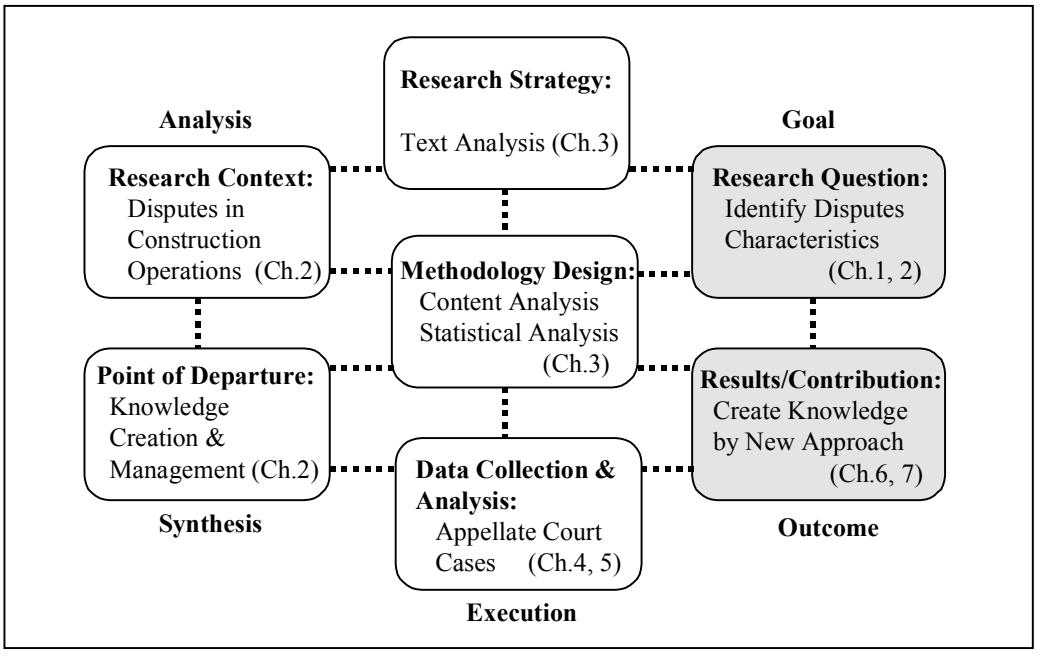


Figure 7. Research framework

The research framework encompasses an exploratory research study by proposing a process of knowledge creation through the defining of dispute project characteristics. This research aims to build a new approach to dispute issues, thereby exploring a source of new knowledge in the construction domain.

Research strategy is set to analyze text data as a way of creating new knowledge from existing qualitative data of dispute cases. Text data is selected from federal

appellate court cases which show a judge's analysis and decision on the issues in dispute. In *methodology design* section, content analysis and statistical analysis methodologies are selected to analyze text data of court cases. Content analysis is selected to interpret and quantify the text data. Statistical analysis is selected to analyze the measurement and validate the analysis results of the content analysis.

The data collection section show how construction dispute cases were selected from federal appellate court judgments. Data collection criteria are developed to select reasonable dispute cases from the pool of retrospective dispute cases. Dispute cases are selected by the presence of dispute keywords in the summary of particular judgment statement. Finally, dispute keywords are selected from the previously mentioned keywords obtained from the literature review.

The data analysis is executed in following order: collecting known-dispute characteristics from a literature review, classifying known-dispute characteristics, and building a set of *general dispute characteristics* (GDCs). A set of keywords as a subset of the GDCs is used to measure the frequency of keywords in selected federal appellate court cases. Therefore, a set of keywords in the GDCs becomes a framework to analyze selected court cases. Analysis of retrospective dispute cases through the measurement of keyword frequency in the text reveals the major (i.e., most frequent) causes of disputes, which I define as *critical disputes characteristics* (CDCs). A set of keywords in the GDCs and databases of retrospective dispute cases are the analytic engine used to define the CDCs. Using content analysis methodology, the final set of 14 CDCs is defined by their frequency and context from a set of 80 keywords. After measuring dispute

characteristics by content analysis, statistical analysis methods are used to validate the analysis of measurements by comparing their means.

Research results are to define *critical dispute characteristics* from retrospective dispute case analysis. With the result of defined critical dispute characteristics, the *research contribution* will be to create a new approach in construction operation practice.

1.4.3 Research Scope

The research scope is limited to disputes of contractual issues in construction operations. Among three types of disputes–contractual, organizational, and technical issues–contractual disputes are measured by frequency of key words, analyzed through content analysis, and interpreted through statistical analysis.

In the data collection process, numerous dispute cases from the federal appellate court are selected for analysis. Public and private construction projects are selected to cover a broad spectrum of construction projects. Various dispute cases from diverse projects, including architectural and civil projects, represent the real world situation of disputes among project stakeholders.

The source of data collection is federal appellate court cases in library database, which record the dispute and judgment [Lexis-Nexis, 2000]. However, most federal appellate court cases describe the worst dispute situations in construction projects because this is the last process in formal dispute resolution under the law and under

standard contracts. Only limited numbers of dispute cases continue to the federal appellate court without any types of prior dispute resolution.

Project stakeholders can use this framework and methodology to understand potential dispute issues and can make sound judgments based on defined dispute characteristics. This framework with dispute characteristics may work effectively as long as the participants act in goodwill.

1.5 Research Methodology – Strategy, Design and Execution

The largest challenge in this research framework is to filter the vast amounts of dispute knowledge from past dispute cases into a manageable subset of dispute characteristics. The research execution framework consists of *research strategy, research methodology design,* and *data collection and analysis* stages.

The *research strategy* introduces the concept of text analysis as a qualitative data analysis method which is a new approach to analyze disputes in construction operations. Qualitative data analysis is more complex than quantitative data analysis, such as time and cost related project data, particularly in terms of measurement. Under this research strategy, text analysis of retrospective construction dispute cases is selected to develop the concept of identifying disputes characteristics. The text analysis method is a proven methodology of extracting knowledge from the large amount of text records [Krippendorff, 1980; Weber, 1990].

In the *research methodology design*, content analysis and statistical analysis are selected to execute text analysis of construction disputes cases. *Content analysis* is selected to analyze text data by quantifying those qualitative data. *Statistical analysis* is selected to analyze and verify various outcomes from the quantitative data in content analysis. Finding precedence knowledge from qualitative data is developed as a methodology of text analysis of construction dispute cases.

The data collection process involves selecting construction dispute cases from federal appellate court judgments. Dispute cases are selected according to the presence and number of dispute keywords in the summary of a particular judgment statement. Text of dispute records is collected through a library database in electronic form [Lexis-Nexis, 2000]. The electronic format of text is an effective tool to analyze those dispute cases.

Data analysis is executed in following stages: measuring dispute characteristics by content analysis, analyzing the measurement by statistical analysis, and validating the analysis results. To measure dispute characteristics, dispute keywords are selected from the previously mentioned keywords found during the literature review.

This exploratory research framework seeks to identify disputes characteristics in the following stages: building a set of GDCs from the literature, measuring the frequency of key words from the text of retrospective dispute cases, and defining CDCs by measuring their frequency so that they can be used to identify dispute characteristics in current construction operations.

1.6 Research Results and Contributions

Through the data analysis of retrospective dispute cases, 14 CDCs are defined from federal appellate court cases: *defect, change, scope, cost, adjustment, bond, schedule, disputes, condition, undiscovered, definition, liability, warranty,* and *fraud*. Using content analysis methodology, the final set of 14 CDCs is defined according to their frequency and context within a set of 80 keywords. The importance of these 14 CDCs and the relationships among them are analyzed from various construction operations perspectives.

The contribution of the research is in developing a framework and methodology of characterization of construction disputes. This research project advances knowledge of disputes in construction operations by converting precedence disputes into a source of valuable knowledge for identification of dispute characteristics in current and future projects. This research develops a methodology for creating new knowledge of disputes from available data and precedence knowledge.

1.6.1 Proposed Functions of Dispute Characteristics

Dispute characteristics are part of a framework and methodology that will permit the analysis of project performance from a dispute issue perspective. Dispute characteristics contain multiple functions, helpful to the identification and understanding of disputes and their potential. These functions are summarized in Figure 8. Functions of *characterization*, *profiling*, *monitoring*, *diagnosis*, and *prescription* are defined as

follows [AHCD, 1993]; characterization and profiling are included in this research scope, and the rest are part of proposed future research.

Characterization is defined as the description of qualities or peculiarities. Characterization of construction disputes is a research problem solved by this research. This way, dispute characteristics form a framework which can be derived from the analysis of data in previous dispute cases and current project operations.

Profiling is defined to produce a formal summary or analysis of data representing distinctive features or characteristics. Further, a process of profiling disputes can be developed as a methodology to analyze retrospectively dispute cases in construction litigation. Profiling is central to the project objectives of this research.

Monitoring is defined as to keep track of systematically with the intent of collecting information. As a function of characteristics, this allows project stakeholders to keep track of project operations highlighting any dispute potential.

Diagnosis is defined as a critical analysis of the nature of something, as well as the conclusion reached by such analysis. Diagnosis contains two aspects which are critical to the analysis as a process and the conclusion as a product. The first, critical analysis as a process, is a tool to be developed in future research for identification of potential disputes. The second, conclusion as a product, is the future goal of a dispute management system outlined in Figure 5.

Finally, *prescription* is defined as an act of establishing official rules, laws, or directions. Prescription can be a tool to manage disputes with rules and directions

obtained from carefully defined dispute characteristics and precedence dispute knowledge.

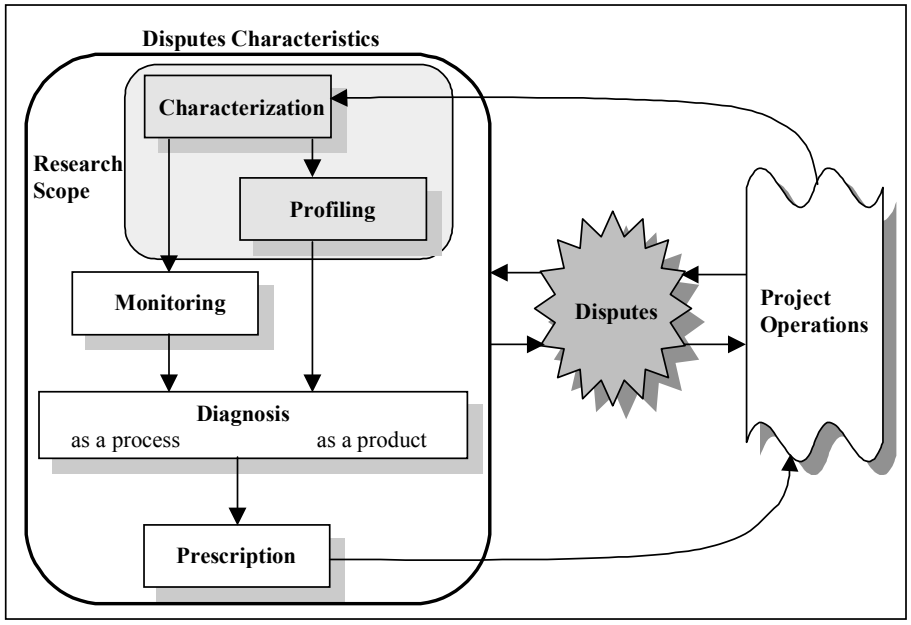


Figure 8. Proposed functions of dispute characteristics

Additionally, there is a need to develop new tools that can assist in monitoring construction projects from a dispute point of view, proactively diagnosing the potential for disputes in a project, and prescribing possible preventive actions. This research defines dispute characteristics which provide the cornerstone for the future development of integrated monitoring, diagnosis, and prescription systems to identify potential disputes during construction operations and provide alternative courses of action to prevent them.

To complete this system, different sets of methodologies are needed to show how to use dispute characteristics to correlate needs to be developed in future research.

1.6.2 CDCs and Dispute Management System (DMS)

The role of CDCs in the evolution of disputes research is depicted in Figure 5. In the past, dispute research studies were focused on resolution, prevention, avoidance, and predictability issues. While there are numerous lessons-learned from construction disputes, there are still many disputes in construction operations. CDCs are proposed as a foundation for the framework and methodology necessary to create dispute knowledge from retrospective analysis of dispute cases. In the future, these CDCs will provide the cornerstone for the development of an integrated monitoring, diagnosis, and prescription system needed to identify potential disputes during project operations. This is proposed as a dispute management system (DMS) for further research.

The contribution of this research to DMS development is the framework and methodology of knowledge creation formulated by dispute cases, characterization, and CDCs depicted in Figure 9. Although a starting point for eventual DMS development, identification of characteristics to manage disputes based on their initial characteristics is paramount.

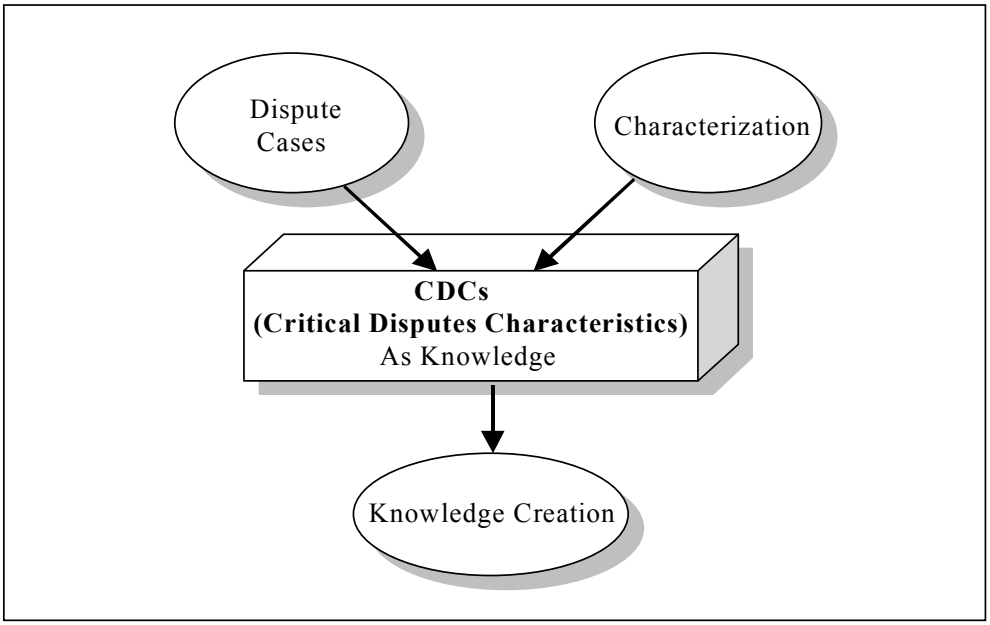


Figure 9. Disputes, CDCs and Knowledge creation

1.7 Reader's Guide

The outline of this dissertation is summarized by chapter as follows.

Chapter 2, *Points of Departure: Results from Literature Review,* describes the point of departure of the research from the literature review. The concept of a dispute is defined and classified, and dispute resolution practices are discussed. The concept of dispute characteristics is defined in the context of project management.

Chapter 3, *Research Methodology,* describes the research methodology in terms of the concept of identifying characteristics and the research strategy. The research methodology is presented as well as rationales for the choice of content analysis and statistical analysis.

Chapter 4, *Data Collection Process and Results,* describes the data collection process and results. The source of data, data collection criteria, and the collection procedure are described along with the selected results. The process and results of a pilot study are explained which is used to finalize the research methodology design and data collection process.

Chapter 5, *Data Analysis Process and Results,* describes the data analysis process and results. Data analysis criteria and procedure are explained. The results are validated through statistical analysis. Final data analysis is presented, and further data analysis is proposed for future research.

Chapter 6, *Research Results and Product,* describes the research results and the products of the research. Research results are presented and defined as a set of critical dispute characteristics.

Chapter 7, *Research Contribution, Extensions and Conclusions* describe the research contributions, future extensions and conclusions. The concept of knowledge creation is proposed as a framework of dispute management. Research contributions in knowledge creation and dispute management systems are presented as well as their implications for future research. The conclusion summarizes this research problem, result and contributions.

CHAPTER II. POINT OF DEPARTURE - RESULTS FROM LITERATURE REVIEW

2.1 Introduction

This chapter focuses on defining concepts of disputes and their characteristics. These elements are closely linked and provide an overall pool of knowledge from which a point of departure is established.

There have been numerous research studies on the subject of construction disputes. In these research studies, disputes are considered as an issue of avoidance or resolution instead of investigating the causes of dispute in construction operations. This research differs from them by treating disputes as a source of new knowledge from which to manage future disputes during construction operations. A proactive approach to dispute issues is proposed in favor of the avoidance or resolution procedures that are usually adopted in construction operations.

Previous research projects have provided valuable results which can improve construction operations significantly, including the Dispute Potential Index (DPI) [Diekmann, 1995], interpretation of contracts [Thomas, 1994], dispute factors [Arditi, 1999], and investigation into disputes [Jahren, 1990].

This chapter serves as a point of departure focused on various issues of disputes in construction operations. The concept of dispute is explained in its definition,

classification of disputes, and dispute resolution processes. Results of an extensive literature review on construction disputes are summarized in tables.

The concept of characteristics is defined and explained by types of characteristics in project management. Dispute characteristics are selected from the literature and summarized and classified in tables. The definition of *general dispute characteristics* (GDC) and *critical dispute characteristics* (CDC) are proposed in this chapter. In this context, the role of precedence dispute cases is developed as a source of new knowledge.

2.2 The Concept of Dispute

2.2.1 Introduction

In the context of disputes in construction operations, the concept of a dispute is dissected from various perspectives as follow: definitions from the literature, standard contracts, acts, and regulations; analysis of selected research; classification of disputes in project operations; and dispute resolution practices in a project life cycle.

Definitions of a dispute are reviewed respectively from standard contracts, acts, and regulations. Standard contract documents are considered as a guideline of the recent trends in the construction industry. Therefore, the dispute related clauses in the latest revisions of standard contracts are analyzed in detail to identify the concept of dispute and the process of resolution in construction operations.

Analysis of selected research in construction disputes is described to outline the current body of knowledge in construction dispute issues. The framework of this research is contrasted with other past research studies to show what this research aims to explore in dispute issues. Disputes are described and classified into three categories; contractual, organizational, and technical disputes.

In the same manner, dispute resolution practices are reviewed from various standard contract forms and regulations. Mediation methods are reviewed as a form of alternative dispute resolution (ADR), which is a recent trend in standard contract documents.

2.2.2 Definitions of Disputes

This research explores the process of identifying dispute characteristics from past dispute cases. Based on this new proposed framework, disputes are analyzed as a source of lessons learned, experiences, and precedence knowledge. Therefore, the definition of a dispute is developed as a point of departure. From a literature review, the definitions of dispute and claim are found together in construction contract terms.

Definitions in standard contracts

Dispute is described in the dictionary as *"to argue about; debate; to question the truth or validity of; contested for"* [AHCD, 1993]. In the context of construction, *Dispute* is defined as an argument about an issue concerning project operations. A dispute is the result of a debate over differences in two or more parties' understanding of

a situation [Vorster, 1993]. Therefore, the difference of positions in understanding a situation should be minimized to reduce the potential of a dispute.

Claim is defined in many standard contract documents as a procedure for dispute resolution. A claim is described *as "to demand or ask for as one's own or one's due; assert one's right to*" [AHCD, 1993]. In this research, a claim is defined as an action of demand resulting from a dispute situation in construction operations.

Table 1 Definitions of Claim in Standard Contracts

Type of Standard	Definitions
AIA A201 (1997)	"A claim is a demand by one of the parties seeking adjustment or interpretation of contract terms, payment, extension, or other relief…."
EJCDC 1910-8 (1996)	**"**A demand or assertion by Owner or Contractor seeking an adjustment of contract price or contract times, or both, or other relief with respect to the terms of the contract."

In private construction projects, standard contract documents are developed to guide construction practices including the documents by provided by the American Institute of Architects (AIA), the Association of General Contractors (AGC), and the Engineer's Joint Contract Documents Committee (EJCDC).

In the AIA standard contract, disputes and claims are used together in same manner. The definitions of claims are summarized in Table 1 which are abridged from the standard contract documents from the American Institute of Architects [AIA, 1997], and the Engineers Joint Contract Documents Committee [EJCDC, 1996]. In an AGC standard contract, the term claim is not defined, but the contract introduces *partnering* as

a dispute resolution process [AGC, 1997]. This is understood as an approach to resolve disputes more smoothly without building hostile relationships through the use of formal dispute resolution processes.

Definitions in acts and regulations

In a public construction project, the Federal Acquisition Regulation (FAR) and the Contract Dispute Act (CDA) are closely related with construction operations.

Federal Acquisition Regulation provisions provide uniform policies and procedures for acquisitions by executive agencies of the federal government as well as federally funded public projects. These provisions also serve as a model for many state and local government construction contracts [FAR; Levin, 1998].

The Contract Dispute Act (CDA) provides formal appeals procedures for claims denied by the government in federal contracts. This act includes various time requirements for the government to respond to claims, for the contractor to appeal, and for subsequent agency or court actions. The various provisions of the CDA have been incorporated into the FAR [CDA; Levin, 1998].

In the Federal Acquisition Regulation (FAR), c*laim* is described as *"a written demand or written assertion by one of the contracting parties seeking the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract..."* [FAR § 52.233-1].

The *claim* is described in Contract Dispute Act (CDA) as "*all claims shall be in writing and shall be submitted to the contracting officer for a decision*" [41 U.S.C. § 605 (a)]. However, the CDA does not define a claim itself.

These definitions show that most standard contract documents and regulations present definitions of claim as a procedure of the dispute resolution after disputes have occurred.

2.2.3 Construction Disputes Research in the Literature

Construction disputes have been a topic of numerous research studies. The research subjects cover dispute prediction, causes, avoidance, resolution, and claim issues as summarized in Tables 2 and 3.

Dispute resolution processes were also a major topic of research [Jahren, 1990; Thomas, 1994; Vorster, 1993]. The analysis of each research framework and results are provided in Table 2. This is a point of departure in the body of knowledge of construction dispute issues.

Fifteen research studies are compared with this research framework in Table 2. Five major research studies show intensive data analysis methodology with large quantities of data [Arditi, 1999; Diekmann, 1995; Thomas, 1994; Jahren, 1990; Diekmann, 1985]. These five research studies reveal different sets of characteristics, indicators, rules, and causes of disputes. The analysis of the selected five research studies within this research framework are summarized in Table 2.

Table 2. Analysis of dispute related research

Researcher		KC Shin, 2000	Arditi, 1999	Diekmann, 1995	Diekmann, 1985	Jahren, 1990	Thomas, 1990	Singh, 1991	Russell, 1991	Thomas, 1992	Zack, 1993	Thomas, 1994	Semple, Hartman; 1994	Jergeas, Hartman; 1994	Kangari, 1995	Hartman, 1996	Scott, 1997
Focused project life cycle	Before site operation			V							V					V	
	During site operation	V			V		V	V		V		V					
	After site operation		V			V			V				V		V		V
Focused project issue	Individual issues	V			V		V			V		V				V	V
	Overall project		V	V		V		V	V		V		V	V	V		
Type of outcomes	Predictive methods		V	V						V		V					
	Lessons learned	V			V	V	V	V	V	V	V		V	V	V	V	V
Focused on	Voluntary resolution	V					V					V					
	Third party resolution		V												V		
	Identify causes	V		V	V	V	V	V	V	V	V	V	V	V	V	V	V
Related stakeholders		OAECS	OAECS	OAECS	OAEC	AECS	OC	OAEC	CS	C	OC	C	OC	OC	CS	OCS	EC
Data		233 Appellate court cases (+ 31 for validation)	102 state circuit court cases (+ 12 for testing)	159 Projects (+ 25 for testing)	427 claims on 22 projects	30 structured interview	30 appellate court cases	–	9 major issues	45 appellate court cases (+10 for testing)	–	90 appellate court cases (+10 cases)	24 project survey	–	64 survey	31 survey	22 interview
Analyzed Characteristics		80 char.; 14 CDCs	43 (38) char.	38 char.	7 major claim types	–	10 major issues	–		10 steps developed	22 major lessons	6 steps developed	16 char.	7 major lessons	–	17 char.	7 major lessons
Methodology	Text analysis	V															
	Case study		V				V			V	V	V					
	Survey			V	V	V							V		V	V	V
	Research review							V	V					V			
	Other methods		CBR, ANN	Logistic regression													

Note: O-Owner; A-Architect; E-Engineer; C-contractor; S-Specialist; CBR-Case Based Reasoning; ANN-Artifical Neural Network

Criteria for literature review

The criteria for the analysis of dispute research are described in Table 2 as follows: focused project life cycle; focused project issue; types of outcomes; focused resolution type; related stakeholders; source of data; numbers of analyzed characteristics; and research methodology.

Given the fifteen research studies analyzed in Table 2, this research framework is also dissected according to those criteria. The analysis of research framework finds that the middle of project life cycle is considered to be the primary focus during site operations. However, individual dispute issues are the focus of analysis. Further, lessons learned from dispute characteristics are expected to be outcomes of research rather than predictive methods. Voluntary dispute resolution processes are considered as the focus of analysis. Every stakeholder is involved. Moreover, this research is designed to collect larger numbers of data by developing a larger set of characteristics. Finally, for this research, a text analysis methodology has been adapted.

Based on above set of criteria, selected research studies are analyzed as follows. *Focused project life cycle* is categorized as three groups: before, during, and after site operation. This research is different from many prior studies in that it is intended to be a foundation for predictive methods used during project operations by proactive identification of dispute characteristics.

The research on Dispute Potential Index (DPI) is the focus before site operation [Diekmann, 1995]. Dispute factors in litigation prediction is the focus after site operation

[Arditi, 1999]. Numbers of research projects show their focus during project operation [Diekmann, 1985; Sing, 1991; Thomas, 1994].

Focused project issues are either an individual issue or an issue for the overall project. Analysis shows that research studies are fairly well distributed in those two categories. The approach to individual issues is more helpful for resolving dispute issues on the project site at the earliest time by the project stakeholders [Diekmann, 1985; Thomas, 1992; Hartman, 1996; Scott, 1997]. Each past dispute can be used as precedence knowledge in identifying disputes characteristics. If each dispute incidence is reviewed from a perspective of overall project operations, the dispute analysis is less beneficial to resolve dispute issues because each dispute issue is not parallel to the overall project performance. In this research framework, a dispute issue is treated as independent of project performance instead of being treated as a project-wise issue.

Types of outcomes are categorized as either a predictive method or a method derived from lessons learned. Most of the extant research proposes a series of lessons learned from the data analysis [Jahren, 1990; Singh, 1991; Russell, 1991]. An important method to identify potential disputes is to recognize lessons learned from many precedence cases. On the other hand, predictive methods have been found to be an effective way to manage potential disputes [Arditi, 1999; Diekmann, 1995; Thomas, 1994]. Prediction of disputes for dispute management is a possible extension of this research since it can obtain results through usage of defined dispute characteristics.

Types of dispute resolution are categorized as voluntary or third-party resolutions. Most research studies identify the causes of disputes as a result of the research

undertaken. Therefore, these results need to be utilized in the dispute resolution process. However, many of them did not extended the scope to the dispute resolution process [Diekman, 1985; Russell, 1991; Zack, 1993; Jergeas, 1994]. When voluntary dispute resolution is adapted, dispute knowledge is more valuable in the negotiation process [Thomas, 1990 and 1994]. This is described in the lower diagram of Figure 1. In this research, the goal of identifying disputes characteristics is to resolve the dispute voluntarily at this earliest time before it becomes worse.

Related project stakeholders in disputes include owners, architects, engineers, contractors, and specialists. Some research findings are related only to a limited set of stakeholder groups [Thomas, 1990; Russell, 1991; Thomas, 1992 and 1994]. If all project stakeholders learn lessons from precedence dispute knowledge, this is ideal in dispute management.

Various *sources of data* have been tapped, including court cases [Arditi, 1999; Thomas, 1990, 1992, and 1994], project surveys [Diekmann,1995; Semple, 1994; Kangari, 1995;Hartmann, 1996], project claims analysis [Diekmann, 1985], and structured interviews [Jahren, 1990; Scott, 1997]. The strengths and drawbacks of data acquisition in case studies, surveys, and text analyses are discussed in detail in Chapter 3. Sample sizes vary in the selected research. More data collected for a larger number of years enables a broader array of data analysis tools to be employed. The breadth of data elements used in data analysis also varies across the research projects.

Selected *research methodologies* are categorized as text analysis, case studies [Arditi, 1999; Thomas, 1990, 1992, and 1994; Zack, 1993], or survey methodology

[Diekmann, 1995 and 1985; Jahren, 1990; Semple, 1994; Kangari, 1995; Hartman, 1996; Scott, 1997]. Text analysis is adapted to analyze dispute cases in this research. This is the only study that aims to analyze the text of past dispute records where each case is treated as precedence case law. Text is considered a source of precedence dispute knowledge, which can be collected and analyzed objectively through scientific methodology.

From the above literature review, this research framework is found to be unique and has never been tried before in the dispute research domain. Therefore, in terms of its framework and methodology, this study is proposed as an exploratory study. This discussion is expanded in the following chapters.

Comparison of approaches to research on dispute issues

Five major research projects among the fifteen previously discussed are selected for comparison of their research strategies and designs, as shown in Table 3. The selected research studies are analyzed by the following criteria: research goal, focused project life cycle, source of data, data analysis methodology, and defined characteristics [Arditi, 1999; Diekmann, 1995; Thomas, 1994; Jahren, 1990; Diekmann, 1985].

Research goals are summarized as a prediction of dispute [Diekmann, 1995], litigation outcomes [Arditi, 1999], rules of contract interpretation [Thomas, 1994], dispute avoidance [Jahren, 1990], and identifying causes of disputes [Diekmann, 1985].

In this research, the goal is to identify dispute characteristics for a foundation of dispute management during project operations.

The analyzed *project life cycle* is categorized in terms of the overall project life cycle [Jahren, 1990; Diekmann, 1985; Diekmann, 1995], and before or during the project life cycle [Thomas, 1994]. There is even a study focused on the litigation process after the project operation [Arditi, 1999]. In this research, the goal is to identify disputes during or before the project operation.

Table 3. Comparison of details in dispute related research

	KC Shin, 2000	Arditi, 1999	Diekmann, 1995	Thomas, 1994	Jahren, 1990	Diekmann,. 1985
Research Topic	CDC (Critical Dispute Characteristics)	Dispute Factors in Litigation Prediction	DPI (Dispute Potential Index)	Interpretation of Construction Contracts	Investigation into Construction Disputes	Claims: Frequency and Severity
Reference	KC Shin's Dissertation	JCCE, v13n3	JCEM, v125n4	JCEM, v120 n2	JME, v6 n1	JCEM, v111n1
Goal	Identify Critical Dispute Characteristics (CDC)	Prediction of the outcomes of litigation	Predict potential disputes	Rules of contract interpretation to resolve questions	Dispute avoidance by good management of people, policy, and communication	Identify cause of disputes
Focused Project Lifecycle	Before and during operation	For litigation process: Comparing of the result of CBR and ANN	Predict before construction begins in a project as a whole	Before and during operation	Overall project	Overall project
Data	233 Appellate Court cases, 30+ cases for validation	102 State (Ill.) Circuit Court cases, 12 cases for testing	159 projects survey, tested with 25 new projects	90 appellate court decisions reviewed. 10 cases to verify.	30 structured interview;	427 claims from 22 Federally funded projects
Data Analysis Methods	Content analysis, Statistical analysis	Used values for factors are 'yes-no' or 'one of a list.'	Logistic regression model; 4 Metrics of subjective and objective;	Review, case analysis	Review, case analysis	Review, case analysis
Characteristics	80 characteristics (keywords) ; 14 CDCs	43 variables (31 factors under 19 themes, 12 project background factors); actually 38 used in CBR; 45 used in ANN	38 potential indicators & 4 measures of contract disputes metrics; reduced to 8 hybrid variables; 5 dependent variables; 3 major groups of people, process, project	The rules are; 1) the plain-meaning rule; 2) patent ambiguity; 3) practical construction; and 4) interpret the contract as a whole.	Changed condition (17/30 counts), payment issue (9/30)	6 major causes are design errors, changes, differing site conditions, weather, value engineering, strike;

Source of data is summarized as court records [Arditi, 1999; Thomas, 1994], survey [Diekmann, 1995], structured interview [Jahren, 1990], and project claim records [Diekmann, 1985]. In this research, federal appellate court cases are selected for analysis of disputes.

Analysis methodology shows mainly the case study approach by analyzing each case [Thomas, 1994; Jahren, 1990; Diekmann, 1985]. Logistic regression [Diekmann, 1995] and an expert system approach [Arditi, 1999] were each adopted by just one research project. Characteristics, rules, and causes are developed by each research project. The more project characteristics that are selected in the analysis, the broader the range of disputes that can be revealed in the analysis. *Types of characteristics* show the focus of analysis in dispute issues. In this research, content analysis is used to analyze text data and larger numbers of characteristics are developed as *general dispute characteristics* to identify potential disputes.

The comparison of details in Table 3 shows various approaches to the dispute related research. Research results are presented as selected variables for analysis, dispute indicators, rules, and causes of disputes. Using the literature review as a point of departure, this research framework aims to pursue a new approach to text analysis and seeks to expand the body of knowledge in dispute issues by identifying dispute characteristics.

2.2.4 Classifications of Disputes

Based on the definition of disputes and analysis of dispute related research, the boundary of this research needs to be defined. The proposed three major types of disputes are: *contractual disputes, organizational disputes, and technical disputes.* This dispute classification is analyzed below from various perspectives as summarized in Figure 10.

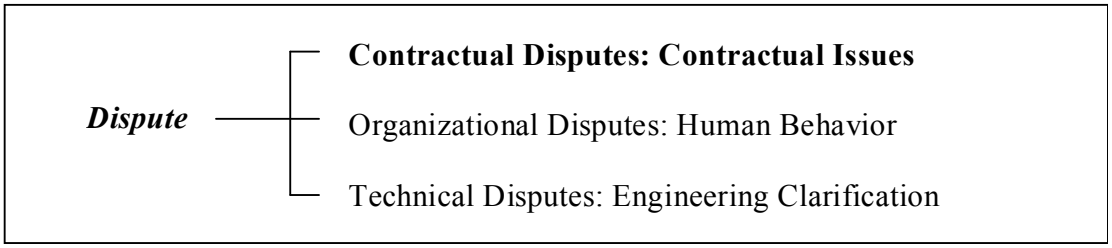


Figure 10. Classification of Disputes

Contractual disputes

Of the three classes of disputes in Figure 10, this research focuses on *contractual disputes*. Contractual disputes include definitions, interpretation, and clarifications of the contract. Contractual issues cause a significant portion of disputes in many projects [Diekmann, 1985; Hartman, 1996; Jahren, 1990; Thomas, 1994].

In project operations, standard contract documents are guided by industry organizations, codes, and regulations. This concept of a standard contract, to a certain degree, guides project operations toward standard contractual practices. Therefore,

standard contracts provide enough common ground for contractual definitions, clarifications in construction operations, and specific project requirements.

The contractual knowledge shared in standard contract documents provides the point of departure for contractual disputes in this research framework. If the contractual foundation is similar in construction projects, more dispute knowledge can be shared in the contractual disputes for specific project operations.

In the context of the standard contract and shared contractual knowledge, the contractual dispute is selected for the subject of this research. This research is intended to integrate precedence dispute knowledge from past dispute cases focusing on contractual disputes.

Organizational disputes

Organizational disputes are related to human behavior in project operations. Organizational disputes include human interactions, personality, cultures, and professional background among project stakeholders. Fraud and bad faith are also organizational issues, and a very obvious cause of dispute by project stakeholders. Other issues in human behavior, such as individuals' ambition, frustration, dissatisfaction, desire for growth, communication, and level of power are also causes in organizational disputes [Vorster, 1993].

These organizational disputes and human behaviors are excluded from this research framework because human interactions in the decision making process are not

appropriate to generalize by a framework. Therefore, the process of decision making in disputes is not analyzed in this research framework.

Technical disputes

Technical disputes include engineering clarification, which is a part of engineering decision making processes. Technical disputes are considered as the most common issues in project operations. For example, *request for information* (RFI) is considered an effective vehicle to clarify differences in understanding during project operations. By utilizing those RFI vehicles, most unclarified issues are resolved on site before they develop as a technical dispute. These disputes can be solved by project personnel with the appropriate expertise.

The engineering decision making process is fairly straightforward and reasonably justifiable for each participant. If technical disputes are unresolved, there are ways of resolving those dispute in project management, unlike the resolution of contractual disputes during project operations. Therefore, technical disputes are excluded from this research because they are too project specific and less transferable to the other projects.

2.2.5 Dispute Resolution Practices

In standard contract documents, acts, and regulations, the procedures of dispute resolution are outlined as a standard process. This process includes various alternative dispute resolution (ADR) methods, including mediation and arbitration, before starting litigation.

In the dispute resolution process, disputes need to be considered as a source of additional information for decision making in project operations. Potential problems and disagreements help to identify unrecognized disputes through discovering differences in project facts and positions among stakeholders [Levin, 1998]. Identification of disputes also helps to recognize differences in project knowledge and position for project operations through stakeholders' own insight.

For example, each party independently interprets the contract conditions of a project. Contractors have an obligation to inform owners of patent ambiguities or inconsistencies [Smith, 1997]. Ambiguities and discrepancies in understanding of a contract condition may cause potential problems. Project stakeholders can discuss ambiguities and discrepancies for better resolution of the problems if sufficient contract knowledge is available from past dispute related cases.

Many dispute cases are resolved easily among parties if they share goodwill during the project operation. However, some disputes remain unresolved until the end of project. Substantial completion, which marks the end of the project contractually, used to mark a starting point for a succeeding phase of "dispute resolution." Often dispute cases continue to ADR and litigation after substantial completion.

In this research, common practices of managing disputes are found to be inadequate. A new framework of managing disputes by their dispute characteristics is proposed as a result. Dispute can be resolved on the project site immediately if there is a proper management approach. Dispute resolution practices depicted in Figures 11 and 12 compare current dispute resolution practices and the proposed dispute resolution approach, respectively.

Current dispute resolution practices

The current, reactive dispute resolution practices are presented in Figure 11. Dispute resolution efforts are also made during later stages of the project life cycle.

As depicted in Figure 11, the conventional dispute resolution process begins after the completion of the project. Since there is no proactive management in dispute issues, problems and disagreement can develop into a dispute without any controls. During project operations, many disputes can be resolved, but unresolved disputes continue to the end of project in the form of a "dispute resolution project."

There are some existing methods to resolve disputes during project operations. A *dispute review board* (DRB) is a vehicle to resolve disputes during the project operation as suggested by ASCE and AGC standard contract documents [AGC, 1997; ASCE, 1991; Groton, 1993b]. However, DRB maintains a reactive approach until the dispute occurs and DRBs rely upon third-party judgments. The third–party judgment may not be

beneficial to the project stakeholders because precedence dispute knowledge cannot be fully utilized by stakeholders.

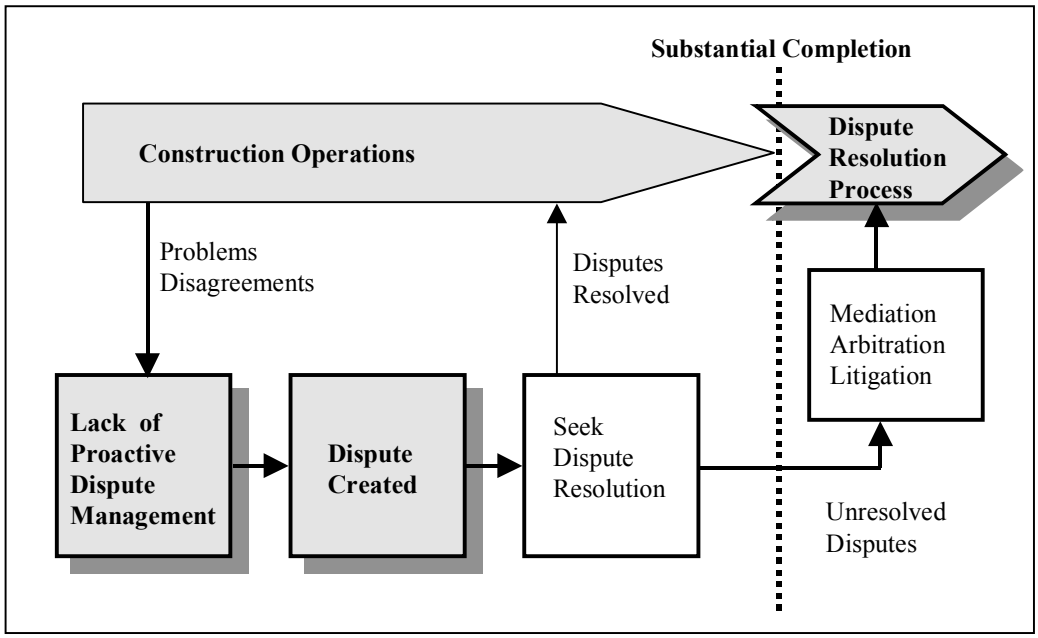


Figure 11. Current dispute resolution practice

Many ADR methods are suggested to resolve disputes including mediation and arbitration [CPR, 1994; Zack, 1998]. If those dispute resolution efforts are unsuccessful, the dispute case continues to litigation. Disputes in litigation are not common dispute cases by nature of the fact that they have gotten so far in the process. As a result, they serve as something of a "worst case scenario," but are nonetheless informative and can be used to extract lessons learned for proactive dispute management.

Proposed dispute resolution approach

The concept of dispute management during a project life cycle is summarized in Figure 12. The intent of this research is to help project stakeholders identify dispute characteristics early in the project life cycle. Voluntary resolution processes may be more beneficial or at least less damaging to all involved parties. This research is intended to advance the knowledge of disputes in construction operations and to find a way of creating new knowledge from precedence dispute cases.

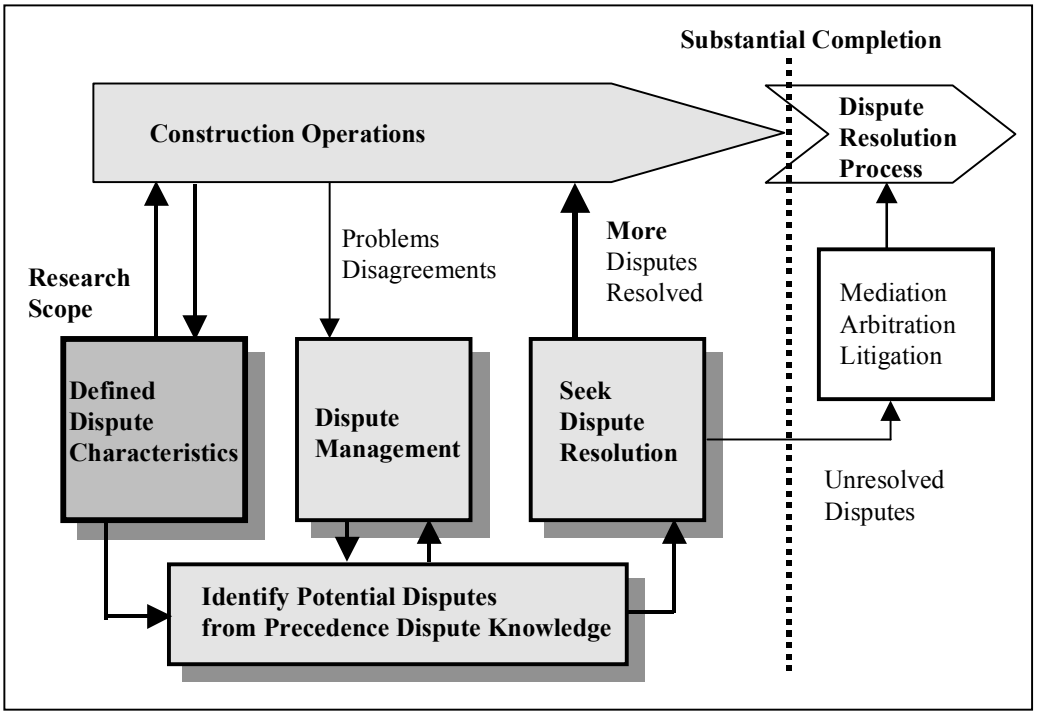


Figure 12. Proposed dispute resolution approach

Proposed dispute resolution approaches are depicted in Figure 12. The major differences from current practice are the inclusion of proactive knowledge creation and the utilization of dispute knowledge. Dispute knowledge from past dispute cases needs to be used to identify disputes characteristics in project operations. When an actual problem or disagreement occurs, those sources of disputes characteristics are managed as dispute knowledge. This approach is expected to increase the probability of dispute resolution during the course of the project. It may not be able to prevent or avoid certain disputes, but project stakeholders can use it to manage disputes during project operations.

The following two examples are introduced to show the role of dispute knowledge in project operations. The concepts of cooperation and voluntary resolution are explained from the perspective of dispute management.

The concept of cooperation and dispute knowledge

Considering the complexity of construction operations, cooperation is the key concept in the construction business. The project needs to proceed toward completion in spite of any disputes. One court judgment even stated that contractors will perform in a "workmanlike manner and without negligence" [Smith, 1997].

Standard contract documents provide clauses for this practice as well. In the AIA standard contract document, *continuing contract performance* is explained as "*Pending final resolution of a claim except as otherwise agreed in writing..., the contractor shall*

proceed diligently with performance of the contract and the Owner shall continue to make payments in accordance with the contract documents" [AIA, 1997].

In AGC standard contract documents, *work continuance and payment is explained as "Unless otherwise agreed in writing, the contractor shall continue the work and maintain the approved schedules during any dispute resolution proceedings. If the contractor continues to perform, the owner shall continue to make payments in accordance with the agreement"* [AGC, 1997].

This concept occasionally produces a misunderstanding for the project stakeholders during project operations. Focusing on the current work does not necessarily mean that the unresolved dispute can be resolved at the end of project successfully. Therefore, the contractor may face potential risk because it performs the work and then may not be fully reimbursed. On the other hand, the owner party might not receive sufficient service and product from the architects, engineers, and contractors because the owner's interim payment has already been made regardless of resolving outstanding disputes.

Disputes can be resolved by contract conditions and circumstances during an operation if both parties utilize enough dispute knowledge from past dispute cases under their dispute management. The nature of disputes in construction operations is comparatively complex and has evolved over a long period of time. The dispute process creates a huge volume of text in documents from dispute management. Therefore, documentation is a source of past knowledge in dispute management. In this research, documents are analyzed by a scientific methodology to explore hidden knowledge from the text data.

The voluntary dispute resolution and dispute knowledge

A change in dispute resolution practices became a trend in the late 1990s. The trend shows the transition of dispute resolution from third–party decisions to voluntary negotiation. Alternative dispute resolution (ADR) became a popular concept as an "alternative" to conventional third–party judgment from litigation. It is focused on issues of voluntary resolution of disputes [AAA, 1994].

Voluntary negotiation becomes an important vehicle to resolve complex construction disputes which require a long time and a huge expense. Negotiation is intended to achieve a *win-win* situation instead of the landslide decisions often handed down through third–party judgments. In the negotiation process, voluntary negotiation is guided by the popularly used acronym, BATNA–*Best Alternative to a Negotiated Agreement* [Fisher, 1991]. Dispute knowledge from precedence dispute cases becomes important in developing alternatives for negotiation.

The 1997 revision of AIA standard contract documents introduced mediation as the first vehicle for dispute resolution [AIA, 1997]. The change, emphasizing the importance of mediation, was made to the arbitration clause which was the first vehicle of ADR until then. This step was taken even though arbitration is widely accepted as an ADR vehicle, because it still relies upon the third–party judgment. However, mediation is much different in nature than the role of negotiation. Mediation leads to mutual agreement by the involved parties' by way of voluntary alternative proposals. As a trend in 1990s, the standard contracts of AGC and DBIA reflected this change within their contract clauses [AGC, 1997; DBIA, 1998].

One of the points of departure in this research is that disputes need to be considered a source of dispute knowledge and part of overall project operations and knowledge creation. This research study asserts that projects and organizations need to manage knowledge of disputes as an important way to develop alternatives based on past dispute cases and dispute knowledge. To accommodate this trend of change, the framework and methodology of managing dispute knowledge is incorporated and developed in this research.

2.3 The Concept of Characteristics

2.3.1 Introduction

Project characteristics are a commonly used framework to analyze performance of a construction project during its operations. Numerous research studies have proposed various sets of project characteristics from different perspectives of analysis. Project characteristics are categorized in terms of the characteristics of the dispute, performance, success, risk, failure, and partnering as summarized in Table 4.

In this research, dispute characteristics are reviewed in detail among the broader set of project characteristics. Definitions of *general dispute characteristics* (GDC) and *critical dispute characteristics* (CDC) are proposed for data analysis in following sections.

2.3.2 Definition of Characteristics

A characteristic is defined as *a feature that helps to distinguish a person, thing, trait, quality, or property* [AHCD, 1993]. In this research, characteristics are used as a framework to analyze the performance of construction operations. Numerous research projects in construction engineering and management (CEM) have developed sets of characteristics for construction operations as listed in Table 4.

Under this research framework, the nature of dispute characteristics is analyzed for data collection and data analysis in the following sections. The concept of dispute characteristics becomes a framework to analyze selected dispute cases.

Definition of dispute characteristics

Dispute characteristics are categorized in three groups as depicted in Figure 13: *general dispute characteristics* (GDCs), *keywords*, and *critical dispute characteristics* (CDCs).

General dispute characteristics are a set of classified dispute characteristics that resulted from a literature review. The causes of disputes are identified as known-dispute characteristics, which are then classified into sets of GDCs.

Keywords are a subset of *general dispute characteristics*. A set of keywords is used to measure their frequency in selected retrospective dispute cases. Therefore, a set of keywords in GDCs becomes a framework to analyze selected court cases. The process of selecting final set of keywords is elaborated in Chapter 4.

Critical dispute characteristics are project characteristics defined by analyzing retrospective dispute cases with keywords to identify common causes of past disputes. *Critical dispute characteristics* are the result of measuring frequency of keywords through content analysis and statistical analysis. This research aims to define the set of *critical dispute characteristics* as common causes of disputes.

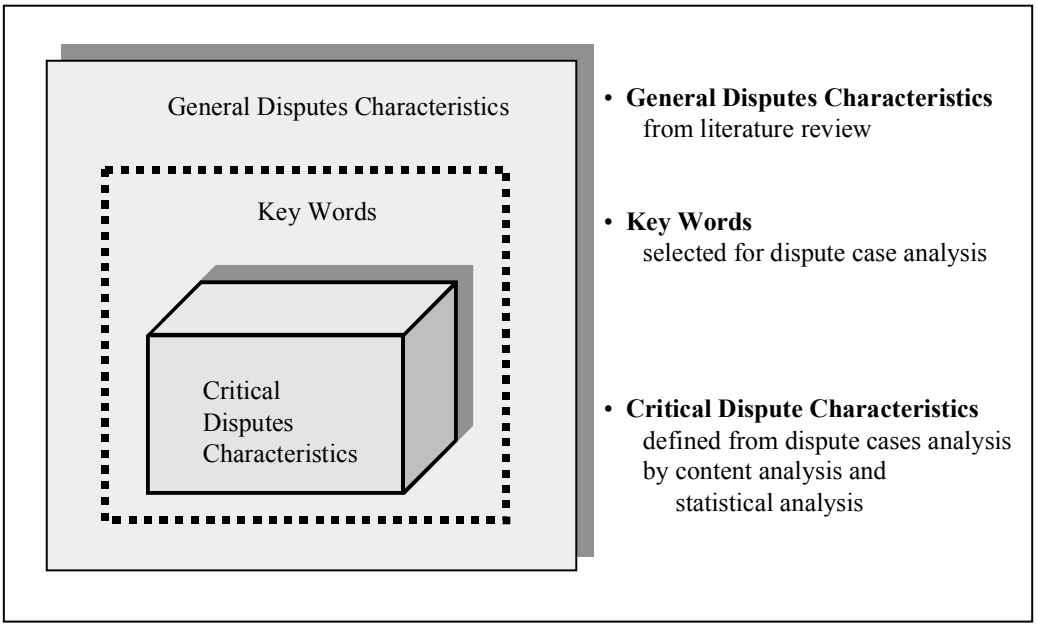


Figure 13. Classification of dispute characteristics

By defining *critical dispute characteristics* in dispute management approach, potential dispute issues in a project can be identified for further managerial oversight. Once managerial attention is focused on a potential dispute issue, opportunities for proactive dispute resolution are made available to the project stakeholders.

This exploratory research framework seeks to identify disputes characteristics through building a set of GDCs from the literature, measuring the frequency of keywords in GDCs from the text of dispute cases, and defining CDCs from their frequency of occurrence in dispute cases.

Research on characteristics

In this research project, numerous project characteristics enable development of a framework for analysis of project performance given various perspectives of project operations. Various characteristics in project management have been defined through a number of research studies as summarized in Table 4.

In Table 4, the research studies are classified by six major groups of characteristics as follows: *dispute, project performance, success, project risk, project failure*, and *partnering and alternative dispute resolution (ADR).*

These research studies are categorized into two groups by research strategy: research with rigorous data analysis and research in a conceptual or framework approach. Many sets of dispute characteristics are found from the research in Table 4. Among these selected research studies, dispute characteristics are analyzed further to develop GDCs for dispute case analysis. Some of the major research findings in dispute characteristics are as follows: Dispute Potential Index (DPI) [Diekmann, 1995], litigation prediction [Arditi, 1999], and interpretation of contract [Thomas, 1994].

Table 4. Classification of research on project characteristics

	Dispute Characteristics	Performance Characteristics	Success Characteristics	Risk Characteristics	Failure Characteristics	Partnering / ADR Related
Research w/ rigorous data analysis	Construction Claim (Diekmann, 1985)	Interaction (Pocock, 1996)	Success (Jaselskis, 1991)	Risk (Abdou, 1996)	Business Failure (Kangari, 1988)	Partnering in 280 Projects (Larson, 1995)
	DPI (Diekmann, 1995)	Performance Model (Alarcon, 1996)	CSF (Sanvido, 1992)	Risk Management (Bing, 1999)	Failure (Russell, 1991)	
	Litigation Prediction (Arditi, 1999)	Performance (Russell, 1997)	DBSF (Molenaar, 1997)	Risk Perceptions & Trends (Kangari, 1995)	Pre-Award Failure (Russell, 1992)	
		DOI (Pocock, 1997)	CSF (Chua, 1999)	Contract Clauses (Ibbs, 1987)	Failure (Russell, 1996)	
Conceptual approach w/ framework	Construction Dispute (Jahren, 1990)	Building Performance (Mohsini, 1992)	CSF (Boynton, 1984)	Construction Risks (Macomber, 1989)	Corporate Risk (Minato, 1998)	Partnering (Cook, 1990)
	Notice Requirement (Thomas, 1990)	Post Evaluation (Garsden, 1995)	CSF (PMI, 1997)	Civil Engineering Contract (Wartel, 1989)		Mediation In H.K.. (Chua, 1992)
	Conflict Management (Singh, 1991)	Budget Performance (Chua, 1997)		Liability Crisis (Lunch, 1990)		Computer Supp.Nego. (Penamora, 1995)
	Disputes in Bond (Russell, 1991)	Cons. Manager Perf. (Abdel-Razek, 1997)		Surety Overview (Russell, 1990)		ADR (Treacy, 1995)
	Misrepresentation (Thomas,1992)			Oral Change Order (Thomas, 1991)		Partnering Conceptual Model (Crowley, 1995)
	Claimsmanship (Zack, 1993)			On-demand Guarantee (Tiong, 1992)		Beyond ADR (Ellison, 1995)
	Interpretation of Contract (Thomas, 1994)			Contracting Method (Gordon, 1994)		Partnering & ADR (Miles, 1996)
	Causes & Cost Time Overrun (Semple, 1994)			Cause of Delay (Assaf, 1995)		Partnering (Crane, 1997)
	Claim Avoidance (Jergeas, 1994)			Uncertainty (Russell, 1995)		Small Const. Project (Conley, Gregory, 1999)
	Const. Docu.(Kangari, 1995)			Change Issues (Ibbs, 1997)		
	Latent Dispute (Hartman, 1996)			Change Order (Kuprenas, 1997)		
	Delay Claim in UK (Scott, 1997)			Political Risk (Wang, 1999)		

In selected research, predictive models are presented in construction performance by the characteristics of success, failure, and disputes [Russell, 1992; Sanvido, 1992; Diekmann, 1995; Pocock, 1997; Molenaar, 1997; Chua, 1999; Arditi, 1999].

Critical Success Factors (CSFs) are another way of analyzing a project performance from a positive perspective contrary to disputes from the negative

perspective. Research on CSF is used to develop *general dispute characteristics* because these characteristics allow broader view of the project, which includes success issues [Jaselskis, 1991; Sanvido, 1992; Molenaar, 1997; Chua, 1999].

Dispute characteristics

The process of developing a set of dispute characteristics is described in Chapters 4 and 5. In this section, sets of dispute characteristics are presented to show the details of each set of characteristics in the literature. Two sets of dispute characteristics and two sets of success characteristics are summarized in Table 5.

Critical success factors are selected to analyze project performance in connection with dispute characteristics. Therefore, these sets of CSFs are contrasted with dispute characteristics to develop the final set of GDCs because success in a project can be considered as an opposite way of defining dispute in a project.

These sets of characteristics show that a project can be analyzed from a broad perspective of disputes and success issues as follows: A research study on dispute factors has proposed 31 dispute factors and 12 project factors [Arditi, 1999]; the DPI study proposed 38 attributes and 8 hybrid variables [Diekmann, 1995]; the Critical Success Factors study proposed 53 attributes in 9 groups [Sanvido, 1992]; another set of CSFs were proposed identifying the overall top 10 characteristics from 67 characteristics [Chua, 1999].

Table 5. Project characteristics by major research

Arditi, 1999 - v13 n3	**Diekmann; JCEM, v121n4**	**Sanvido; JCEM v118n1**	**Chua, 1999 - JCEM v125 n3**
Dispute Factor Input Features	**Dispute Potential Index (DPI)**	**Critical Success Factor (CSF)**	**Critical Success Factor (CSF)**
19 topic w/ 31 items, 12 project factors	159 proj, (+ 25 cases testing), 38 attri, 8	9 group>53 attri; 16 proj	67 characteristics
Status of parties involved	**People**	**Facilitity team**	
Type of Plaintiff	**Project**	>management team	**Project aspect**
Type of defendant	**Process**	>planning team	Project characteristics
Type of counterplaintiff	owner	>design team	Contractual arrangements
Type of counterdefendant	contractor	>construction tream	Project participants
Third party plaintiff	business relationship	>operation team	Interactive Processes
Third party defendant	external	**Contracts, changes, obligations**	
Any posttrial filed	internal	>management contract/ plan	**Construction Project Success**
Resolution technique involved/ used	Pre-construction Planning	>planning contract/ plan	Budget performance
Type of contract	Construction contract	>design contract/ plan	Schedule Performance
Contract value	environmental issues	>construction contract/ plan	Quality performance
Type of designer used	public interference	>operation contract/ plan	Project characteristics
	site limitation	**Facility experiences**	Contractual arrangements
Direct **changes**	remoteness	>management exp.	Project participants
Constructive **changes**	availability of capable craftmen/subcontractors	>planning exp.	Interactive Processes
Radical **changes** in scope	Input from all group involved	>design exp	
Misrepresentation of **site**	financial planning	>construction exp	**Overall top 10 characteristics**
Unknown **site** conditions	permits and regulations	>operation exp	Adequacy of plans and specification
Conditions discovered in prebid **site**	scope definition	**Resources**	Constructability
Compensable **acceleration**	pioneer proj	>management reso	Construction control meeting
Non-Compensable **acceleration**	design complexity	>planning reso	Contractual motivation (Incentives)
Compensable **delay**	construction complexity	>design reso	Economic risks
Excusable **delay**	size	>construction reso	Formal communication (Construction)
Non-excusable **delay**	realistic obligation	>operation reso	PM commitment and involvement
Concurrent **delay**	risk identification/ allocation	**Products**	PM competency
CPM involved	adequacy of technical plans/ specification	>site	Realistic obligations/clear objectives
Contractor **coordination**	formal dispute resolution process	>constructed facility	Site inspections
Supplier has contract with whom	operating procedures	>operational facility	
Estoppel doctrine involved	team building	**Product information**	
Subcontract involved	history together	>facility idea	
Provision of contract involved	power balance	>planning info/ program	
Claim for material and equipment involved	expectation of future work	>design information	
Alternative material and equipment used	Capable management	>construction information	
Installation requirements satisfied	effectiveness of responsibility	**External**	
Misrepresentation of supervision	experience with proj type	>external factors	
Legal interpretation of **contract documents**	success of past	>owner's home office	
Legal interpretation of **drawings and**	experience/ competence	>planner's home office /sub	
Technical testimony (**quality of work**	motivation (reward)	>designer's home office/ sub	
Liquidated damage involved	interpersonal skills	>constructor's home office/ sub	
Measure of **damages**		**Optimization information**	
Surety bonds	21 variables combined into 8 hybrid variables.	>user's information	
Surety assured	Owner's management and organization	>designability information	
Non or late **payment**	Contractor management and organization	>constructability information	
Lien case involved	project complexity	>operability information	
	project size	**Performance information**	
	financial planning	>project	
	project scope definition	>planning	
	risk allocation	>design	
	contract obligation	>construction	
		>operation	

2.3.3 Summary of Dispute Characteristics from a Literature Review

Many dispute characteristics are found for this research framework from a literature review in Tables 4 and 5. Six groups of past research studies in Table 4 –disputes, project performance, success, risk, failure, and partnering–were utilized to develop a set of dispute characteristics in Table 5 for the data analysis.

Table 6. Dispute characteristics from literature review

Dispute Characteristics	Key words in disputes
Change	Addition, Deletion, Revision, Issuance of Change Order, Authority to Issue, Numbers of change, Scope of Change
Design/Specification	Error/Omission, Experience, Deficiency, Coordination, Complexity
Contract Condition	Definition, Ambiguity, Scope, Liability, Notice Requirement
Work	Quantity, Quality, Complexity Site Access, Sub-surface Condition, Defective work, Liability, Performance Risk, Warranty
Time/Cost	Delay, Disruption, Acceleration, Cost overrun, Loss & Damage
Completion	Practical Completion, Payment, Liquidated Damage

While numerous characteristics were collected, some categories of characteristics were found within the dispute characteristics. A group of characteristics can be used more effectively to describe an issue in project operations. Therefore, numbers of groups are developed to represent major activities in dispute related processes.

As a result of categorizing characteristics in Table 5, a set of dispute characteristics is proposed as a point of departure for this research and is presented in Table 6 [Arditi, 1999; Diekmann, 1995; Sanvido, 1992; Chua, 1999]. This is a synthesis process as well as a selection process among numerous characteristics. Selected dispute characteristics are categorized to develop similar concepts together in six major groups: change, design and specification, contract conditions, work, time and cost, and completion. Each category includes many synonyms which represents closely related activities in construction operations. In this way, many synonyms in characteristics can be treated as categories of major concepts.

This framework of dispute categories is developed to analyze retrospectively dispute cases according to their dispute characteristics. The following set of dispute characteristics in Table 6 is defined further through the pilot study as presented in Chapter 4.

2.4 Synopsis

In this chapter, the results of a literature review were summarized as a point of departure from the research on dispute issues. The concept of a dispute was defined and classified according to dispute resolution practices. Likewise, the concept of characteristics was explained, and defined. Selected research studies on various project characteristics and selected dispute characteristics were reviewed. The outcome of the review was a set of GDCs that form a starting point for the methodology described in the following chapter.

CHAPTER III. RESEARCH METHODOLOGY

3.1 Introduction

Text data do not speak for themselves. The researcher must do the speaking and the language of the speech is the language of theory [Weber, 1990].

Weber's book, "*Basic Content Analysis,*" rigorously summarized the theory of content analysis as a research methodology and synthesized a number of major discussions in content analysis previously made. The process of text analysis was described in terms of a theory of qualitative data analysis. Text data can produce valuable results from proper data and analysis methodologies. Text data analysis is becoming more valuable with the increasing availability of electronic data.

This chapter provides an in-depth discussion on the process of dispute identification, research strategy, research methodology design, and details of content analysis and statistical analysis. The chapter describes the process of selecting proper data and methodology for the analysis of construction disputes. The research strategy is based on the concept of text analysis to create new knowledge from precedence dispute data. The concept of dispute identification is described as analyzing text data from retrospective dispute cases. Among the possible research methodologies (such as content analysis, case studies, or surveys), content analysis was selected and is described in detail in terms of its definition, procedures, and major issues to be noted. Selected statistical analysis

techniques, the t-test and the Mann-Whitney test, are described. This chapter summarizes and outlines the selected methodologies under the "*language of theory*."

3.2 The Process of Dispute Identification

The research goal is to identify critical dispute characteristics through detailed analysis of dispute cases. While the definitions of characteristics are described in Chapter 2, the concept of identification is defined as follows.

Identification is defined as "to ascertain the origin, nature, or characteristics of; to associate or affiliate closely with a person or group" [AHCD, 1993]. In this research, *identification* is defined as a process of pursuing the major dispute causes through a set of characteristics.

The process of dispute identification starts from analyzing text data of retrospective dispute case records. Text data contains lessons learned, experiences, and knowledge of past dispute cases in project operations. Those text data include various aspects of project operations, such as contractual, organizational, and technical issues.

Steps in dispute identification are described in Figure 14. The goal of identifying dispute characteristics is achieved through data collection, content analysis, and statistical analysis inherent to the research framework.

Conventional construction operations focus on the quantitative data derived from project operations, such as schedule and cost data. Therefore, managerial emphasis is placed more on quantitative resources than on qualitative resources in construction

operations. Qualitative data in textual form are often disregarded in project operations and research studies of construction management because a methodology has not previously been fully developed to utilize text in a meaningful way.

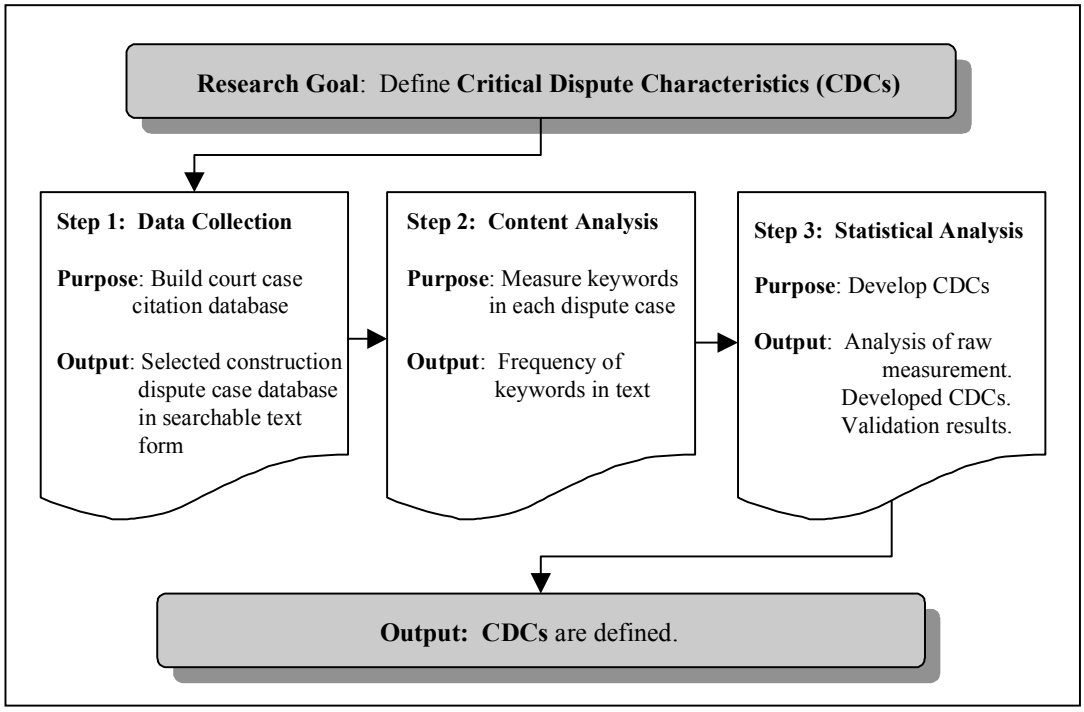


Figure 14. Steps in research strategy to define CDCs

Proper methodologies for the process of defining dispute characteristics will allow for the thorough utilization of text data in project operations. Therefore, possible research strategy and methodologies are reviewed by their strengths in the following sections.

3.3 Research Strategy

The research strategy concerns the global vision and characterization of this research study. The research strategy introduces text analysis to develop the concept of defining dispute characteristics from precedence dispute cases. This strategy is a new approach to analyze disputes in construction operations. Text analysis, as a method of extracting knowledge from a large amount of text data, has proven useful in other research fields, such the as social sciences and management [Kabanoff, 1995; Larwood, 1995; Roberts, 1997; Ross, 1997].

From the literature review in Table 2, sources of data used in dispute research studies include court cases, survey data, and interview data. Most prior research of court cases were analyzed through case study methodologies under the legal research approach. Survey and interview research studies have produced numerous data and analysis results.

Among the sources of data in Table 2, court cases are not fully analyzed with regard to their contents from the perspective of dispute management. In the literature on dispute studies, court cases are commonly analyzed through case study approaches which are sufficient to develop "*individual knowledge"* from the case (often the aim of these previous studies). However, "*collective knowledge,"* which embodies the lessons learned across multiple dispute cases, needs to be developed for dispute management.

A dispute record exists as data until it is analyzed under a research framework. A dispute record can be regarded as *individual knowledge* when it is analyzed under case study methodology. However, *collective knowledge* needs to be developed from multiple

dispute cases analysis in order to build *dispute knowledge* for dispute management in a future dispute management system.

The process of developing *collective dispute knowledge* from past dispute cases is an important framework and methodology for defining CDCs. This processes is depicted in Figure 15.

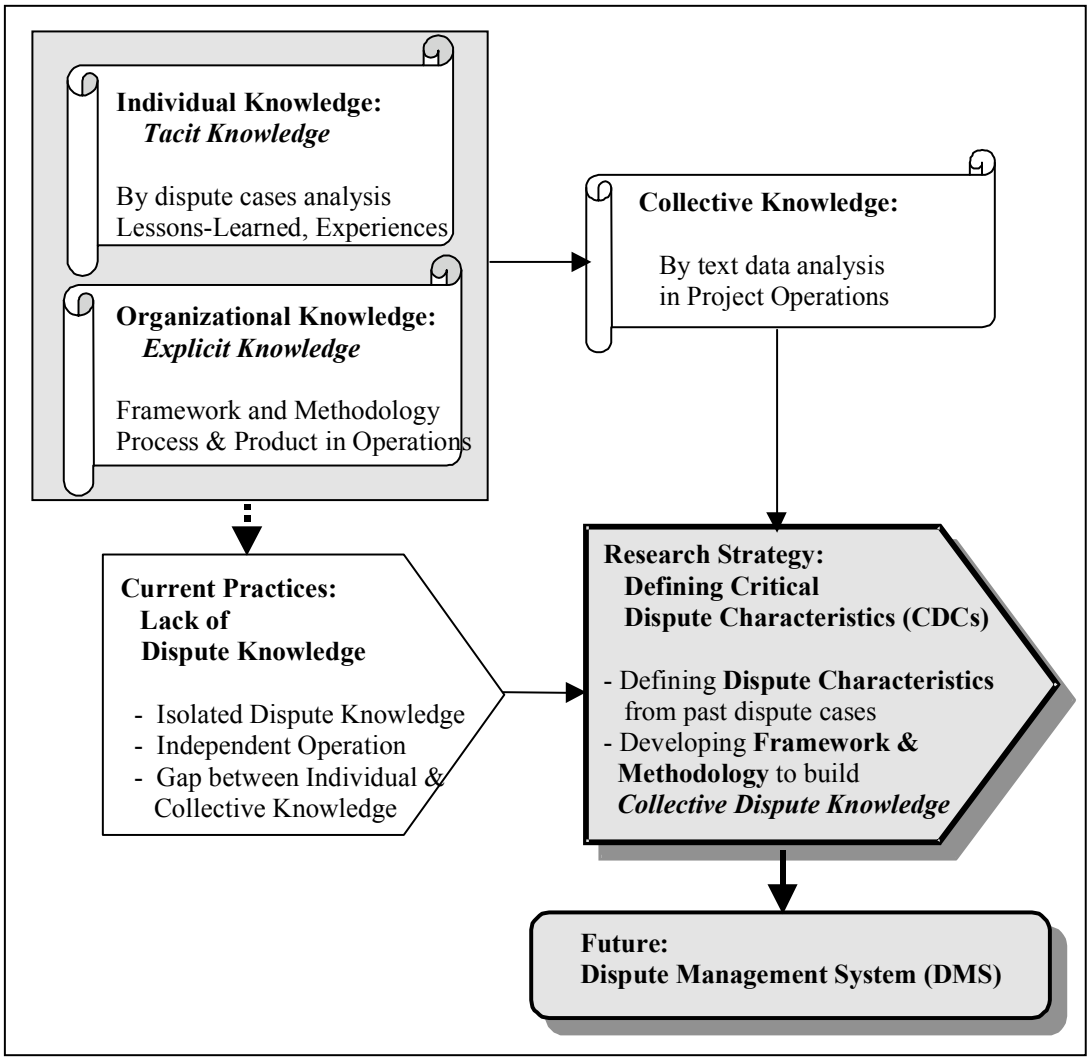


Figure 15. Process of developing collective knowledge in disputes

The largest challenge in this research framework is to filter the vast amounts of existing dispute data from past dispute cases into a manageable subset of dispute characteristics. Existing text data may hold hidden knowledge which cannot be explored or fully utilized in project operations without thorough analysis. Therefore, exiting text data needs to be processed through proper framework and methodological procedures.

In Figure 16, the process of selecting data and methodologies are summarized. Text data of past dispute cases are selected under this research strategy. Therefore, several plausible methodologies are reviewed, such as content analysis, case study, and survey methodologies.

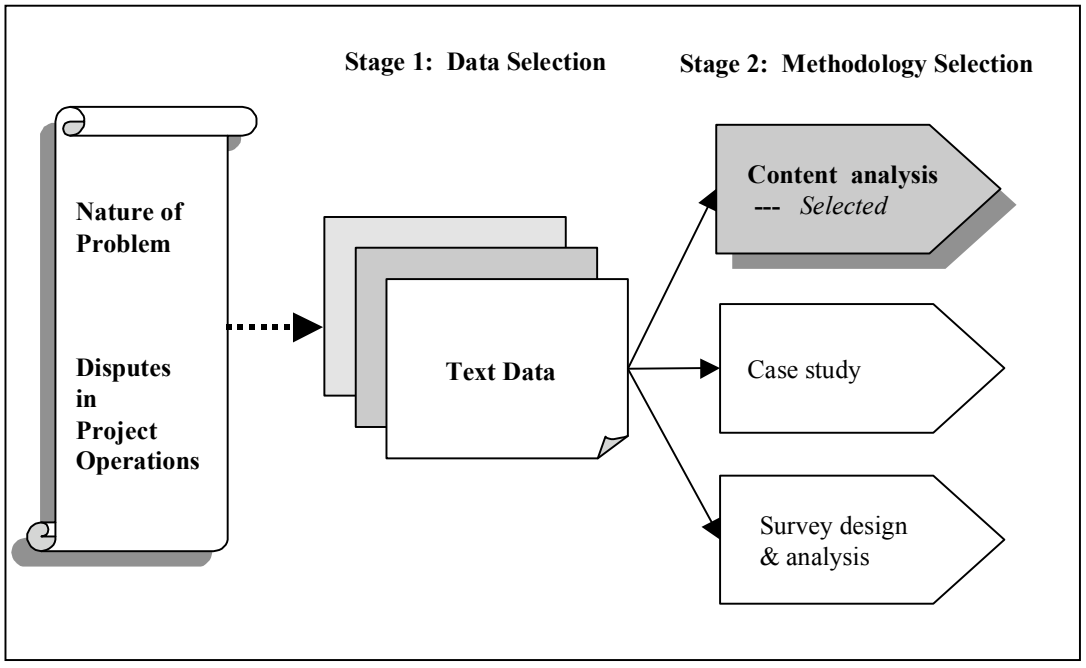


Figure 16. Selection of data and methodology

Qualitative data includes text data from past dispute cases and non-numerical data from surveys. Text data in disputes are available from the numerous sources including court cases. A survey result may produce text and numerical data depending on the survey design. Qualitative data analysis, such as text analysis, is more complex than quantitative data analysis particularly in terms of measurement. Quantitative data analysis for project-related data, such as schedule and cost data as well as numerical survey results can be analyzed explicitly by defined statistical analysis techniques.

The literature review, however, reveals that qualitative data analysis has not been widely adopted in the construction research studies as outlined in Table 2. Therefore, qualitative data analysis through text analysis is selected to reveal a new layer of knowledge in text data that has not been available in quantitative analysis studies.

The research strategy involves analyzing text data in past dispute cases. Content analysis and statistical analysis are selected as the research methodology to execute text analysis of past dispute cases. Content analysis is selected to interpret and quantify the text data of dispute cases. Statistical analysis is selected to analyze the measurement and verify the analysis results from the content analysis.

In this research strategy, the concept of *collective dispute knowledge* is developed for defining CDCs by analyzing text data. In following sections, research methodologies are reviewed to establish the analysis process of text data. Comparisons of strengths and drawbacks are made among the selected methodologies, such as content analysis, case studies, and surveys.

3.4 Research Methodology Design

3.4.1 Selecting the Research Methodology

For the research methodology design, content analysis and statistical analysis are selected to execute text analysis of construction dispute data. *Content analysis* is selected to analyze text data by quantifying those qualitative data. *Statistical analysis* is selected to analyze and verify various outcomes from the content analysis. In the following sections, content analysis is compared with case study and survey methodologies, both of which are popularly used in data analysis of construction research studies.

Text data in the form of qualitative data exhibit different characteristics than quantitative data. Text data reveal explicit information without defined structure. Therefore, text data are difficult to analyze theoretically and objectively by scientific methods. Since text data are difficult to measure, the analysis of text data requires great care in the research design. On the other hand, quantitative data—such as survey results, cost data, and schedule data—reveal more precise information in numeric form. Because quantitative data are precise, they can be measured directly and analyzed objectively by various statistical methods.

In this research, text data need to be analyzed theoretically through an objective and scientific method to achieve the research goal. This approach is essential to the research process of not only exploring precedence data for hidden knowledge but also for creating new knowledge from text data. In this context, the following methodologies are reviewed to select the most appropriate methodology for this research study.

3.4.2 Content Analysis

A dispute case is a vast source of information. When latent disagreements or problems occur, the involved parties recognize a potential dispute issue in construction operations. Otherwise, each party's interpretation of the contract and understanding of the facts constitute a source of potential disputes.

These dispute cases can be found from various sources as described in the section on data collection process and results of Chapter 4. All these dispute cases are presented in text data form rather than in quantitative form. Therefore, the methodology of analyzing text data is important in this research.

Content analysis is defined as a research method that uses a set of procedures to make valid inferences from texts [Weber, 1990]. However, collecting valuable information in each dispute case becomes a challenging task. When large numbers of dispute cases are analyzed, determining common causes across dispute cases is even more challenging. An effective method for handling large numbers of dispute cases needs to be developed so that these cases can be classified into structured information through their related characteristics. This is the reason why content analysis is selected to develop dispute characteristics through text data analysis in this research design.

Content analysis methodology has been adopted widely in other research domains [Malhotra, 1999; Ross, 1997]. In the domain of general management, content analysis of electronic texts through computerized data collection and analysis has recently been given much attention [Kabanoff, 1995; Larwood, 1995]. The procedure of content analysis is expanded in section 3.5.

3.4.3 Case Study Methodology

Case study research methodology is commonly used in legal research, general management, and construction research. Despite the difficulties of using case analysis for a large number of cases, this method remains an effective approach to review a single dispute case independently.

The case study is defined as a way of investigating an empirical topic by a set of prespecified procedures [Yin, 1994]. The case study is a method for learning about a complex instance, based on a comprehensive understanding of that instance obtained by extensive description and analysis taken as a whole [GAO, 1990].

A case study methodology can be compared with case law in legal research. The precedence case law from a court judgment is important for legal research. Even one case law can affect the judgment of cases that follow. Moreover, in a research study of general management, case studies have also been found to be important tools in analyzing situations within business contexts [Benoma, 1989]. The capability of analyzing the business environment, necessary for decision-making in a business situation, can be enhanced through case studies. The case study approach is also a major part of education in general management classes.

Many research studies in the construction dispute domain have adopted a case study methodology [Thomas, 1994; Jahren, 1990; Diekmann, 1985]. In these research studies, a construction dispute case was analyzed independently as precedence case law.

In the case study research framework, case studies may produce significant lessons, rules, and procedures as shown in previous research studies [Thomas, 1990; Russell,

1991; Zack, 1993]. However, as a means of collecting precedence knowledge, case study methodology is not sufficient to handle large numbers of cases simultaneously because each case needs to be analyzed independently to identify its lessons.

Case study methodology is still an effective approach in dispute resolution processes because it is a technique for discovering lessons of each important precedence case. However, case study methodology is not selected in this research framework because this research aims to analyze many dispute cases collectively. Case study methodology is not feasible to handle many dispute cases and to analyze common characteristics across numerous cases.

In legal research, a case is treated in a unique fashion. In the litigation process, case law is very important in building the foundation of an argument. Even a single precedence case can influence the whole foundation of legal theory. Therefore, a precedence case law is analyzed individually and intensively by legal professionals. This process is an example of case study methodology. Searching the lessons from each precedence case can be an effective way to utilize past cases to build knowledge. This practice is adopted in the process of legal research to locate proper precedence case law.

A significant dispute case may set the rule of dispute resolution in construction disputes. However, this approach is not sufficient to handle large numbers of past cases. Creating dispute knowledge from large numbers of retrospective dispute cases needs a scientific approach to find shared knowledge across many commonly occurring dispute cases.

There are certain prejudices in the case study methodology. The greatest concern has been over the lack of rigor in case study methodology. The case study researcher has been accused of allowing equivocal evidence or biased views to influence the direction of the findings and conclusions. Case studies also provide little basis for scientific generalization. In fact, scientific facts are rarely based on one or just a few experiments. They are usually based on a multiple set of experiments, which have replicated the same phenomenon under different conditions. Case studies, like experiments, are generalizable to theoretical propositions and not to populations or universes. In this sense, the case study does not represent the sample. The researcher's goal in a case study is to expand and generalize theories as analytic generalizations and not to enumerate frequencies as statistical generalizations [Yin, 1994]. Based on this review, case study methodology was not selected due to its deficiencies in handling numerous cases together.

3.4.4 Survey Methodology

Survey analysis is another possible methodology of collecting text data that was dismissed. Survey methodology is based on the questioning of respondents. Respondents are asked a variety of questions regarding their behavior, intentions, attitudes, awareness, motivations, and demographic and lifestyle characteristics [Babbie, 1995]. Typically, the questioning is structured, meaning some standardization is imposed on the data collection process [Malhotra, 1999].

Surveys can be used for descriptive, explanatory, and exploratory purposes. They are chiefly used in studies that have individual people as the units of analysis. Although

this method can be used for other units of analysis, such as groups or interactions, it is necessary that some individual persons are used as respondents or informants [Babbie, 1995].

Survey methodology is a popular method of collecting specific data from various sources in many construction research studies. Survey methodology in construction dispute research was adopted by several research studies [Hartmann, 1996; Kangari, 1995; Semple, 1994].

Survey methodology is the administration of questionnaires to a sample of respondents selected from a larger population. Survey research is especially appropriate for descriptive studies of a large population, although survey data may be used for explanatory purposes as well. Questionnaires may be administered in three basically different ways—self-administered questionnaires, face-to-face interviews, and telephone surveys [Babbie, 1995].

The advantages of a self-administered questionnaire over a face-to-face interview survey include low cost, speedy administration, lack of interviewer bias, greater anonymity, and better privacy to encourage candid responses on sensitive issues. The advantage of an interview survey over a self-administered questionnaire include fewer incomplete questionnaires, fewer misunderstood questions, generally higher return rates, and greater flexibility in terms of sampling and special observations.

Survey data need to be analyzed by various statistical methods including basic descriptive statistics such as means, standard deviations, medians, and rankings. Testing for a difference in means can be executed by a t-test and analysis of variance (ANOVA).

Relationships among variables can be tested through correlation statistics and regression of variables. Groups of variables can be identified by cluster analysis, discriminant analysis, and factor analysis [SPSS, 1998].

The strengths of survey methodology include ability to handle large samples, usefulness in describing a large population, and the ability to collect data economically. Drawbacks include the possibility of superficial data and the lack of flexibility in reacting to new variables identified during the research process [Singleton, 1993]. Survey methodology is not selected in this research framework because data about dispute characteristics cannot be collected in the detail required by this research design.

3.4.5 Comparison of Methodologies

In comparing the possible methodologies of content analysis, case study, and survey, content analysis is selected in this research framework. Content analysis is the most applicable research methodology for this research strategy of the analysis of text from retrospective dispute cases as compared in Table 7. The definition and procedures of content analysis are described in the following sections.

Content analysis utilizes text data as a solid data source. Text data have various strengths in content analysis methodology. While text data are not produced under the research framework, they are able to be used repeatedly for different set of analyses, thereby providing precise and objective details of issues. Subsequently, existing text data can be analyzed to cover broad sets of factors, including span of time, location, and even multiple dispute events [Weber, 1990].

Table 7. Summary of methodologies

Methodology	Strengths	Drawbacks
Content analysis	• Utilizes existing data • Less bias in data collection • Able to handle large volume of data • Explicit procedures and controls • Objective and scientific method	• Difficulties in measuring methods of variable • Possibility of subjectivity and Inference in the process
Case study	• Able to analyze qualitative/ quantitative data • Able to analyze objectively • Independent analysis procedures • Discover lessons, rules, procedures	• Unable to apply to large number of cases • Potential lack of rigor, equivocal evidence, biased views • Little basis for scientific generalization
Survey	• Flexible way of obtaining data • Economical for collecting large amounts of data • Useful in describing a large population • Possible to handle large samples • Standardization of data collection	• Difficult to gain a full sense of social processes in their natural settings • The initial study design remains unchanged throughout • Limits by standardization • Somewhat artificial and potentially superficial

The strengths and drawbacks of possible research methodologies are summarized in Table 7. While executing content analysis, the strengths are enhanced and the drawbacks are mitigated in the analysis process. The details of content analysis methodology is described in following section.

3.5 Content Analysis

3.5.1 Introduction

Content analysis is selected for the text analysis of retrospective dispute cases. This section describes definitions, analysis procedures, major issues to be noted during the analysis process, and issues of reliability and validity. Definitions are introduced from various research studies. Procedures are summarized for fundamental questions and stages of analysis in this research framework. Major issues in content analysis describe how to apply research methodology scientifically and theoretically in this research procedure. Issues of reliability and validity are discussed, enhancing the research methodology.

3.5.2 Definitions of Content Analysis

Content analysis methodology is described as an effective methodology in grouping observations based on similarities among observations. The goal of procedures is to reflect patterns of subject groups, to reveal the focus of subject groups, and to describe trends in contents [Weber, 1990]. Content analysis is also described as a systematic research method for analyzing textual information in a set of standardized procedures that allows researchers to make valid inferences about the information [GAO, 1996].

A main idea of content analysis is to classify many words of the text into fewer content categories. Each category may consist of one, several, or many words. Words,

phases, or other units of text classified in the same category are presumed to have similar meanings. Depending on the purpose of the researcher, this similarity may be based on the precise meaning of the word, or may be based on words sharing similar connotations. Content analysis can be used to make sense of data such as historical documents, newspaper stories, political speeches, open-ended interviews, diplomatic messages, psychological diaries, or official publications [Krippendorff, 1980; Weber, 1990].

The unit of analysis may vary including: 1) words, such as different words or type of words in the message, 2) characters, such as individuals or objects, 3) themes such as propositions, 4) space and time measures, such as length or duration of the message, or 5) topics, such as the subject of the message [Krippendorff, 1980].

Building a set of words for measurement, and measuring the frequency of selected words, are the foundations of content analysis. In this research framework, a set of dispute characteristics is first built as *general dispute characteristics (GDC)* and *keywords*. Then, the keywords are measured to summarize a complex dispute situation from each dispute case.

Examples of previous research studies utilizing content analysis demonstrate the value of this methodology. In particular, the following research subjects show broad application of content analysis within text analysis: a legal research study of the emerging trend in correctional civil liability cases from the federal court decisions in last 25 years [Ross, 1997]; a research study on organizational value in marketing topics [Kanbanoff, 1995]; a research study on the structure and meaning of organizational vision [Larwood, 1995]; an analysis of how federal employees view the government as a place to work

from written comments on survey reports of federal employment [GAO, 1996]; and an analysis of editorials on the Korean War from American newspapers [Weber, 1990]. In marketing research applications, content analysis can be used to analyze the message of advertisements, newspaper articles, and television and radio programs [Malhotra, 1999]. In applying content analysis, these research studies present well-defined research methodologies and proper analysis techniques.

Table 8. Examples of research with content analysis in general management

Topic	Espoused values and organizational change themes	Structure and meaning of organizational vision
Subject	Organizational value in text	Analysis of their organizational vision
Author, source	Kabanoff, 1995	Larwood, 1995
Criteria	Strength of nine values: authority, performance, reward, normative, commitment, participation, leadership, teamwork, affiliation	Vision leadership: vision content; vision process in development, articulation, communication, implementation
Data	88 Australian organization's text	Four sample groups, 250 executives from each group
Methodology	Content analysis, cluster analysis	Content analysis, factor analysis
Analysis	Four value structure: elite, leadership, meritocratic, collegial	Patterns of vision: seven major factors selected from 26 factors

In the domain of general management, several research studies have adopted content analysis methodologies as summarized in Table 8 [Kabanoff, 1995; Larwood, 1995]. In both research studies, the content analysis methodology is utilized to analyze the text data. Kabanoff analyzed a selected organization's text data to reveal the common value structure of an organization. Larwood analyzed a set of executives' vision statements to develop a pattern of organizational vision.

In both research studies, the content analysis methodology is executed by following several major steps: building a word dictionary, measuring selected words, and analyzing measurements under a research framework.

These research studies show interesting examples of content analysis and how it is applied to research subjects in general management, such as organizational vision and value. Therefore, content analysis is a viable methodology to analyze qualitative data in various research subjects.

3.5.3 Analysis Procedure

Content analysis starts from the definition of variables as measurable units. In this research framework, selected *keywords* among *general dispute characteristics (GDCs)* from the literature review become the variables to be measured. The hierarchy of keywords and general dispute characteristics (GDCs) are depicted in Figure 13 of Chapter 2.

A keyword needs to conceptualize a single subject of a dispute issue in construction operations. Therefore, many keywords are required to represent a dispute issue. Those keywords are categorized to represent major dispute issues because major causes can be identified by classifying large numbers of causes of disputes.

Units of measurement need to be selected among words, sentences, paragraphs, themes, and the whole text. Clearly defined units help to develop better analysis from the text. In this research framework, the whole text of each dispute case is selected as a unit of records.

Variables in the text can be measured by identifying their presence (whether they exist or not), frequency (how many times they appears), intensity (level of description), space (location in the text), and time (chronological presence in the text) for the analysis. In this research project, frequency of keywords in the whole text is selected to measure variables.

Content analysis, however, raises many questions regarding theory and scientific research procedures [Weber, 1990]. The following answers are developed to justify the fundamental questions in this research framework.

- *Is a keyword, such as "work scope," a valid measure of the dispute topic in this research framework?*

Certainly, keywords are a valid measurement because as variables, keywords can be carefully selected by this research framework to represent the meaning of source data. Keywords and general dispute characteristics (GDCs) are developed to cover broad issues in construction disputes through the literature review. General dispute characteristics result from the analysis of dispute causes in the literature as summarized in Table 2. Keywords are selected among GDCs through actual dispute cases analyzed in the pilot study. In this process, many synonyms are added together in measurement to cover various subjects in dispute cases. Some keywords, which did not appear in the text data as expected, were removed from measurement. This keyword development process is explained in Chapter 4 to enhance validity of the measurement.

- *Is a keyword, such as "work scope," a reliable measure?*

A keyword measurement is reliable where unified rule is applied to measure predefined keywords. Moreover, measurement of selected keywords is a fundamental concept of content analysis. Measurable variables, such as a set of keywords, are developed from the literature review. Then, measurement of these words strictly follows the procedure of content analysis methodology. In content analysis of the pre-computer age, accuracy of measurement was an issue according to the literature. Therefore, the rule was required for measurement procedures. The unified rule among multiple recorders was required in a large-scale research project. However, a reliable procedure of measurement is adopted in this research process through the aid of computer software. Computer software was utilized in selecting measurable keywords. *AskSam* was selected to extract keywords from the text data [AskSam, 1995]. Therefore, a single recorder performed this research to unify the measurement rule.

- *Should a broad code category, such as conflict and dispute, be constructed from a set of synonymous keywords?*

A large category of keywords can be developed to include various synonyms of dispute issues. These issues become part of a set of general dispute characteristics (GDCs) that are developed initially to describe various causes of dispute issues in construction dispute cases. These GDCs are used in the pilot study to ascertain whether they validly capture the major causes of a dispute case. Further, numerous dispute characteristics including related synonyms are utilized to capture the various causes of dispute issues within the analysis process.

- *How does this quantitative indicator relate to identified disputes?*

Measurement as a quantitative indicator needs to be interpreted by dispute characteristics. This result is developed to define CDCs as a group of keywords representing dispute issues. Measurement of a single dispute characteristic may not be sufficient to identify a potential dispute issue. Therefore multiple dispute characteristics, totaling 80 keywords as summarized in Chapter 4, are used to measure each dispute case. Those multiple characteristics are used to capture the causes of past dispute cases. The analysis results reveal the broad nature and causes of past dispute cases. This research framework provides a systematic approach to identify the dispute characteristics—an approach which was previously unavailable to project stakeholders.

- *What about other themes in the text data?*

This research framework is focused on the dispute issues only. The other themes, such as technical and organizational issues in text data are not considered in this research framework. If the research framework can be proven by the results obtained, the process can be applied to analyze other themes in the text data. This extension can be a future research topic based on this research methodology.

Text analysis procedures are summarized under the content analysis methodology in Table 9. Each stage of the procedure is described by required actions as follows:

1) Document selection and sampling: A proper source of text data is required for data collection. Sampling needs to be done scientifically from the population.
2) Define the recording units: The unit of record is each dispute case. Each dispute case is treated equally in measuring keywords.

3) Define the categories: Categories as a group of keywords are to be developed. A set of GDCs is developed from the literature review, then keywords among GDCs are selected for measurement.
4) Test coding on a sample of text: The pilot study is designed to test the coding scheme on a sample of text data. The procedure and results are tested.
5) Assess accuracy and reliability: Pilot study results are reviewed and compared with the contents of text data. Dispute issues on a case are reviewed with the measurement results to determine whether they represent the contents of dispute issues.
6) Revise the coding rules: The initial set of keywords is revised based on the result of the pilot study. A final set of keywords among GDCs is defined through revisions to capture dispute issues effectively.
7) Set the coding scheme: A final set of keywords is set for measurement. Frequency of keywords is the quantitative measure in the scheme.
8) Code all the text: Selected text data are measured by frequency of keywords.
9) Assess achieved reliability and accuracy: The results of keyword measurement are to be reviewed with the contents of dispute issues.
10) Category counts: The raw data of keyword measurement is to be converted into categories representing the major issues of dispute as CDCs.
11) Measurement model: A model of framework and methodology for keyword measurement is built to represent the dispute issues as CDCs.

Detailed issues in analysis process are discussed in following sections. Content analysis of dispute text data is executed under this procedure in following chapters.

Table 9. Analysis procedure in content analysis methodology

Stages in Content analysis	Required Action	Applicable sections in this research	Chapters
1) Document selection and sampling	Select data source and dispute cases	Data collection	4
2) Define the recording units	Select units of recording.	Pilot study Data analysis	4 5
3) Define the categories	Develop categories to be measured.	Pilot study	4
4) Test coding on sample of text	Test through pilot study	Pilot study	4
5) Assess accuracy and reliability	Test through pilot study	Pilot study	4
6) Revise the coding rules	Revise keywords among GDCs	Develop keywords	5
7) Set the coding scheme	Develop a final set of keywords	Develop keywords	5
8) Code all the text	Measure frequency of keywords	Data analysis	5
9) Assess achieved reliability and accuracy	Review process and results	Data collection, Data analysis	4 5
10) Category counts	Make categories from keywords	Data analysis	5
11) Measurement model	Build a model to represent categories of keywords	Data analysis	5

3.5.4 Issues in the Analysis Process of Content Analysis

By selecting a content analysis methodology, there are certain major issues to be noted in the analysis process. The content analysis process creates quantitative indicators, such as measurement of keywords, from dispute cases. Those quantitative indicators assess the degree of attention or concern devoted to the themes, categories, or issues, such as major causes of disputes. The researcher then interprets and explains the results of measurement. This analysis process is summarized as following four major stages [Weber, 1990].

- *Measurement* – the assignment of numbers that stand for some aspect of the text, such as frequencies of selected dispute characteristics.
- *Indication* – the inference by the researcher of some unmeasured quality of a characteristic in the text from those numbers, such as developing a group of synonyms under a keyword to minimize unmeasured qualities of dispute cases.
- *Representation* – techniques for describing syntactic, semantic, or pragmatic aspects of texts, such as developing a rule of word usage in the dispute cases.
- *Interpretation* – the translation of the meaning in text into some other abstract of analytical or theoretical language, such as exploring multiple groups of meaning from measured dispute characteristics.

In these stages, representation and interpretation, for example, entail difficulties that are neither understood widely nor resolved easily. During the analysis processes, difficulties exist that may detract from the reliability of the procedures or from the

validity of substantive conclusions based on them [Weber, 1990; Krippendorff, 1980]. These reliability and validity issues are explained further in the next section. This content analysis processes leads to the results of data analysis, exploration, and discovery of patterns and relationships in the text data.

Reliability and validity

Reliability and validity are major issues of content analysis. The central issues are how the process of data reduction from many words of text to much fewer content categories can be explained theoretically in the content analysis methodology.

Reliability refers to the stability or consistency of an operational definition [Singleton, 1993]. Reliability refers to the likelihood that a given measurement procedure will yield the same description of a given phenomenon if that measurement is repeated. For example, estimating a person's age by asking his or her friends would be less reliable than asking the person or checking the birth certificate. Reliability, however, does not ensure accuracy but merely indicates consistency.

Reliability problems in content analysis usually grow out of the ambiguity of word meanings, categories of words, definitions, or other coding rules in the process. Reliability sets limits to the potential validity of research results. Reliability does not guarantee the validity of research results. Reliability assessments serve as important safeguards against the contamination of scientific data by effects that are extraneous to the aims of observation, measurement, and analysis [Babbie, 1995].

To test reliability, some duplication of effort is essential. A reliable procedure should yield the same results for the same set of phenomena regardless of the circumstances of application. In this research framework, the pilot study is used to test the reliability of measuring a set of keywords. Therefore, the *AskSam* software is used to select keywords from the text data to ensure consistency. The selection process of keywords in this method is very robust compared with the methods that rely upon recorder's human judgment.

Validity of variables in content classification is a much more difficult set of problems. Validity refers to the goodness of fit between operational definition and the concept it is purported to measure [Singleton, 1993]. A valid measure is necessarily reliable, but a reliable measure may or may not be valid. A set of text as content analysis variables is valid to the extent that it measures the construct that the researcher intends to measure. Validity refers to the extent to which a specific measurement provides data that relate to the commonly accepted meaning of a particular concept.

To test validity, on the other hand, the results of a procedure must match with what is known to be "true" or assumed to be already valid. Whereas reliability assures that the analytical results represent something real, validity assures that the analytical results represent what they claim to represent [Singleton, 1993]. In this research, the pilot study is used to test whether the GDCs are a valid measure of dispute issues. A set of keywords is finalized through this process of validating the GDCs.

Pros and cons for content analysis

Some advantages of content analysis are that: 1) it can be less biased than a survey or interview because existing text data are utilized, 2) a large volume of text data can be treated under explicit procedures and controls, and 3) it is a structured process of measuring text by a defined methodology [GAO, 1996]. These advantages are enhanced in the analysis process by utilizing existing court cases for dispute data, collecting large number of cases chronologically, and building a rigorous process of defining and measuring keywords.

However content analysis is criticized by detractors who claim that the method needs to improve its measurement methods of variables [Weber, 1990]. Content analysis needs to be carefully applied because it inherently involves subjectivity and inferences in the process of analysis [Krippendorff, 1980]. In this analysis process, measurement of keywords is carefully developed systematically to avoid any problem of subjectivity and inferences. This procedure is explained further in Chapter 4.

3.6 Statistical Analysis of Measurement

Statistical analysis is used to analyze the measurement and verify various outcomes from the results of the content analysis. According to the content analysis process, measurement of keywords is presented in numbers. Numbers as raw data from each dispute case need to be converted to a form of valid scientific data for further statistical analysis.

First, raw data need to be converted to a normalized value per dispute case. For example, keyword counts of 10 and 20 in two dispute cases does not mean that the frequency of keywords in the latter is two times the former, because a keyword in a long dispute case record may appear more times in a long case than in a short dispute case. Therefore, normalized values are developed to allow equal weight of measurement in keywords from each dispute case.

Second, a comparison is made among grouped characteristics. Keywords are grouped to developed critical dispute characteristics after normalized values are calculated. A comparison of means and standard deviations shows yearly and aggregated characteristics of data. The most frequent characteristics among keywords are selected in this process.

Third, the validation process is executed after critical dispute characteristics are identified. The validation is tested between the analyzed data set and a separate new set of data. A comparison of means by a *t-test* and a nonparametric test, *Mann-Whitney test,* is performed to validate the analysis results. These processes of statistical analysis are described further in Chapter 5.

3.6.1 Types of Statistical Analyses

With the collected data, statistical analysis needs to be executed. The analysis process can be classified in the following categories. A statistic is a summary statement about a set of data. Statistics as a discipline provides techniques for organizing and analyzing data. There are two types of statistics that are commonly grouped according to their function—descriptive and inferential. Descriptive statistics are concerned with organizing and summarizing the data at hand to make them more intelligible, such as identifying high and low values and average values. Inferential statistics deals with the kinds of inferences that can be made when generalizing from data, as from sample data to the entire population [Healey, 1999].

Statistical measures of central tendency reveal various points of concentration: the most typical value (mode), the middle value (median), and the average (mean). In this research process, descriptive statistics is applied to describe text measurement data in which mean values and standard deviations are used to compare the analysis results.

3.6.2 Tests for Comparing Means

The mean value of the keywords measurement from each data set is tested to find whether the data sets are significantly different. The purpose is to draw conclusions about population parameters based on statistics observed in the sample and to identify any differences that may exist. The null hypothesis (H_0) needs to be accepted unless

statistical tests provide evidence for rejection. Rejection results in support of the alternative hypotheses (H_a).

Parametric statistics, or statistics based on test distributions, offer three statistics typically used for determining the significance of differences in two samples: the student's t-distribution, the x^2 (chi square) distribution, and the *F*-distribution. A nonparametric or distribution-free equivalent is the Mann-Whitney test [Healey, 1999]. In this research, the t-test and Mann-Whitney test are selected to analyze the measurement data.

Difference between parametric and non-parametic tests

Most classical statistics assume that the data being analyzed come from a specific distribution, usually the normal distribution. These statistics are calculated based on parameters of the distribution, such as the mean and variance. Many statistics, such as the t-test, also assume the groups being analyzed have equal variances. Nonparametric tests are known as distribution-free tests because they make no assumptions about the underlying distribution of the data. In general, the parametric versions of tests are more sensitive than the nonparametric versions and should be used when the necessary assumptions are met [Healey, 1999].

In other words, the main difference of parametric and nonparametric tests is that the parametric test, such as *t-test*, assumes that the populations are normally distributed, while the non-parametric tests do not make this assumption. If t-test does meet the

assumption of normality, a t-test can detect true differences between groups with a smaller sample size than can its nonparametric counterpart. Therefore, it is preferable to use a t-test when possible. However, if the researcher has reason to believe that the sample does not come from a normal population, nonparametric tests for two independent samples offer an alternative. While the non-parametric tests of Mann-Whitney test do assume that the two distributions have the same shape, this shape does not have to be normal.

The measurement of keywords in each court case is not conclusively either parametric or nonparametric. The characteristics of the measurement data need to be investigated further along the research process. Therefore, both test types are executed in this analysis process.

T-test for two samples

The *t-test* is used to test hypotheses about means of quantitative variables. Using the independent sample t-test procedure, one can test whether the mean of a single variable for subjects in one group differs from that in another group. Each hypothesis is an assertion or conjecture about the parameters of a population. Notice that the null hypothesis is usually set up to see whether it can be rejected [Healey, 1999; SPSS, 1998].

In the process of the t-test, two tests are computed for comparing group means. The first, labeled *equal variances assumed* is called the *pooled-variance t-test*. It assumes that the population variances for the two groups are equal, meaning the distributions have

the same shape. The second test, *equal variances not assumed,* does not require equal variances and is also called the *separate-variance t-test*. In this research process, the pooled variance t-test is selected for analysis. The degrees of freedom for the pooled variance tests is $(n_1 + n_2 - 2)$.

The t-test compares the samples in the following manner:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

, where X_1 and X_2 = means of the two samples; S^2_p = pooled sample variance; and n_1 and n_2 = sizes of the two samples.

The specification of the rejection region was chosen to be $(\alpha) < 0.05$. In other words, there is a 95 percent certainty that the result is not due to chance or, put differently, the finding is significant at the 0.05 level [Healey, 1999; SPSS, 1998].

Mann-Whitney test

The Mann-Whitney rank sum test is the nonparametic analog for the two sample t test. It is used to test that two samples come from identically distributed populations, that is, there is no shift in the center of location (not the mean, because the distribution might be skewed). The test is not completely distribution-free, since it assumes that the populations have the same shape. Thus, the groups may differ with respect to the center of location, but they should have the same variability and skewness. There are other

nonparametric tests for two independent samples, such as the Moses test of extreme reactions, the Kolmogorov-Smirnov test, and the Wald-Wolfowitz run test which are not selected in this research.

The Mann-Whitney test is a nonparametric alternative to the independent samples t-test. Like the t-test, Mann-Whitney tests the null hypothesis that two independent samples come from the same population. Rather than being based on parameters of a normal distribution like mean and variance, the Mann-Whitney statistics are based on ranks. The Mann-Whitney statistic (U), is obtained by counting the number of times an observation from the group with the smaller sample size precedes an observation from the larger group.

The equation for the Mann-Whitney U is

$$U = N_1 N_2 + \frac{N_1 (N_1+1)}{2} - T_1$$

, where N_1 and N_2 are the sample sizes of the two groups, and T_1 is the sum of ranks of one of the samples.

The Wilcoxon statistic (W), which is equivalent to Mann-Whitney statistic, is calculated by ranking the pooled observations of the two samples and obtaining the sum of the ranks of the population with the smaller sample size. The Mann-Whitney U and Wilcoxon W are related by the following equation.

$$U + W = \frac{m\,(m+ 2n + 1)}{2}$$

, where m is the number of observations in the smaller group, and n is the number of observations in the larger group. Because U and W sum to a constant, using one of them is equivalent to using the other. Another way of looking at the equivalency between U and W is that they have the same *z* score.

The Mann-Whitney test and the Wilcoxon test are computed by ranking the combined sample of both populations, from smallest to largest. The Wilcoxon statistics is simply the value of the sum of ranks of the group with the smaller N.

The Mann-Whitney test is used for two or more independent samples, which in this research is the comparison of measurement data in two cases, such as between the 1980s and 1990s dispute cases or between the sum of the 1980s and 1990s cases and the 1993 cases. As the t-test compares the means of two independent samples, the Mann-Whitney nonparametric test for two independent samples compares the center of location for the two samples [Healey, 1999; SPSS, 1998].

3.7 Synopsis

In this chapter, a research methodology was described within the framework of a research strategy—the process of dispute identification and research methodology design in selecting a research methodology. Content analysis was selected for the measurement of text data. Content analysis was described by its definition, analysis procedure, and major issues in analysis process in this chapter. Statistical analysis was described by the type of statistical analysis and tests for comparing means in parametric and nonparametic tests. These discussions become the theoretical background of this research framework and methodology. Based on this research methodology, the data collection and analysis are explained in the following chapters.

CHAPTER IV. DATA COLLECTION PROCESS AND RESULTS

4.1 Introduction

Data collection—specifically selecting a proper data set for analysis—is an important stage of the research process. The data collection process includes data source selection and dispute cases selection. Data source selection reviews the potential sources of dispute data. Dispute case selection describes the criteria for selecting construction dispute cases from the pool of court judgments.

The data collection results summarize the nature of the selected dispute cases. Data collection results show selected data by their type of sources, which will be further analyzed in the next chapter. A summary of the selected data is described to show the nature of the dispute cases.

A pilot study was carried out to ensure proper procedures of data collection and data analysis. The pilot study process is composed of the pilot study design, data collection, analysis, and their results.

4.2 Data Collection Process

4.2.1 Introduction

Data collection is attempted from various dispute sources to cover a broad spectrum of disputes in the construction projects. Types of construction projects include public and private projects and architectural and civil projects. Various dispute cases from diverse projects are included in the collected data to represent the real world situation of construction disputes among project stakeholders.

The data collection process is described by selecting the data source and then selecting the dispute cases. The data source selection describes the comparison of possible sources of dispute cases and the selected federal appellate court cases. In the next section, dispute case selection is explained, including the criteria for selecting dispute cases, the structure of the court judgment, and the steps of case selection.

4.2.2 Selecting Data Sources

Text analysis is selected as the research strategy in this research framework. The text of credible dispute records is assumed to reveal all the details of dispute issues under the research hypothesis. The details of dispute issues include the facts on contractual relationship, problems in a project, disagreements in operations, and the development of dispute issues. These details are measured by a set of keywords in the text to investigate

the major causes of construction disputes. The causes of disputes are analyzed from the measurement of keywords as dispute characteristics.

Therefore, the goal of data collection is to find a source of credible dispute records, then select dispute cases conforming to the purpose of the research framework. Many types of dispute sources were reviewed as possible sources of data. Selected dispute sources are analyzed for their contents, reliability, and availability based on the researcher's discretion along the research process in Table 10.

Table 10. Analysis of Dispute Data Source

Source	Contents	Reliability	Availability
Corporate internal records	Details	Relatively subjective	Participant's business record
Records from arbitration and mediation	Details	Objective	Confidentiality in the process
Records from board of contract appeal (BCA)	Selected disputes	Objective	Partially available to the public
Federal District Court cases	Serious disputes with details	Very objective	Public records
Federal Appellate Court cases	Worst disputes with details	Very objective	Public records

Comparison of dispute data sources

The federal appellate court cases were selected for the data source under this research framework after analyzing the following potential sources. The steps to finalize the data source are summarized as follows.

Dispute records exists in the following several sources: project stakeholders' corporate internal records, records in dispute resolution processes of arbitration and mediation, records of the formal dispute resolution process from board of contract appeal (BCA) of public agencies, and federal court records from district and appellate courts. The analysis of these data sources in Table 10 needs to be made to select the proper data source.

First, the corporate internal record of project stakeholders is a direct source of information. The dispute record includes all the details of project operations. However, the record can be subjective since it reflects the stakeholders' own perspectives and will probably vary in structure, content, quality, and detail from company to company. Therefore, the corporate internal record is generally less reliable than the third party's objective record. Availability of a large amount of records is also questionable for large-scale research since it may contain confidential business matters.

Second, the dispute records of arbitration and mediation as an alternative dispute resolution (ADR) process contains certain arguments of the dispute issues. However, the concept of arbitration and mediation relies on the confidentiality of the process. Furthermore, the decision of the arbitrator is made without any reasoning for the record, making it an insufficient data source for determining dispute causes [AAA, 1994; AAA, 1996]. Although many arbitration and mediation cases are reported each year, these cases are not available to the public. Therefore, these data sources are not suitable for the text analysis in this research.

Third, the other formal dispute resolution records in the BCA are potential data sources in terms of their reliability and availability for the text analysis. In the case of public construction projects, the board of contract appeal (BCA) is the major vehicle to resolve construction dispute under current regulations [CDA, 1987; FAR]. Therefore, the board handles many construction cases in public construction.

Many disputes are submitted by the BCA to the General Services Administration (GSA), but most dispute cases do not reveal the details of dispute issues for the record. One of the interesting trends is that many of these dispute cases are actually dismissed in the dispute resolution process without revealing the detailed dispute contents [Lexis-Nexis, 2000]. A tendency observed from the dismissed cases is that the board of contract appeal is just used as a tactic in dispute resolution between contracting officer and contractors in public construction projects rather than as a practical resolution process. Therefore, details of dispute issues cannot be effectively traced in the BCA under these circumstances.

Fourth, dispute cases in the federal court represent the final process of formal dispute resolution. The worst situations in dispute resolution can be found in cases ultimately residing in federal court. This is evidence that they could not be resolved by all prior resolution efforts. The dispute cases in court generally do not represent disputes that commonly occur in construction project operations. These, the worst of dispute cases, may not occur often in project operations. However, analyzing these worst dispute cases is a way of identifying serious dispute characteristics in project operations. Actually most disputes on a project can be resolved casually within the scope of the

project and among project participants. The major research objective in this framework is to identify dispute characteristics in project operations that have greater impact on overall project operations.

The important lessons from the court cases can be extracted as a body of dispute knowledge through dispute characteristics. Therefore, court cases are selected as a pool of data in text analysis. The court cases are available electronically from a library database which is an effective way to access a large number of cases [Lexis-Nexis, 2000]. Text data in electronic form is an essential source to analyze the large volume of text data.

Selected dispute data sources

Federal appellate court cases are the source of data that was selected for this research study. There are many types of courts for the resolution of construction disputes in the judicial system of United States. Federal court cases reveal a broad spectrum of causes and judgments beyond the limit of state codes and regulations. And, the federal court is the venue of appeal from the BCA as shown in Figure 17.

Federal appellate court cases are the worst dispute situations in construction projects because this is the last point in the formal dispute resolution process under the law and standard contracts. Therefore, only limited numbers of dispute cases continue to the federal appellate court without any type of prior dispute resolution.

Litigation is a system used to get a third party's judgment if the disputants cannot reach an agreement. Therefore, the third party's decision is important if voluntary

resolution by the disputants is impossible. However, if the disputants have better knowledge of the possible outcomes and consequences that may result from their dispute issue, the disputants may resolve this issue voluntarily at an early stage.

Court cases in state level are not considered in this research scope because each state has different precedence and practices for the resolution of construction disputes. This research focuses on the broad spectrum of dispute cases which are applicable beyond the limits of state jurisdiction. In federal court system, the jurisdiction of appellate court system is depicted in Figure 18 since the dispute cases are also classified by the jurisdiction of appellate court in Table 14.

4.2.3 Selecting Dispute Cases

Court judgment consists of three major parts: facts, dispute issues, and judgments. The facts are consistent issues aired by the disputants in any disputes situation. This serves as the background information for the dispute case. The dispute issues are the arbitrary issues as perceived by each disputant. The initial dispute allegations raised by a party may not be accepted as a foundation for judgment by the judge. Therefore, the initial dispute allegations do not describe the dispute characteristics unless they are recognized by the judge. The court judgment reveals many dispute characteristics through the analysis of dispute issues. This reveals the abstract of the dispute through a rebuilding of the facts by the judge.

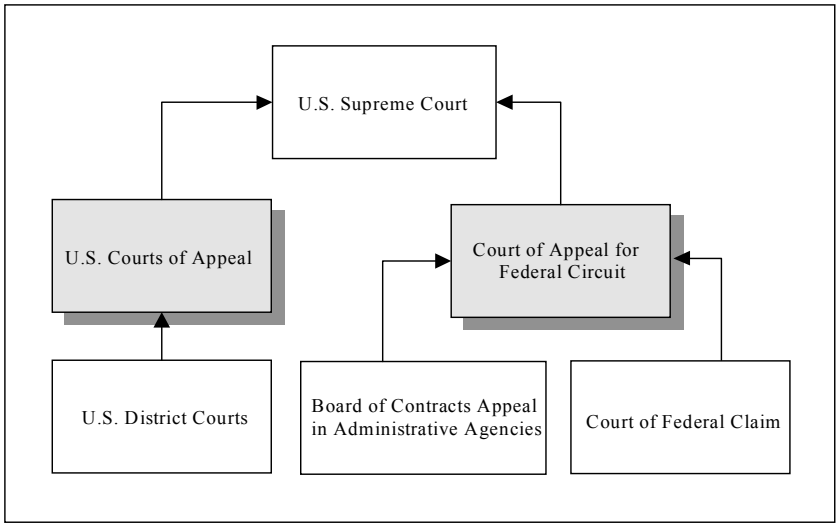


Figure 17. The federal judicial system

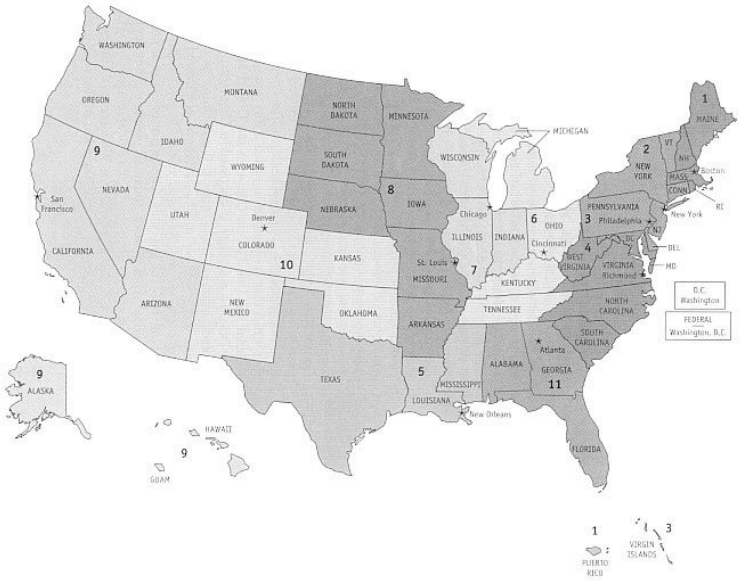


Figure 18. Jurisdiction of U.S. Appellate Court

All three of the parts—facts, dispute issues, and judgments—in citation could be used in this research to measure dispute characteristics. Court judgments are the most appropriate source to measure dispute characteristics for this research since the details of dispute issues and development of the dispute are described objectively by the judge.

Structure of court judgments

Court judgment cases are recorded in the citation of cases. These case data are available in electronic text form by a library database, Lexis-Nexis Academic Universe database [Lexis-Nexis, 2000].

The structure of court cases is composed of the name, number, court, cite, data, history, counsel, judge, opinion by, opinion, and other opinions as shown in Figure 19 [Lexis-Nexis, 2000]. Other opinions are added in the judgment if there is difference in opinions among judges (i.e., opinions of dissent or concurrence). These details of court judgments are described below.

Name introduces the names of the parties involved in the litigation case. *Court* describes the name of court which holds jurisdiction in the dispute issues. *Cite* is an important number to locate the citation. *History* describes the story of a case, the actions of prior courts, and who the judge is. This history record is included in most dispute cases to describe the prior history of the cases. *Council* describes the legal counsel of plaintiff and defendant. *Opinion* is the main body of the judgment statement and the major body of the text to be measured in this research. In the opinion part, there are

additional opinions if there is difference in opinions among judges. These additional opinions are eliminated from the measurement of the text. Additional opinions may add a bias of measurement to the dispute keywords because only some cases include additional opinions for the purpose of expressing other opinions. The presence of an additional opinion is listed in the selected case tables in Tables A30 through A44 of the Appendix A.

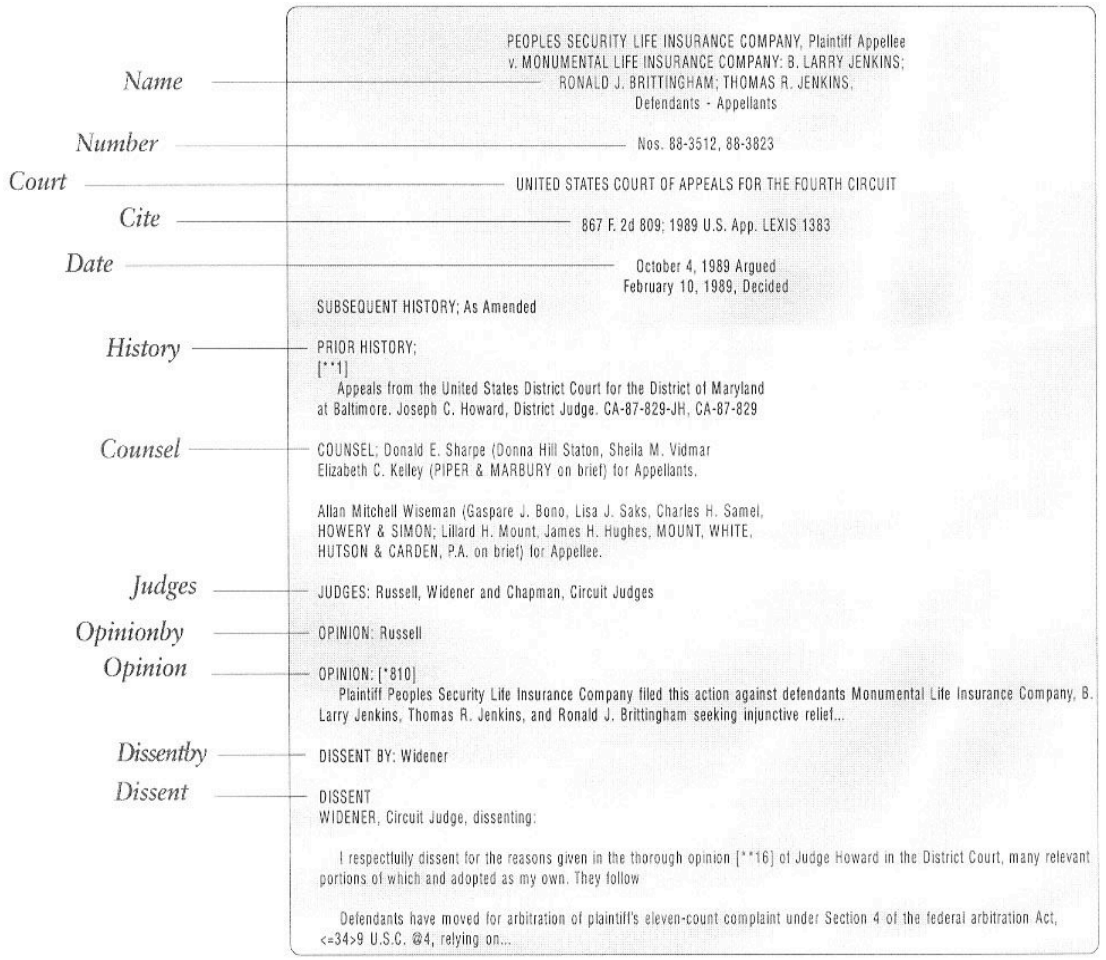


Figure 19. Structure of court judgment

Example of selected cases

In the content analysis, text is measured by the predefined rule of analysis. The text of court judgments has explicitly detailed structure in the format as described in previous section. The following example case in Figure 20 outlines the components of the court judgment. Only the main text is analyzed for keywords in the content analysis.

This example case is a search result from a library database. The initial search was made by a combination of words in a sentence, such as *contractor and construction*, *contractor and subcontractor*, and *contractor and surety*. The final set of dispute keywords is used for the initial search to find construction dispute cases. However, dispute keywords can select broad types of disputes including other industries. After numerous trials and errors, it was determined that searching dispute parties is a more relevant way to select construction-related disputes. The "within sentence" option was used in the search which means the case is selected if two keywords are in the same sentence. The keywords of *contractor, subcontractor,* and *surety* are found to cover a broad range of construction dispute cases. An initial search result is summarized in Table 11. The initial search from database shows average of 126 cases for *contractor and construction*, 81 cases for *contractor and subcontractor*, and 22 cases for *contractor and surety*. Many of these cases are duplicated under different categories.

After the initial search is made, the summary of each case is reviewed by the researcher against the final set of keywords. There is opinion summary by the judge in the judgment statement. This summary is reviewed to determine if the case is really relevant to the research problem and framework.

MARRIOTT CORPORATION, Plaintiff-Counter-Defendant-Appellee, v. DASTA CONSTRUCTION COMPANY, Defendant-Counter-Claimant-Appellant.
No. 92-2981.
UNITED STATES COURT OF APPEALS FOR THE ELEVENTH CIRCUIT
26 F.3d 1057; 1994 U.S. App. LEXIS 18294; 8 Fla. Law W. Fed. C 413

July 22, 1994, Decided

SUBSEQUENT HISTORY: [**1] As Amended. Rehearing En Banc Denied September 29, 1994, Reported at: 1994 U.S. App. LEXIS 31495.

PRIOR HISTORY: Appeal from the United States District Court Middle District of Florida. (No. 86-821-CIV-ORL-18). Richard B. Kellam, Judge.

DISPOSITION: AFFIRMED.

COUNSEL: For Plaintiff-Counter-Defendant-Appellee: MARY APPLEGATE LAU, Lau, Lane, Pieper, & Asti, Tampa, Florida.

For Defendant-Counter-Claimant-Appellant: HERMAN M. BRAUDE, ROGER C. JONES, Braude & Margulies, Washington, DC. TERRENCE JOSEPH McGUIRE, Williams, McGuire & Bragg, Orlando, Florida.

JUDGES: Before TJOFLAT, Chief Judge, DUBINA, Circuit Judge, and PAINE, * Senior District Judge.

* Honorable James C. Paine, Senior U.S. District Judge for the Southern District of Florida, sitting by designation.

OPINIONBY: TJOFLAT

OPINION: [*1059] TJOFLAT, Chief Judge:

This case arises out of the construction of a Marriott Corporation hotel in Orlando, Florida. Marriott, the appellee, acted as both the owner and general manager of the project. In that capacity, Marriott contracted with Dasta Construction Company, the appellant, to perform certain portions of the work. After the hotel was built, Marriott brought this suit in the district court to recover payments it had made on Dasta's behalf to Dasta subcontractors and suppliers. Dasta counterclaimed, contending that Marriott not only had failed to carry out its contractual obligations, but also had interfered with Dasta's performance. A jury found for Marriott on its claims and awarded Marriott the sums it had paid Dasta subcontractors and suppliers. On the counterclaim, the jury found for Dasta and awarded it $ 4,659,390.90. The district [**2] court subsequently granted Marriott's motion for judgment notwithstanding the verdict, dismissing Dasta's counterclaim on the merits and limiting Marriott's award to its costs of action. Dasta now appeals, seeking reinstatement of the jury's verdict. Finding no merit in any of Dasta's arguments, we affirm.

I.

In early 1982, Marriott began construction on an elaborate resort complex, or "mega hotel," in Orlando, Florida. n1 The Marriott Orlando World Resort ("Resort") was to contain fourteen different building segments, including a twenty-eight story guest tower; numerous convention rooms, restaurants, and ballrooms; and several outbuildings for swimming pools, golf courses, and tennis courts. Due to the size and complexity of Marriott's undertaking--at the time of completion, the Resort was the largest building in terms of square footage in the state of Florida--construction was divided into several distinct projects requiring the coordination of numerous contractors and subcontractors.

Figure 20. Case Example: 26 F.3d 1057 (1994) - part

A selected case is presented as an example in Figure 20. The summary part of the opinion is reviewed in terms of the dispute keywords. Keywords of "recover payment," "failed contractual obligation," and "performance," are found in the summary of the case which is sufficient to believe that the case is related to construction disputes. Therefore, this case is selected for the measurement of dispute keywords.

Out of 1031 total cases identified as candidates, 233 cases were selected for further analysis based on the presence of one or more GDCs in their summary components. This represents approximately 22.6 percent of the total population of relevant cases over the selected time frame as summarized in Table 12.

4.3 Data Collection Results

4.3.1 Overview

Data collection begins with selecting the right source of dispute cases which is the federal appellate court cases in this research study. The initial search is made from the last nineteen years of data since 1980. The selected data is found to be quite evenly distributed across years. The chronological case analysis aims to find any trend of keywords hidden in the cases. Therefore, blocks of four years of data in the middle 1980s and 1990s are selected for the final case selection. The data of selected years are not significantly different in the numbers of dispute cases across the years in initial search results shown on Table 11.

Table 11. Summary of selected court cases (per year)

	1) Contractor w/s construction	2) Contractor w/p subcontractor	3) Contractor w/p surety	Affirmed cases in Appellate Court
Appeal Court Case	126	81	22	47.6%
District Court Case	200	139	42	
Percentage of Appellate Court Case	63 %	58 %	52 %	-

The numbers of cases in federal appellate court show 52 to 63 percent of the numbers of cases in federal district court. These percentages mean more than half of district court cases continue to the appellate court. Among these appellate court cases, 47.6 percent are only fully affirmed which means that the previous district court

judgment was fully confirmed by the appellate court. Therefore, about one-fourth of district court judgments were fully confirmed in appellate court without any change. The rest of district court cases (three-fourths of all district court cases) were either affirmed in appellate court (about one-fourth of all district cases) or accepted by the disputant as final judgment (about half of all district court cases)

The trend in percentage of affirmed cases at appellate court is monitored by year in Table 13. Since there is no great difference in selected case numbers per year, this trend confirms that about half of district court cases are only fully affirmed in appellate court. In this research framework, each case in district court is not monitored at the appellate court for the final judgment. This approach belongs to case study and precedence case law which is not adopted in this methodology. Therefore, this trend of affirmation in appellate court is an observation only, not a chronological or statistical analysis. This trend of affirmation in appellate court can be analyzed in a future research study as it is beyond the scope of this research framework.

4.3.2 Data Selection Criteria

The cases at federal appellate court are selected for the text analysis. The final set of 80 dispute keywords for measurement is summarized in Table 20.

An initial search of dispute cases by keywords was executed from the library database. However, the results turned out less effective than a search of construction dispute cases only. Because a set of keywords—for example, change or contract—apply

to dispute cases of other industries like defense, construction projects cannot be easily identified and isolated.

Therefore, the disputant's role names are used to select the construction cases. Contractor, subcontractor, surety, and construction were used to search the cases. Keywords of "construction" and "contractor" become effective words in the broad search to find construction related dispute cases in the database. In Table 12, the search result from federal court cases is summarized.

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	Avg	STDev
1) Contractor w/s construction																					
Appeal	112	129	101	124	139	113	130	133	131	119	128	157	143	124	142	131	128	115	108	126.68	13.52
District	139	127	152	141	149	144	155	192	211	207	218	235	284	243	230	282	256	235	212	200.63	50.23
2) Contractor w/p subcontractor																					
Appeal	82	80	56	65	77	81	76	77	76	78	86	104	95	79	112	82	75	80	84	81.32	12.32
District	78	84	78	87	78	106	109	120	165	155	152	183	189	169	183	187	198	166	170	139.84	44.14
3) Contractor w/p surety																					
Appeal	27	22	17	17	17	18	24	23	20	14	32	30	27	29	20	24	23	15	19	22.00	5.24
District	23	23	28	26	26	19	32	30	62	45	40	45	76	56	51	57	51	66	55	42.68	16.83
4) Selected case																					
Appeal					25	31	36	42							22	27	33	17		29.13	8.03
Percentage of 1) cases					18%	27%	28%	32%							15%	21%	26%	15%			

233 cases (22.6% of search option 1) in the 4th group are selected out of 1031 cases from search option 1.

Table 12. Search result from database

From the selected cases, each case is reviewed against a final set of keywords to determine whether the dispute issues are related to keywords in construction disputes.

After executing a keyword search, each case is reviewed to determine whether it is related to construction dispute issues. The initial part of the judge's opinion shows the judge's summary of the case and expresses the judge's conclusion of the case. The percentage of finally selected cases from the initial database search is summarized in Table 12. About 15 to 32 percent of the initially searched cases from database are actually related to construction disputes.

This result indicates many issues in the usage of the database. The practice of case searching in the database is the only effective way for legal professionals to find valuable precedence court cases for building legal theory in the legal research. Dispute case searching in the database is not so helpful in gathering lessons from previous dispute cases. However, the database search has even less value to non-legal professionals since they have no way to analyze those cases. When defined dispute characteristics are available for any project stakeholder, the issues in dispute are effectively analyzed for further resolution in project operations.

4.3.3 Summary of Selected Cases: By Year and By Court

Selected dispute cases are summarized in Table 13. The total number of selected dispute cases in federal appellate court is 233. These cases are analyzed by their characteristics: year of judgment, percentage of affirmed cases, whether other opinions of dissent or concurrence are included, construction sector (i.e., either public or private), and either civil or architectural related projects.

Table 13. Summary of dispute cases: sorted by year

Year	Total Cases		Affirmed Cases		Other Opinions		Public		Civil	Arch
	Numbers	%	Numbers	%	Numbers	%	Private			
1984	25	10.7%	17	68.0%	4	16.0%	21	84.0%	12	9
							4	16.0%	0	4
1985	31	13.3%	13	41.9%	4	12.9%	21	67.7%	12	9
							10	32.3%	4	6
1986	36	15.5%	19	52.8%	3	8.3%	29	80.6%	20	9
							7	19.4%	0	7
1987	42	18.0%	15	35.7%	1	2.4%	33	78.6%	15	18
							9	21.4%	2	7
Sub-Total	134	57.5%	64	47.8%	12	9.0%	104	77.6%	65	69
							30	22.4%	48.5%	51.5%
1994	22	9.4%	9	40.9%	4	18.2%	15	68.2%	10	5
							7	31.8%	2	5
1995	27	11.6%	15	55.6%	3	11.1%	21	77.8%	11	10
							6	22.2%	3	3
1996	33	14.2%	18	54.5%	1	3.0%	27	81.8%	16	11
							6	18.2%	1	5
1997	17	7.3%	5	29.4%	2	11.8%	12	70.6%	8	4
							5	29.4%	2	3
Sub-Total	99	42.5%	47	47.5%	10	10.1%	75	75.8%	53	46
							24	24.2%	53.5%	46.5%
Total	233	100.0%	111	47.6%	22	9.4%	179	76.8%	118	115
							54	23.2%	50.6%	49.4%

Among the 233 selected dispute cases, 57.5 percent of the cases occurred in the 1980s while 42.5 percent were in the 1990s. Therefore, the sample is considered fairly distributed between the two decades to make further analysis of the dispute characteristics feasible. Nearly half (47.6 percent) of the district court judgments were affirmed (i.e., accepted outright) by the federal appellate court. This shows a trend of judgment at appellate court in the litigation result.

Appellate Court	Total Cases		Affirmed Cases		Public		Civil	Arch
	Numbers	%	Numbers	%	Private			
1st C.	6	2.6%	4	66.7%	4	66.7%	3	1
					2	33.3%	0	2
2nd C.	17	7.3%	8	47.1%	13	76.5%	5	8
					4	23.5%	2	2
3rd C.	9	3.9%	3	33.3%	5	55.6%	2	3
					4	44.4%	0	4
4th C.	29	12.4%	13	44.8%	22	75.9%	13	9
					7	24.1%	1	6
5th C.	31	13.3%	9	29.0%	22	71.0%	14	8
					9	29.0%	5	4
6th C.	10	4.3%	5	50.0%	8	80.0%	5	3
					2	20.0%	0	2
7th C.	16	6.9%	7	43.8%	10	62.5%	7	3
					6	37.5%	2	4
8th C.	14	6.0%	9	64.3%	10	71.4%	5	5
					4	28.6%	0	4
9th C.	21	9.0%	15	71.4%	18	85.7%	14	4
					3	14.3%	1	2
10th C.	12	5.2%	3	25.0%	9	75.0%	8	1
					3	25.0%	2	1
11th C.	20	8.6%	7	35.0%	10	50.0%	5	5
					10	50.0%	1	9
D.C. C.	4	1.7%	1	25.0%	4	100.0%	3	1
					0	0.0%	0	0
Fed. C.	44	18.9%	27	61.4%	44	100.0%	19	25
					0	0.0%	0	0
Total	233	100.0%	111	47.6%	179	76.8%	117	116
					54	23.2%	50.2%	49.8%

Table 14. Summary of dispute cases –2: sorted by appellate court

The presence of other opinions shows that in only 9.4 percent of cases is a third opinion of dissent or concurrence offered. These other opinions add diverse views to the dispute issues which introduce important perspectives into the legal procedures. However, this additional description adds more text to the specific issues cited in the judge's opinion. In the measurement process, this additional opinion is removed to allow

equal weight across cases to the main judgment in each dispute. The length of each judgment varies by judge but it is considered as a single unit of analysis in the content analysis.

The distribution of cases by years and by court is summarized in Tables 13 and 14. The project types are distributed 76.8 percent public and 23.2 percent private, while about half were civil (50.6 %) and half were architectural (49.4 %).

4.3.4 Details of Selected Cases

Dispute cases selected for analysis are summarized in Tables 13 and 14. Each dispute case is labeled by citation number, name of the appellate court, name of the court prior to the appellate court (such as district court or other appeal process), decision made by the appellate court, the presence of other opinions in the judgment, and the name of the parties involved. The selected cases are classified by year and exhibited in Table 15 and Tables A30 through A44 of the Appendix A.

The reason for collecting data by year is to examine any trends that may be apparent in the time frame studied. In this research, the trend in the 1980s and 1990s are compared rather than comparing the cases year by year.

The citation number shows the reference of the source data. The measurement of a dispute case can be related back to the full text of dispute cases. Therefore, the process of identifying causes of disputes can be precisely traced back to the dispute case by the users. This process of measurement can be combined with the case study methodology which is the traditional methodology in legal research.

In this legal research, there are "computer supported" and "computer assisted" methodologies. The major flaw in these research approaches is that the reasoning process is not revealed to the users—the so-called "back box" approach. In contrast, an objective of this research framework is for the reasoning process to be transparent to the user. Therefore, the user can revisit the source data to retrieve more lessons by using the citation number under the case study methodology. Otherwise, the measurement results can be used as a product of this research study, that is, a result of collective lessons from the collected dispute cases.

The names of the appellate court and prior courts are classified according to the jurisdiction of the court. In this research process, the investigation of the trend by court and jurisdiction is not pursued because the purpose of the research approach is to identify common causes of construction disputes. Therefore, the difference in jurisdiction is not relevant and is beyond the scope of this research.

The decisions made in the judgments reveal the third party's judgment of dispute issues in the legal process. Other opinions are removed from the measurement because these other opinion adds more keywords in the text data and could bias the analysis.

The name of parties is added to describe the parties involved in the dispute case. In this research process, formal analysis of the parties is not conducted although this information may reveal important clues in the case study approach.

Table 15. Dispute cases list in 1984: Part - A

1984A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1984	725 F.2d 650	11th C.	Fl.	Reverse, remand		UNITED STATES of America for the Use and Benefit of AETNA DRYWALL CONTRACTORS, INC., a Florida Corporation, Plaintiff-Appellant, v. AETNA CASUALTY AND SURETY COMPANY, a Connecticut Corporation, et al., Defendants-Appellees
2	1984	726 F.2d 149	8th C.	Mn.	Affirm		The County of Hennepin, a body politic and corporate in the State of Minnesota, Appellant Cross-Appellee, and Alpana Aluminum Products, Inc. and Midwest Industries, Inc., a joint venture, Appellee Cross-Appellant, v. AFG Industries, Inc., Appellee Cross-Appellant
3	1984	728 F.2d 444	10th C.	Oklahoma	Affirmed.		UNITED STATES OF AMERICA, Plaintiff-Appellee, v. METROPOLITAN ENTERPRISES, INC., and DANIEL P. KAVANAUGH, Defendants-Appellants
4	1984	728 F.2d 682	5th C.	Texas	Affirmed.		UNITED STATES of America, Plaintiff-Appellee, v. YOUNG BROTHERS, INC., Contractors, Defendant-Appellant
5	1984	729 F.2d 334	5th C.	Texas	Affirmed		COMMERCE PARK AT DFW FREEPORT, Plaintiff-Appellant, v. MARDIAN CONSTRUCTION COMPANY, Defendant-Appellee
6	1984	729 F.2d 743	Fed. C.	GSBCA	AFFIRMED IN PART; REVERSED IN PART; AND REMANDED.	CONCUR	CAPITAL ELECTRIC COMPANY, Appellant, v. THE UNITED STATES, Appellee
7	1984	731 F.2d 810	Fed Cir	DOEBCA	Affirmed		ERICKSON AIR CRANE COMPANY OF WASHINGTON, INC., * Appellant, v. THE UNITED STATES, Appellee
8	1984	731 F.2d 183	4th C.	VA	Affirmed		G & C Construction Corp., Appellant, v. St. Paul Fire and Marine Insurance Co., Appellee
9	1984	731 F.2d 805	Fed. Cir.	GSBCA	Vacated and remanded.		WILLIAM F. KLINGENSMITH, INC., Appellant, v. UNITED STATES, Appellee
10	1984	732 F.2d 913	Fed. Cir.	Claims court	Affirmed (but partially different reasons)		P.J. MAFFEI BUILDING WRECKING CORPORATION, Appellant, v. THE UNITED STATES, Appellee
11	1984	735 F.2d 433	11th C.	GA	VACATED and REMANDED.		James R. FRENCH, Plaintiff-Appellant, v. JINRIGHT & RYAN, P.C. ARCHITECTS, Defendant-Appellee
12	1984	735 F.2d 437	11th C.	GA	Affirmed		CECIL'S, INCORPORATED, Plaintiff-Appellee, v. MORRIS MECHANICAL ENTERPRISES, INC., and Transamerica Insurance Company, Defendants-Appellants
13	1984	736 F.2d 1007	5th C.	Mississippi	Affirm , in favor of Sub	DISSENT	AFFHOLDER, INC., a Missouri corporation, Plaintiff-Appellee, v. SOUTHERN ROCK, INC., a Mississippi corporation, Defendant-Appellant
14	1984	739 F.2d 1287	7th C.	Ill	Affirmed		JOHN V. ARVANIS, d/b/a, INDUSTRIAL CONTRACTORS, Plaintiff-Appellant, v. NOSLO ENGINEERING CONSULTANTS, INC., NOSLO ENGINEERING CORPORATION, and the UNITED STATES OF AMERICA, Defendants-Appellees;

4.4 Pilot Study

4.4.1 Purpose of Pilot Study

The pilot study is designed to test the research design framework with limited data before the large-scale research work is executed. The main purpose is to test the research design procedures for data collection and data analysis under the selected research methodology. The pilot study is used to confirm the research strategy of text analysis, the research methodology of content analysis, the data source of court judgment cases, the case selection of dispute related cases, and the measurement of keywords in text data.

The pilot study helps to test if the research methodology is suitable for the intended research problem. The results of pilot study are examined against the research framework to determine if the results are valid in answering the research questions.

4.4.2 Pilot Study Design

The pilot study is designed to execute the actual research framework but on a smaller scale. The pilot study is used to test the research framework with specific data and methodologies and to see whether those data and research procedure are executable to solve the research problem. Therefore, the process needs to follow the intended research framework.

The selected data are tested for whether they represent the dispute cases in research design. The method of content analysis is tested to determine if the measurement of

keywords is really able to capture the core issues of the dispute case. The keywords measurement is also reviewed against the content of the dispute case text to see if the measured results represent the actual issues of dispute. This is fundamentally based on the subjective review in content analysis methodology.

Keywords from general dispute characteristics (GDCs) are used to measure the text data. An initial set of keywords needs to be reviewed against the content of actual dispute cases since the keywords are developed from the literature review. An initial set of keywords needs to be revised to capture the broad concept of dispute issues while executing the actual case review. The set of keywords is revised from the text of actual dispute cases if a new keyword is identified that represents a new dispute issue. Therefore, the final set of keywords is developed through the pilot test procedure. This pilot process of adding and deleting keywords is important in finalizing the set of keywords used in the large-scale measurement.

4.4.3 Pilot Study Data Collection

Dispute cases for the pilot study are collected from various sources to test the effectiveness of the source—whether the data source is fit for the purpose of this research design. The dispute cases are selected from appellate and district court cases, board of contract appeal (BCA) cases, and others to confirm the data source of appellate court.

The selection procedure is used to test whether proper dispute cases are selected for keyword measurement among the pool of dispute cases. Those selected cases need to be measured by a set of keywords. The contents of dispute cases are reviewed by the

researcher to determine whether the cases are relevant to the dispute subject under this research design. This usually begins with a summary of the case, which is reviewed against a selected set of keywords to determine if the case is relevant to the dispute issues. After reviewing numerous dispute cases, 31 cases were finally selected for the keyword analysis.

4.4.4 Pilot Study Data Analysis

The purpose of the data analysis procedure is to measure keywords in the dispute text data. An initial set of keywords is developed for this pilot test from a literature review. The initial set of keywords is reviewed against actual dispute cases and the keywords are added or deleted according to their usage in the content of the text. The frequency of keywords is measured to analyze major dispute issues from the dispute cases.

Dispute characteristics – initial set of keywords

Dispute characteristics from the literature review were summarized in Table 6 of Chapter 2. This table presents a summary of keywords under six major groups of dispute concepts. The major groups were developed to categorize the relevant issues of a dispute. From this list of keywords, the following steps were carried out to develop a set of keywords for the measurement of text.

Initially a chain of keywords is developed to present the exact implication of the keywords. The chains of dispute keywords are categorized hierarchically in Table 16. For example, the keyword "change" is developed under many different words of addition, deletion, revision, scope, numbers, and change order. Forty-three keyword chains under seven major groups (developed from Table 6 in Chapter 2) are presented in Table 16. These chains of words rigorously capture the meaning of the general dispute characteristics (GDC) and the selected keywords. However, measuring keyword chains can become too complex and individual words can be left out. If the measurement is focused on the chain of words only, it may not cover every related issue in the text.

The searching of each keyword chain can be achieved by logical search operations, such as Boolean connectors, proximity searching, and phrase searching. Boolean connectors are word connectors such as "and" and "or" options in the combination of keywords. This options helps to locate where multiple words are used in conjunction. Proximity searches are used to find keywords within a designated distance between words. For example, the words in the phrase "change in work scope" are all within four words of proximity in a sentence. Phrase searching is used to search multiple words together in a phrase.

However, there is a problem in the measurement of each keyword chain in the text data. Measuring keyword chain method turns out to be a limited way of measurement in complex, real situations of dispute because numerous key words group can be made by permutation.

Table 16. Dispute characteristics – Keywords chain

	Characteristics		Characteristics
1	change-addition	23	cost-indirect cost (w/ potential risk)
2	change-deletion	24	cost-impact cost (disruption)
3	change-revision	25	cost-overhead (site/head office)
4	change-scope	26	cost-additional payment (claim/liquidated damage)
5	change-numbers	27	cost-payment withheld
6	change-change order-issuance	28	project risk-bad faith/misconduct
7	change-change order-directive	29	project risk-complexity
8	change-change order-procedure (include oral)	30	project risk-site access
9	design/specification-defiance	31	project risk-weather condition
10	design/specification-error/omission	32	project risk-subsurface condition
11	design/specification-ambiguity	33	project risk-defective works
12	contract condition-clarification	34	project risk-code compliance/requirement
13	contract condition-price type(unit/fixed)	35	project risk-warranty/guarantee
14	contract condition-ambiguity/conflict	36	project risk-practical completion
15	contract condition-breach of contract	37	project risk-waiver
16	contract condition-termination	38	project risk-dispute resolution procedure(ADR)
17	contract condition-liability	39	dispute-disputant-prime v. owner
18	contract condition-notice requirement	40	dispute-disputant-prime v. subcon/supplier
19	contract condition-payment condition(pay if paid)	41	dispute-liable party-owner
20	time-acceleration	42	dispute-liable party-prime
21	time-delay	43	dispute-liable party-subcontractor
22	cost-direct cost		

The strength of this measurement method is that it is able to search the content in detail through the relationships among keywords. However, the weakness of this approach is that it is unable to handle multiple combinations of keywords, making it difficult to build various combinations among keywords. If keyword chains are limited, various aspects of dispute issues may not be captured under defined keyword chain groups. If a keyword group is expanded to include every possible option, the precision of measurement is beyond effective control. Nevertheless, if keyword chains remain too limited, the measurement is limited in its ability to disclose dispute issues. Therefore, the method of keywords chain measurement is not sufficient for this research design. This method is transformed to the following method of more independent keyword searching, described in the next section.

Dispute characteristics – revised and final set of keywords

The initial set of dispute characteristics extracted from the literature review consists of 43 concepts in Table 16, which are not sufficient to capture the issues of dispute cases. Therefore a set of dispute characteristics is expanded to include more relevant words which includes synonyms of selected dispute characteristics. This is the process of building a lexicon of dispute keywords which are further developed into sets of keywords for the measurement in the content analysis.

A revised set of keywords is summarized in Table 17 which includes 110 keywords under six major categories. While reviewing the dispute cases in the pilot study, however, it became apparent that more keywords appeared in the text of dispute cases. These additional keywords need to be examined to determine whether they capture new perspectives of dispute issues. Therefore, new keywords were added to the lexicon for the pilot study and re-measured for the pilot study cases.

This extended set includes 128 keywords in Table 18 that need to be verified during the pilot study. This extended set of keywords are measured and analyzed throughout the pilot study to verify that they are representative of the core issues of the disputes. This extended set of keywords is analyzed through the measurement results.

Table 17. Dispute Characteristics - For Pilot Study (Revised set)

work	work	1	**cost**	cost	30	**Project Risk**	access - site	52	inadequate	82
	add	2		compensation	31		ambiguity	53	interpret	83
	alteration	3		Eichleay formula	32		arbitration	54	interruption	84
	corrective	4		equitable adjustment	33		bid	55	liability	85
	defect	5		increase	34		breach	56	lien	86
	deficiency	6		liquidated damage	35		claim	57	misconduct	87
	delete	7		overhead	36		clarify	58	misrepresent	88
	extra	8		payment	37		code - comply	59	mistake	89
	improve	9		payment withheld	38		complaint	60	negligent	90
	increase	10		penalty	39		complete	61	notice requirement	91
	modify	11		profit	40		complexity	62	obligation	92
	overrun	12		recover	41		comply	63	omission	93
	quality	13		retainage	42		conflict	64	performance	94
	repair	14		**bond**	43		controversy	65	progress	95
	revision	15		- payment bond	44		damage	66	quantum meruit	96
	scope	16		- performance bond	45		default	67	remedy	97
	workmanship	17					definition	68	risk	98
	change	18	**Architect**	Architect	46		dispute	69	settlement	99
	- change order	19		design	47		duty	70	union	100
	- directive	20		specification	48		error - omission	71	unjust enrichment	101
	- purchase order	21		drawing	49		expert witness	72	waiver	102
							express	73	warranty	103
schedule	schedule	22	**Surety**	Surety	50		faith - bad	74	weather - condition	104
	acceleration	23		Miller Act	51		faith - good	75	**contract**	105
	delay	24					fitness for purpose	76	- contracting officer	106
	expedite	25					force majeure	77	**termination**	107
	extension	26					fraud	78	termination-convenience	108
	interruption	27					guarantee	79	**subsurface**	109
	suspension	28					implement	80	- differing site condition	110
	withhold	29					imply - implicitly	81		

Table 18. Dispute Characteristics - For Pilot study (Extended set)

Work	work	1	**schedule**	schedule	43	**Project Risk**	express	86
	add	2		acceleration	44		faith - bad	87
	alteration	3		delay	45		faith - good	88
	corrective	4		expedite	46		Tort	89
	error	5		extension	47		fraud	90
	defect	6		interruption	48		**force majeure**	91
	deficiency	7		suspension	49		weather - condition	92
	delete	8		withhold	50		implement	93
	extra (work)	9		extra time	51		imply	94
	improve	10	**Architect**	Architect	52		implicitly	95
	increase	11		design	53		interruption	96
	modify	12		plan	54		**liability**	97
	overrun	13		specification	55		misconduct	98
	quality	14	**Surety**	Surety	56		misrepresent	99
	replace	15		Miller Act	57		mistake	100
	repair	16	**Project Risk**	access - site	58		negligent	101
	revision	17		bid	59		obligation	102
	scope	18		**breach**	60		**notice requirement**	103
	workmanship	19		claim	61		order	104
	change	20		**code - comply**	62		penalty	105
	- change order	21		comply	63		performance	106
	- directive	22	**Project Risk**	**complete**	64		progress	107
	- purchase order	23		fitness for purpose	65		quantum meruit	108
Cost	cost	24		incentive	66		failure	109
	budget	25		**damage**	67		remedy	110
	compensation	26		**default**	68		requirement	111
	Eichleay formula	27		**definition**	69		responsibility	112
	equitable adjustment	28		ambiguity	70		risk	113
	expense	29		clarify	71		settlement	114
	increase	30		complexity	72		suspension	115
	liquidated damage	31		controversy	73		union	116
	loss	32		discrepancy	74		unjust enrichment	117
	overhead	33		error - omission	75		**waiver**	118
	payment	34		inaccuracy	76		**warranty**	119
	payment withheld	35		inadequate	77		guarantee	120
	profit	36		interpret	78		**contract**	121
	recover	37		omission	79		- contracting officer	122
	retainage	38		**dispute**	80		**termination**	123
	bond	39		arbitration	81		termination-convenience	124
	- payment bond	40		complaint	82		**subsurface**	125
	- performance bond	41		conflict	83		- differing site condition	126
	extra cost	42		**duty**	84		**Contract dispute act**	127
				expert witness	85		**lien**	128

In Table 18, the measurement of the extended set of keywords in the pilot study is summarized. This table presents the number of related cases per keyword. Some of keywords—such as increase, budget, modify, bid, claim, obligation, performance, and requirement—are too frequently found in the text which suggests they have less value for the analysis of text. On the other hand, although some keywords may imply important meanings in the dispute, they are rarely used in the text, making them of little measurement value. These words include extra cost, unjust enrichment, waiver, expedite, interruption, incentive, discrepancy, inaccuracy, insufficient, tort, termination, risk, suspension, and penalty. Therefore, the extended keywords are filtered again to finalize the set of keywords for the large-scale analysis. A final set of keywords is developed for the large-scale analysis.

In the pilot process, keyword measurement and the content of the text are reviewed together to determine if the measurement represents the core issues in a dispute. The process of building a lexicon of keywords, as shown in Table 19, was developed in the pilot study to capture broad categories of keywords, and to explain major issues of the disputes. The final set of keywords for large-scale analysis of the text is presented in Table 20.

Table 19. Dispute characteristics from pilot study measurement.

		Included	31	Excluded	31	Excluded	31			Included	31	Excluded	31	Excluded	31
Work	1	**add**	13	increase	19			**Project**	44	breach	22	access site	6		
	2	extra (work)		overrun	2			**Risk**	45	comply	10	bid	19	interruption	1
	3	**defect**	10	error					46	complete	25	claim	29		
	4	deficiency	7	correct(ive)					47	contracting officer	11				
	5	repair	7						48	damage	17	fitness for purpose			
	6	**delete**	3						49	default	9	incentive	3		
	7	**change**	14	alter(ation)		alternative			50	**definition**	4			contract	
	8	change order	8	revis(ion)	8				51	ambiguity	7	complexity	2		
	9	directive		modify	16				52	clarify	9	controversy	3		
	10	purchase order	6						53	error	17	discrepancy	1		
	11	replace	6						54	omission	5	inaccuracy	2	inadequate	6
	12	**scope**	10	quality	7	dissatisfaction			55	interpret	21	insufficient	9		
	13			improve		displeasure			56	**dispute**	20	arbitration	1		
	14			workmanship	1				57	complaint	19	controversy	3		
	15			work					58	conflict	11				
Cost	16	**cost**	26	budget	18				59	duty	18				
	17	compensation	3	extra cost	3				60	expert witness	4	express	19		
	18	expense	13						61	**failure**	22				
	19	overhead	6						62	**fraud(ulent)**	13				
	20	Eichleay formula	12						63	faith - good	10	tort	3		
	21	payment	22	withhold	0				64	faith - bad					
	22	profit	9						65	**force majeure**	1	weather condition	5		
	23	Increase (cost)	14						66	**liability**	16	implement	3	imply	11
	24	**equitable adjustment**	7	unjust enrichment	2				67	misconduct	1			implicitly	7
	25	liquidated damage	4						68	misrepresentation	9				
	26	recover	25						69	mistake	7				
	27	retain(age)	9						70	negligent	8	obligation	22	responsibility	10
	28	loss	15	waiver	6				71	**notice requirement**	3	order	25	penalty	2
	29	**bond**	14						72	**progress**	5	performance	26	suspension	4
	30	payment bond							73			remedy	17		
	31	performance bond							74	**quantum meruit**	4	requirement	30		
	32	surety	17						75	termination	9	termination-convenience	1		
	33	Miller Act	12						76	**subsurface**	3	settlement	11		
Schedule	34	**schedule**	8	extra time	2				77	differing site condition	4	union	10		
	35	accelerat(ion)	9	expedite	2				78			waiver			
	36	delay	11	interruption	1				79			risk	9		
	37	extension	8						80	warranty	4				
	38	suspension	5						81	guarantee	9				
	39	withhold	5						82	plans	15	design	20		
Parties	40	Architect	4						83	drawings	8				
	41	Engineer	18						84	specification	13				
	42	subcontractor	21	contractor	30				85	Contract Dispute Act	4				
	43								86	lien	6				

Table 20. Dispute characteristics - For actual analysis (Final set)

Parties	Architect	1	**Cost**	**cost**	25	**Project Risk**	**Contract condition**	46	omission	67
	Engineer	2		compensation	26		**breach**	47	**plans**	68
	Subcontractor	3		expense	27		comply	48	drawings	69
	Contracting Officer	4		overhead	28		**damage**	49	**specification**	70
Schedule	**schedule**	5		Eichleay formula	29		**dispute**	50	**Liability**	71
	acceleration	6		payment	30		complaint	51	misconduct	72
	delay	7		profit	31		conflict	52	misrepresent	73
	extension	8		increase	32		expert witness	53	mistake	74
	suspension	9		**equitable adjustment**	33		**CDA**	54	negligent	75
	withhold	10		liquidated damage	34		**duty**	55	**warranty**	76
	progress	11		recover	35		**failure**	56	guarantee	77
Work	**defect**	12		retainage	36		**force majeure**	57	**fraud(ulent)**	78
	deficiency	13		loss	37		**notice requirement**	58	faith - bad	79
	repair	14		**bond**	38		**subsurface**	59	faith - good	80
	change	15		payment bond	39		- differing site condition	60		
	- change order	16		performance bond	40		**termination**	61		
	- directive	17		Surety	41		**Contract definition**	62		
	- purchase order	18		Miller Act	42		ambiguity	63		
	- replace	19		**default**	43		clarify	64		
	add	20		**lien**	44		error	65		
	extra (work)	21		**quantum meruit**	45		interpret	66		
	delete	22								
	scope	23								
	complete	24								

4.4.5 Pilot Study Results

The pilot study results are reviewed to examine the measurement of keywords. The pilot study is intended to test whether keywords are an effective filter to find major issues in construction disputes. The final set of 80 keywords in Table 20 is reviewed to ensure that they demonstrate actual counts for the purpose of measurement. The content of dispute cases and keyword counts are reviewed together to determine if the count is relevant to the issues of the disputes. This is a part of process in content analysis to build a proper lexicon of keywords before the execution of the data analysis. The change in the keywords set from 43 to 128, and then finally to 80, indicates the important role of the pilot study in changing the research design before major data collection and analysis.

The measurement of 80 keywords is summarized in Tables 21 and 22 to show the details of the counts in text data. Statistical analysis is not made in pilot test stage, but the measurement results present a fairly even convergence among keywords. The sum of the measurement per case shows a large variance indicating that a difference in text length and usage exists. This difference is corrected through normalization in the data analysis. The count of the final set of keywords and a review of each case, indicate that major issues of disputes and counted keywords are related. This is based on a researcher's subjective judgment at the pilot study stage which is unavoidable in the process of content analysis.

Table 21. Pilot study cases: Part - A

	Group	Characteristics	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22	c23	c24	c25	c26	c27	c28	c29	c30	c31	Sum	AVG
1	**work**	**add**	2	1	0	0					1	1		21	2	4	5	1		1								0		2	0	3	0	44	1.419
2		extra (work)		1				1				2			4		4	16						6								3		37	1.194
3		**defect**	10				1										20	1				6	9	1				7		1				56	1.806
4		deficiency	1						1				2				6		1			1	1	3				12			4			32	1.032
5		repair	5														2		1					2		2		7						19	0.613
6		**delete**		1										2								7												10	0.323
7		**change**					8					9	3		8	3	3		1					2				1	2	9	11	3	11	74	2.387
8		- change order					1						1		3	1				6		1		3						1				17	0.548
9		- directive																																0	0.000
10		- purchase order			15										5			7		24								1	1					53	1.710
11		- replace	4	1										27			4					13						9						58	1.871
12		**scope**		1				1							2	1		1	1		5			4						1		1		18	0.581
13	**cost**	**cost**	5	25		2	2	8		3	3	7	53		23	10	35	2	3	5	4	6		21		7	1	19	4	27	16	2	13	306	9.871
14		compensation																																0	0.000
15		expense		8				1			2	1	3	27		2							2	3		5		2	3			7		66	2.129
16		overhead		1									1							1			5		4				1				13	0.419
17		Eichleay formula												69																				69	2.226
18		payment		6	6	2	16	2		15	3	2	6		4		10	1	1	2	3			13			15	2	57	1	18	12		197	6.355
19		profit		3		11									4					6	2			1		4			1	1			33	1.065
20		increase	5								1	1	1	2	1		1	1	3		4							1		6	1		1	29	0.935
21		**equitable adjustment**										1	1			8						1								1	9		12	33	1.065
22		liquidated damage			1		1																3							3				8	0.258
23		recover	1	9	3		10			24	1	6	35		7	2	17	9	1	16	15	1		48		1	5	6	6	18	5	15	4	265	8.548
24		retainage		1			67				5						5		5				1			1	2		1					88	2.839
25		loss		5		2	6				2			3	4		19						1	4	1	2			1	3	1	1		55	1.774
26		**bond**				1	12	1		18			38	2									3	4		3	2	6	4	2		4		100	3.226
27		payment bond																																0	0.000
28		performance bond																																0	0.000
29		Surety				2	106	1			37		8						3	6	1		7				6	5	5	2		19		208	6.710
30		Miller Act				2			5	22			31					13		23	21			23			8		13	25		40		226	7.290
31	**schedule**	**schedule**					2					5	1		16							3	6	4			2							39	1.258
32		acceleration		3			1	1			1			2	1		1						1						1					12	0.387
33		delay										17	18		6	2		13			6		5	5				3				16	10	101	3.258
34		extension	1	12		1							2		3		1													1			2	23	0.742
35		suspension										5		108	1	1	1																	116	3.742
36		withhold					12				1												2	1						1				17	0.548

Table 22. Pilot study cases: Part - B.

	Group	Characteristics	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22	c23	c24	c25	c26	c27	c28	c29	c30	c31	Sum	AVG
37	**Parties**	Architect	1										3												7			1						12	0.387
38		Engineer		1								2			1	2	6	1																13	0.419
39		Subcontractor																																0	0.000
40		Contracting Officer					7	23				7		2		4				8		4	2							1	37		7	102	3.290
41	**Project Risk**	**breach**	4	14	14	8	4					3	35		8		2	6	1	1	7			41	2	1		13	5	9	7	6	1	192	6.194
42		comply				1	1			1		1	2				8	1					2							1	1			19	0.613
43		**complete**	8	10	5	1	22				28	8	7	34	18	4	4	2	1	6		17	25	33	4	2		3	11		4	4	1	262	8.452
44		**damage**	1	3			4					2	12		8		14	1			1		1	3	1	4		1		7		1	1	65	2.097
45		**default**		1		2	9	3			4		1		1								16						1					38	1.226
46		**definition**																																0	0.000
47		ambiguity		1								5	1						2			25			7				3					44	1.419
48		clarify		1	2	1							3	7	11		5								1						1			32	1.032
49		error (- omission)	1	3	2	1							32		24	1	2				1	1	1	6		1	5	13	1			2		97	3.129
50		interpret		13	3			4		3		10	1	3	4	7	27		8	2	1	40		8	8	1		2	10		1		12	168	5.419
51		omission					1						3			1	1							1											7	0.226
52		**dispute**		1			1	31				4	1	5	4		5	1	20	2		1		8	3		1	2	2		18	1	1	112	3.613
53		complaint	8	2	1	1		3	2	1			5		1	1		1	5				2	1					3	2	8	3		1	51	1.645
54		conflict			2										2	1	2	4				3		8		1	2	3	6						34	1.097
55		**duty**		2		30	10					1	1		2		1	3	1	1		2	3	1				7	26	6	1		1	99	3.194
56		expert witness		1									14			2												2						19	0.613
57		**failure**																																0	0.000
58		failure		3	1	2	3	1				5	17	2	6	1	3	1	1	2			7	7	2			6	2	2	1	1		76	2.452
59		**fraud(ulent)**	12	2	4			12				1	1			1	10	2				1		2				2		3				53	1.710
60		faith - bad		52								1	3	1			2	1				1		6						18	1			86	2.774
61		faith - good																																0	0.000
62		**force majeure**		6																														6	0.194
63		**liability**		1		5	7				1		2	7	1						3			1			1	4	2	2		5		48	1.548
64		misconduct	1																															1	0.032
65		misrepresent	4									9	1				1	3					3	1				2		3				27	0.871
66		mistake		1										3	53	1		1			1							1						61	1.968
67		negligient	6	2									3		2									2	1			1	2					19	0.613
68		**notice requirement**					2			5																			4					11	0.355
69		**progress**		1									1										8	2				2						14	0.452
70		**quantum meruit**								2			21											43							8			74	2.387
71		**termination**		2		56	1	4							24		1						32	11						72			203	6.548
72		**subsurface**										3				24																	7	34	1.097
73		- differing site condition										1				9	3																1	14	0.452
74		**warranty**	10									3										6						3						22	0.710
75		guarantee				1	4			3			2	1	1													2	1	1				16	0.516
76		**plans**										6																						6	0.194
77		drawings																																0	0.000
78		**specification**										11	1	2	12	4	3		1				1	3				2						40	1.290
79		**Contract dispute act**							27			4					8													29				68	2.194
80		**lien**									1				4					1	1			2					2					11	0.355

4.5 Synopsis

In this chapter, the data collection process and results were summarized. The data collection process was explained step by step through the selection of a data source and dispute cases. The data collection results were presented with an analysis of trends by year, by court, and by project types. The selected dispute cases are analyzed in the next chapter. The pilot study was executed to demonstrate the research design and data collection approach. The final set of 80 keywords is defined through the application of numerous steps to analyze data in the next chapter.

CHAPTER V. DATA ANALYSIS PROCESS AND RESULTS

5.1 Introduction

This chapter describes the data analysis process and results. Data analysis is composed of the analysis criteria and final data analysis results. The analysis results are tested through a validation procedure using a separate set of data. The validation results are presented in the form of the a t-test and a Mann–Whitney test.

The data analysis criteria include the criteria used for measurement and explain what data analysis procedures are executed. Final data analysis results are presented by the 80 dispute keywords and 14 groups of CDCs. The validation process explains validation criteria, validation data selection, validation procedures, and the results.

5.2 Data Analysis Criteria and Procedures

Data measurement criteria

The criterion for data measurement is to record the most frequently used dispute keywords in the text of court judgments. The frequency of keywords indicates the dispute issues and arguments in the dispute cases as described in Chapter 3. Frequency of the keywords is an objective measurement for text data analysis.

One method for determining the most important keywords in the judgment is through expert's case review, usually in the form of a case study approach. This approach involves making subjective decisions and is inappropriate in multiple data analysis. In the methodology of measuring keyword frequency, the most frequently used words will embody the central characteristics of dispute issues, arguments, and the nature of disputes. First, however, the nature of the text data was reviewed and tested through a pilot study.

The dispute cases were treated for measurement in the following manner. The measurement of keywords in a case is related to the length of the judgment text. The length of a judge's opinion depends on the judge's description and the presence of other opinions in the judgment. Other opinions of concurrence or dissent add more keywords and dispute issues to the text of a judgment. Therefore, some keywords appear more frequently in lengthy judgments that include opinions of concurrence or dissent. These additional opinions are removed from the final measurement to compensate for the difference in the length of these judgments. Finally, the measurement in each case is normalized to allow prorated weight within each case.

Weight among keywords in a case based on the importance of dispute issues is not considered in this analysis since it would involve a subjective judgment on the part of the researcher. This weight measure is avoided to ensure objective measurement.

The data measurement criteria are summarized by the most frequently used keywords in the judgment statement. The results are recorded for which keywords are

frequently used in the judgment. The measured keywords are the most important issues in explaining dispute cases in the legal process.

Data analysis procedure

The procedures of data analysis and validation are summarized in the following steps in Table 23.

Table 23. Procedures of data analysis and validation

Stages	Action
Analysis Process	*1) Measure keywords from the text.* *2) Convert raw numbers of measurement to normalized value per case.* *3) Analyze high frequency characteristics.* 4) *Identify fourteen groups of critical dispute characteristics (CDCs).*
Validation Process (In the next section)	5) Validate the results of the major data with the new set of data. 6) Test the statistical significance of means in the measurement data by t-test and Mann-Whitney test. 7) Interpret the result of validation.

The action items of the analysis process are described as follows.

1) *Measure keywords from the text*.

Dispute keywords are measured by counting each keyword in the text. A software tool was used to extract related keywords. The "*AskSam*" software (Version 3.0) is used to find and edit related keywords from the text data [AskSam, 1995]. Measured counts of

keywords are recorded in the spreadsheets shown in Tables A10 through A27 of the Appendix A. The final set of 80 keywords is measured in all 233 selected dispute cases.

2) Convert raw numbers of measurement to normalized value per case.

Measurement is made from the text of each case. Therefore, the unit of measurement is each dispute case. The count of keywords depends on the length of the text. The total count of each case is treated equally under the normalized value to compensate various length of judgments. Examples of normalized value calculation are made with the data of 1984 in Tables A12 and A13 of the Appendix A.

3) Analyze high frequency characteristics.

The frequency of keywords indicates the usage of keywords in the dispute. After the measurement is made, the final set of 80 keywords needs to be reduced into a smaller number of critical dispute characteristics (CDCs). The 80 keywords are too large to make practical sense of the measurement. Therefore, the keyword measurements need to be grouped by their relevance of the issues to develop the CDCs. Although there are many discussions of the major characteristics of disputes in the literature of Chapter 2, most of these are not measured quantitatively and do not involve quantitative analysis of dispute case data. Therefore, these keyword measurements are used to identify major dispute characteristics.

4) Identify groups of critical dispute characteristics (CDCs).

Major groups of dispute keywords are formed from the classification of measured keywords. These CDCs represent the nature of dispute issues more broadly than do keywords because CDCs cover relevant issues together. These groups are formed from

the frequency acquired during the measurement of the keywords. After carefully reviewing usage in the text, some of the keywords are classified further from the originally intended six major groups of keywords. The groups were formed based on an exploratory approach through measurement of frequency and relevance of issues. Fourteen major groups of keywords as CDCs were finally formed from the measurement.

The four action items of the validation process in Table 23 are described in the following section about the validation process and the results.

5.3 Final Data Analysis Results

Final data analysis presents the measurement of 80 keywords and 14 groups of CDCs. The results of 80 keywords are summarized by year and depicted in graphical form for the 1980s and 1990s. Fourteen major CDCs are developed from the context of 80 keywords in the text data. Both methods of analysis are summarized in this section.

Dispute keywords.

Final analysis of keyword measurements is presented in Figure 21. There are a total of 233 dispute cases, which is composed of 134 cases in 1980s and 99 cases in 1990s. Four years in each decade were selected for the data collection to investigate any trends in dispute issues. The lowest number of cases per year is 17 (in 1997) and the highest is 42 cases (in 1987).

The total measurement of keywords is 25,258 counts, which means an average of 108 counts per dispute case. These large numbers of measurement ensure that the broad spectrum of dispute keywords is selected for measurement. The measurement from each year shows a large standard deviation.

Summary Table

	YR 1984	YR 1985	YR 1986	YR 1987	YR 1994	YR 1995	YR 1996	YR 1997	Sub-1980'	Sub-1990'	Total
Cases	25	31	36	42	22	27	33	17	134	99	233
Tatal Count	1804	3021	3196	4921	3206	2671	3912	2527	12942	12316	25258
Avg. per Case	72.16	97.45	88.78	117.17	145.73	98.93	118.55	148.65	96.58	124.40	108.40
St. Devi.	48.7739	79.4392	81.1123	89.5523	106.4094	91.4111	85.5304	109.8322			

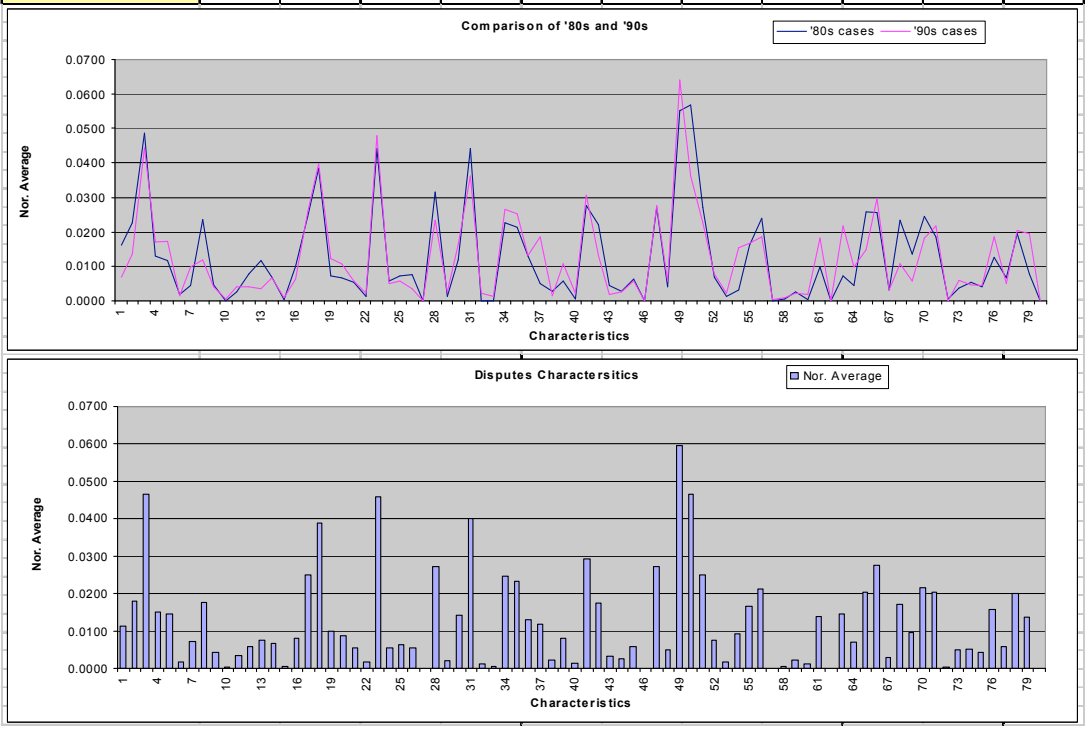


Figure 21. Final analysis - distributions of dispute characteristics.

For example, the average measurement of keyword occurrence for 1994 is 145.73 with a standard deviation of 106.4094, indicating that the measurement results of 22 cases are very scattered, i.e. some cases have many instances of keywords while others

have very few. The large standard deviation is recorded because the sum of measured numbers shows big differences per each case. The high variance in keyword measurements and the large standard deviation are due to a number of reasons, including varying length of the judgments, writing style and word usage of the judge, the nature of dispute issues, and legal arguments.

Even though the measurement results slightly vary by case, over 25,000 data points from 233 cases ensure sufficient data to make valuable conclusions. This analysis framework and methodology have never been attempted in the construction dispute research domain.

Finally, a set of 80 keywords were utilized for measurement. The upper graph of Figure 21 shows the trend of 80 keywords during the 1980s and 1990s. It should be noted that some keywords are measured with a relatively high frequency (between 2 to 4 percent of all measurements), while some appear less frequently (below 1 percent of all measurements). The comparison of 1980 and 1990s will be analyzed statistically by comparing means, but the graph shows reasonably similar trends between the 1980s and 1990s.

Normalized averages of 80 keyword measurements from all the data in the 1980s and 1990s are depicted in the lower graph of Figure 21. When this graph is reviewed, it is clear that analysis of the 80 keywords is too complex to identify some of the more significant keywords among the 80. Therefore, a smaller number of groups is necessary to develop the trend of dispute keywords and to identify critical dispute characteristics. The groups of keywords as CDCs are developed from analyzing the 80 keyword

measurements. A final number of 14 groups of CDCs are developed from the measurement analysis as shown in Table 24.

Table 24. Final data analysis with 80 disputes keywords.

1	Parties	Architect	26		equitable adjustment	51		complaint	76		warranty
2		Engineer	27		liquidated damage	52		conflict	77		guarantee
3		Subcontractor	28		recover	54		CDA		**A13**	**S-Warranty**
4		Contracting Officer	29		retainage	55		duty	78		fraud(ulent)
	A0	**S-Parties**	30		loss	56		failure	79		faith - bad
5	Work	defect		**A5**	**S-Adjustment**	58		notice requirement		**A14**	**S-Fraud**
6		deficiency	31		bond	61		termination		**SUM**	**Sub-Total-1**
7		repair	34		Surety		**A9**	**S-Condition**			
	A1	**S-Defect**	35		Miller Act	57		force majeure			
8		change	36		default	59		subsurface			
10		- directive	37		lien	60		- differing site condition			
11		- purchase order	38		quantum meruit		**A10**	**S-Subsurface**		Excluded	
12		- replace		**A6**	**S-Bond**	63		ambiguity	9		- change order
14		extra (work)	39	Schedule	schedule	64		clarify	13		**add**
15		delete	40		acceleration	65		error (- omission)	18		**cost**
	A2	**S-Change**	41		delay	66		interpret	25		increase
16		scope	43		suspension	67		omission	32		payment bond
17		complete	44		withhold	69		drawings	33		performance bond
	A3	**S-Scope**	45		progress	70		specification	42		extension
19	Cost	compensation		**A7**	**S-Schedule**		**A11**	**S-Defintion**	53		expert witness
20		expense	49		damage	71		Liability	68		**plans**
21		overhead	50		dispute	72		misconduct	46		**Contract condition**
22		Eichleay formula		**A8**	**S-Dispute**	73		misrepresent	62		**Contract definition**
23		payment				74		mistake	80		faith - good
24		profit	47	Project	breach	75		negligent			Sub-Ex-Total-2
	A4	**S-Cost**	48	Risk	comply		**A12**	**S-Liability**			Total

Critical Dispute Characteristics (CDCs)

Eighty dispute keywords are analyzed by group in Table 24. These 80 keywords need to be classified into groups to develop major CDCs. Major groups need to represent the dispute issues and arguments of the court cases. Therefore, CDCs as groups of keywords are developed from the measurement of text data.

The finalized 14 groups of CDCs, with the keywords they include, are summarized in Table 25. The reasoning of each of the CDCs is also described in the Table 25.

Table 25. Reasoning behind fourteen groups of CDCs

Major groups	Included keywords	Numbers of Keywords
1) defect	**Defect** and **deficiency** are considered synonyms. **Repair** is considered a result of defects.	3
2) change	**Change** of the project contract and work scope is developed as a group. **Change** order, change **directive** (in AIA contract)**, and purchase order are** grouped together. **Replace** and **delete are** considered synonyms. **Extra (work)** is considered a result of **change.**	6
3) scope	**Scope** means work scope in the contract. **Complete** means completion of the work related to the scope of the contract.	2
4) cost	**Compensation**, **expense**, **overhead**, **payment**, and **profit** are somehow related with the cost of the project. These keywords present the concept of cost. The Eichleay formula is used to calculate head office overhead when a delay on a project prevents the contractor from obtaining new business during the delay project. Therefore, it appears frequently in cost-related disputes.	6
5) adjustment	**Equitable adjustment** is a legal term used for a monetary claim caused by the third party's act. Therefore **adjustment** is asked for in many dispute situation. **Liquidated damage** is asked for when there is a contractor's delay. **Recovery** and **loss** are considered part of the adjustment. Because **retainage** and **loss** are not released or recovered commonly in dispute situations, these are asked for under **adjustment**.	5
6) bond	**Bond** and **surety** are popular issues when **default** is involved in the project. The **Miller Act** governs payment bond requirements on construction contracts with the federal government. Mechanic's **lien** is used to collect unpaid sums in bankruptcy. **Quantum meruit** is used in damage claims by the subcontractor to recover works performed for the owner.	6
7) schedule	**Schedule** and **progress** issues include **acceleration, delay, suspension, and withhold** in the project**.**	6
8) dispute	**Dispute** is a broad issue of the litigation. Restitution of **damage** is a popular issue of litigation.	2

9) condition	Contract **condition** represents various issues in contractual disputes including **breach** of contract**, comply, complaint, conflict, duty, failure, notice requirement,** and **termination.** Disputes related to the performance of a government construction contract **condition** are governed by the **CDA (Contract Dispute Act)**.	9
10) Undiscovered (subsurface)	**Subsurface** issues and **differing site condition** are common issues in the dispute of unforeseen ground conditions. **Force majeure** describes a natural situation beyond human control.	3
11) definition	Contractual **definition** becomes an issue of the dispute and includes **ambiguity, clarify, error, omission, and interpret. Drawing and specification** are also issues of definitions partly related to errors and omissions.	7
12) liability	**Liability, negligent, misconduct, misrepresent, mistake** are considered similar dispute issues. Definitions of each word are various, but most of the measured usage is focused on liability issues in the disputes.	5
13) warranty	**Warrant** and **guarantee** become popular issues whether they become express or implied.	2
14) fraud	**Fraud** and **bad faith** describes a party's intention in negative ways.	2

The purpose of these 14 CDC groups are to present major dispute issues for the project stakeholders when they need to make a decision. These results present what are the actual issues, arguments, and judgments in dispute resolution under the litigation process. The 14 major groups describe why each keyword is classified in its category in Table 25.

The measurements of 14 groups of CDCs are summarized in Table 26. The data from 1984 to 1987 and from 1994 to 1997 and their average are presented in this table. The average measurement in the 1980s and 1990s is depicted in the lower graph of Table 26. However, this average needs to be validated to determine whether it represents a

statistically significant difference in trend. The validation process is used to test the means of the data by t-test in the next section but the graph in Table 26 shows interesting trend of similarity between 1980s and 1990s data. This supports the selection of CDCs as potential dispute predictors, since it suggests that the underlying causes of disputes do not vary significantly over time, at least for the thirteen-year period considered in this research.

Table 26. Summary of normalized value for 14 keywords groups

Normalized Value		YR 1984	YR 1985	YR 1986	YR 1987	YR 1994	YR 1995	YR 1996	YR 1997	Sub-1980	Sub-1990	Total	1993
Cases		25	31	36	42	22	27	33	17	134	99	233	
Tatal Count		1804	3021	3196	4921	3206	2671	3912	2527	12942	12316	25258	
Avg. per Case		72.1600	97.4516	88.7778	117.1667	145.7273	98.9259	118.5455	148.6471	96.5821	124.4040	108.4034	
St. Devi.		48.7739	79.4392	81.1123	89.5523	106.4094	91.4111	85.5304	109.8322				
										Avg. - 80	Avg. - 90	Avg.	
	S-Parties	0.0980	0.0988	0.0750	0.1294	0.0678	0.0602	0.0655	0.1331	0.1018	0.0762	0.0909	0.0682
A1	S-Defect	0.0184	0.0196	0.0254	0.0099	0.0391	0.0216	0.0297	0.0241	0.0179	0.0286	0.0224	0.0229
A2	S-Change	0.0436	0.0375	0.0334	0.0504	0.0234	0.0143	0.0507	0.0256	0.0416	0.0304	0.0368	0.0305
A3	S-Scope	0.0313	0.0318	0.0409	0.0340	0.0276	0.0241	0.0391	0.0377	0.0348	0.0322	0.0337	0.0241
A4	S-Cost	0.0610	0.0644	0.0710	0.0867	0.0928	0.0515	0.1162	0.0741	0.0725	0.0862	0.0783	0.0884
A5	S-Adjustment	0.0602	0.0502	0.0531	0.0463	0.0418	0.0346	0.0461	0.0609	0.0516	0.0446	0.0486	0.0564
A6	S-Bond	0.0665	0.0865	0.1485	0.1349	0.0955	0.1358	0.1110	0.1425	0.1146	0.1197	0.1168	0.1312
A7	S-Schedule	0.0763	0.0423	0.0238	0.0488	0.0824	0.0244	0.0587	0.0482	0.0457	0.0528	0.0487	0.0526
A8	S-Dispute	0.1471	0.1110	0.1074	0.0823	0.1003	0.1082	0.1117	0.0810	0.1078	0.1029	0.1057	0.0917
A9	S-Condition	0.0964	0.1769	0.0925	0.1091	0.1498	0.1821	0.1327	0.0719	0.1180	0.1395	0.1271	0.0929
A10	S-Subsurface	0.0052	0.0004	0.0011	0.0049	0.0076	0.0031	0.0039	0.0026	0.0029	0.0043	0.0035	0.0015
A11	S-Defintion	0.1119	0.0955	0.1195	0.0896	0.1113	0.1077	0.0711	0.1209	0.1031	0.0986	0.1012	0.0976
A12	S-Liability	0.0203	0.0353	0.0401	0.0334	0.0365	0.0325	0.0361	0.0446	0.0332	0.0367	0.0347	0.0348
A13	S-Warranty	0.0273	0.0268	0.0148	0.0084	0.0166	0.0351	0.0156	0.0279	0.0179	0.0233	0.0202	0.0131
A14	S-Fraud	0.0283	0.0280	0.0221	0.0325	0.0337	0.0646	0.0195	0.0419	0.0278	0.0388	0.0325	0.0227
	Sub-Excluded	0.1081	0.0950	0.1318	0.0995	0.0736	0.1002	0.0926	0.0631	0.1087	0.0854	0.0988	0.1716
	Total	1	1	1	1	1	1	1	1	1	1	1	1

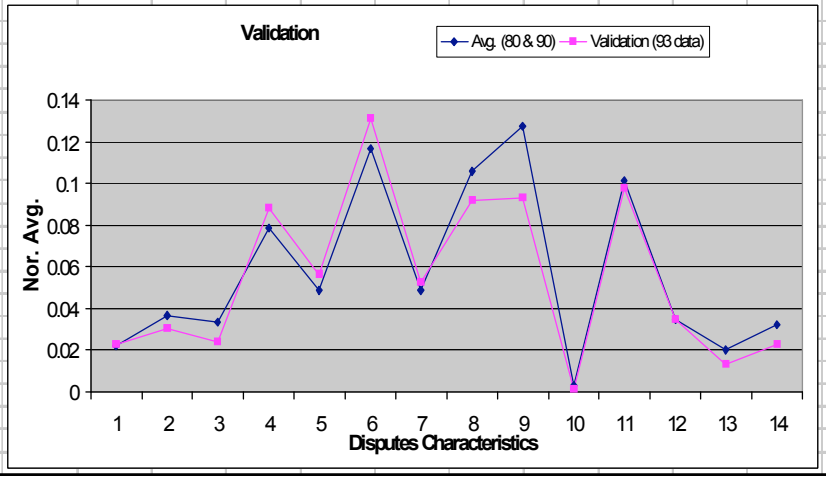
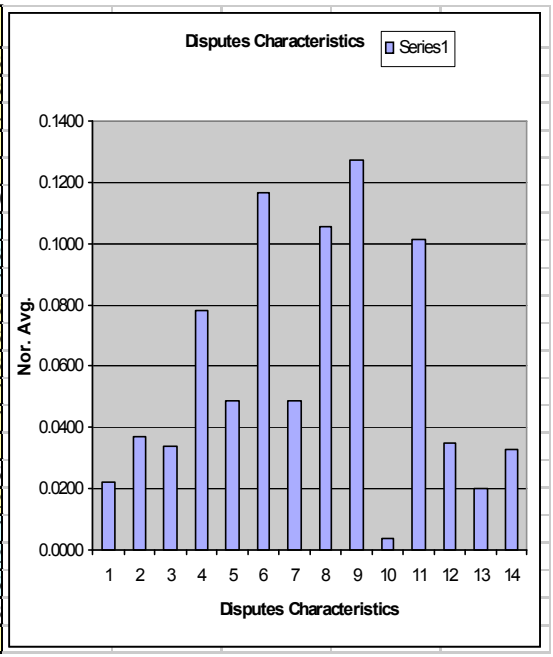


Table 27. Final analysis - fourteen CDCs.

Normalized Value		Sub-1980'	Sub-1990'	Total
Cases		134	99	233
Tatal Count		12942	12316	25258
Avg. per Case		96.5821	124.4040	108.4034
St. Devi.				
		Avg. - 80	Avg. - 90	Avg.
	S-Parties	0.1018	0.0762	0.0909
A1	S-Defect	0.0179	0.0286	0.0224
A2	S-Change	0.0416	0.0304	0.0368
A3	S-Scope	0.0348	0.0322	0.0337
A4	S-Cost	0.0725	0.0862	0.0783
A5	S-Adjustment	0.0516	0.0446	0.0486
A6	S-Bond	0.1146	0.1197	0.1168
A7	S-Schedule	0.0457	0.0528	0.0487
A8	S-Dispute	0.1078	0.1029	0.1057
A9	S-Condition	0.1180	0.1395	0.1271
A10	S-Subsurface	0.0029	0.0043	0.0035
A11	S-Defintion	0.1031	0.0986	0.1012
A12	S-Liability	0.0332	0.0367	0.0347
A13	S-Warranty	0.0179	0.0233	0.0202
A14	S-Fraud	0.0278	0.0388	0.0325
	Sub-Excluded	0.1087	0.0854	0.0988
	Total	1	1	1



The final results of the 14 CDCs are summarized in Table 27. Normalized average measurements of CDCs from all 233 cases are presented in the 14 CDC groups. In summary, there are five higher groups of frequencies between 6 and 13 percent, as well as nine lower groups of frequencies between 2 and 5 percent.

In Table 27, two groups of frequency are noticed in the court cases of the 1980s and 1990s. However, any special meaning of CDCs groups is not pursued in this research frame from the frequencies of keywords.

5.4 Validation Process and Results

5.4.1 Validation Criteria

The final results of the measurement are the means of 1980s and 1990s and the means of the combined data. These means of two sets of data need to be tested to determine if they represent the same population. In other words, the trend of CDCs is similar during 1980s and 1990s.

Once this trend is tested, the research results are tested with a separate set of new data from 1993 cases. This new data set of 1993 cases are validation data and are compared against the results from the all data. This validation process is intended to test whether the findings from the data analysis are consistent in the separate set of new data.

The dispute case data for validation is selected using the same method as the main data. The validation data set was selected from the cases heard before the federal appellate court in 1993. The procedure and criteria to select these cases are exactly same as the major research data set.

5.4.2 Validation Procedure

After analysis is executed as described in the previous section, a validation process is executed by following the predefined procedure in Table 28. The keywords are measured from the selected validation cases as executed in the major data analysis. Then

the means are tested with the major research data to determine whether the two data sets came from the same population.

Table 28. Procedures of data analysis and validation

Stages	Action
Analysis Process	1) Measure keywords from the text. 2) Convert raw numbers of measurement to a normalized value per case. 3) Analyze high frequency characteristics. 4) Identify 14 groups of critical dispute characteristics (CDCs).
Validation Process	5) *Validate the results of the major data with the new set of data.* 6) *Test the statistical significance of a difference in means in the measurement data by t-test and Mann-Whitney test.* 7) *Interpret the result of validation.*

Action items of the validation process shown in Table 28 are described as follows.

5) Validate the results of major data with the new set of data.

The means of measurements of the data need to be tested to determine if they came from the same population. The initial comparison is made between the data of 1980s and 1990s. Then second comparison is made between all the data of 1980s and 1990s, and a separate set of data from 1993. This procedure aims to test whether the findings of the major data are consistent with the separate set of new data.

6) Test the statistical significance of means in the measurement data by t-test and Mann-Whitney test.

The tests for means of measurement are executed by both parametric and nonparametric methods as explained in the methodology sections of Chapter 3. The test results present whether or not the difference in the two means is statistically significant. In other words, although separate data are obtained from the same population of data between 1980s and 1990s, as well as between all the collected years and 1993. Therefore, the tests validate whether there is any difference in the means of the measurement data.

7) Interpret the result of validation.

The validation results are reviewed against the research questions in this research design. The statistical significance is used to determine if the findings are consistent across the years in the research design. Final CDCs are then reviewed to decide if they are consistent dispute characteristics in this research frame.

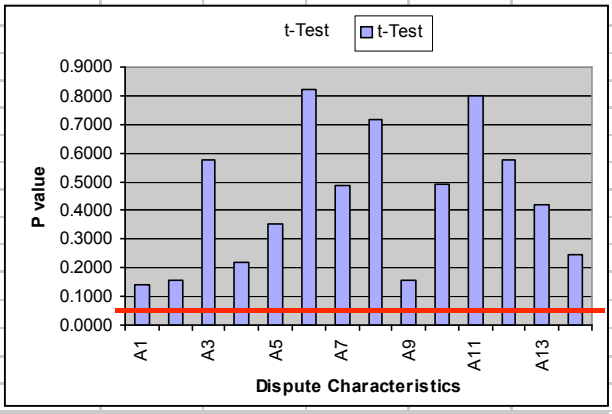
5.4.3 Validation Results

Two stages of test of means are executed in the validation test. The first stage is between the 1980s and 1990s data. The total sample sizes in the two groups are: 134 cases from the 1980s and 99 cases from the 1990s. The second stage is all the sample cases and validation cases from 1993. The sample sizes for this stage of 233 cases from the 1980s and 1990s and 31 validation cases from 1993 are to be tested. A comparison of means is executed by both the t-test and Mann-Whitney test for the validation.

Table 29. Summary of t-test results

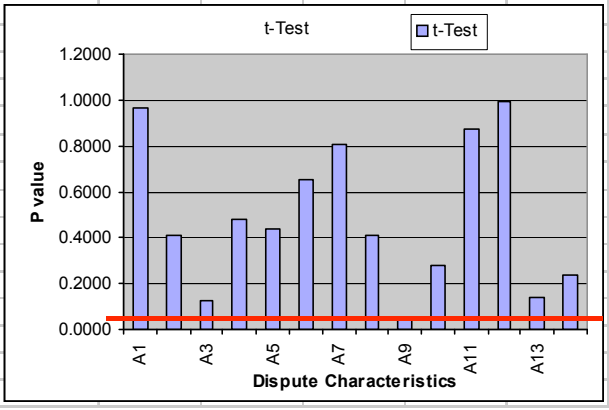
t-Test: Two-Sample Assuming Unequal Variances (Between 80s and 90s)

P(T<=t) two-tail	
A1	0.1393
A2	0.1578
A3	0.5777
A4	0.2179
A5	0.3523
A6	0.8236
A7	0.4878
A8	0.7181
A9	0.1592
A10	0.4892
A11	0.7966
A12	0.5757
A13	0.4198
A14	0.2450



t-Test: Two-Sample Assuming Unequal Vari.(Between 80s & 90s and 1993)

P(T<=t) two-tail	
A1	0.9631
A2	0.4119
A3	0.1255
A4	0.4770
A5	0.4370
A6	0.6486
A7	0.8073
A8	0.4089
A9	0.0475
A10	0.2760
A11	0.8749
A12	0.9897
A13	0.1420
A14	0.2339



The level of significance is summarized in the tables and graphs in Table 29. If the test result show statistical significance is below 0.05 level, the null hypothesis is rejected which means two independent samples came from different populations.

The following validation results show that the means are not significantly different. Therefore, all the cases in the two tests—between 1980s and 1990s and between the 1980s and 1990s (as taken as a whole) and 1993—are believed to have come from the same population. In other words, the measurement trends of keywords are consistent in this research design.

T-test results

The validation by t-test is executed under two samples assuming an unequal variance condition as summarized in Table 29. In the first test of data from 1980s and 1990s, all 14 p-values are higher than the customary 0.05 level, which means the paired samples are not statistically significantly different. In the second test of all the data and 1993, thirteen of the p-values are higher than 0.05 level, but one is not (A9, contract condition issues). The details of test results are summarized in Tables of A56 through A58 of the Appendix A. Therefore, the time-based trends of CDCs are not statistically significant in 13 CDCs.

Mann-Whitney test results

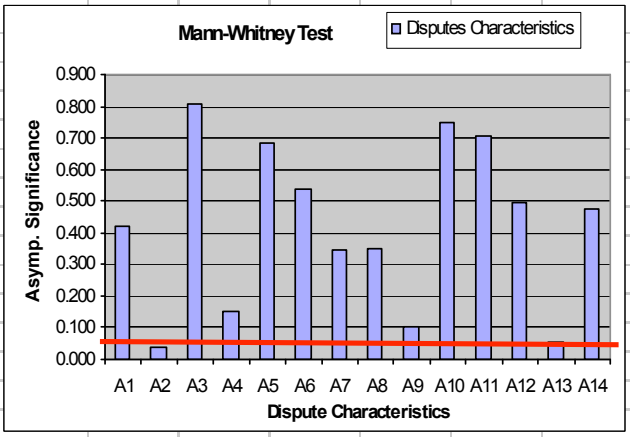
The validation by Mann-Whitney test is executed under the two samples and two tails conditions as summarized in Table 30. In the first test of data from the 1980s and

1990s, 12 CDCs exceed the 0.05 significance level. Only A2 (change) and A13 (Warranty) are shown as 0.039 and 0.051 respectively. This result can be interpreted as meaning the data from 1980s and 1990s are consistent.

Table 30. Summary of Mann-Whitney test results

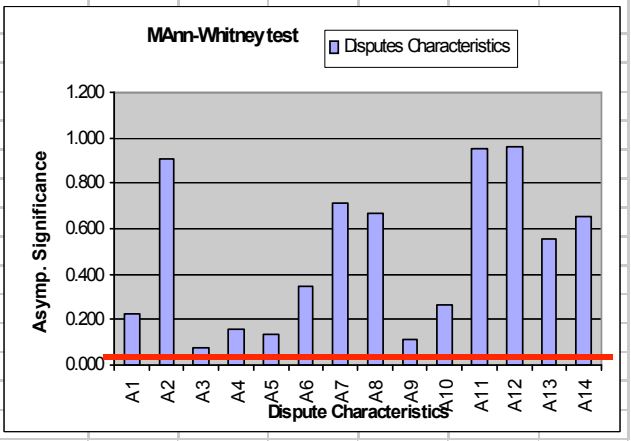
Mann-Whitney Test (Between 80s cases and 90s cases)

Asymptotic. Sig. (2-tailed)	
A1	0.421
A2	0.039
A3	0.808
A4	0.149
A5	0.682
A6	0.541
A7	0.345
A8	0.349
A9	0.103
A10	0.751
A11	0.707
A12	0.496
A13	0.051
A14	0.473



Mann-Whitney Test (Between 80s and 90s cases and 1993 cases)

Asymptotic. Sig. (2-tailed)	
A1	0.228
A2	0.905
A3	0.076
A4	0.161
A5	0.136
A6	0.345
A7	0.714
A8	0.665
A9	0.109
A10	0.261
A11	0.953
A12	0.963
A13	0.552
A14	0.655



In the second test of all the data and 1993, all 14 CDCs are at a higher level of significance than 0.05 level. Since two of the CDCs are not statistically significant in the

first test, the meaning of second test may not be used as a test of statistical significance. These details of test results are summarized in Tables A52 through A54. of the Appendix A. However, the results show that the samples came from the same population as the research frame. While some CDCs defined in this research frame may not show strong evidence to make this judgment, 12 out of 14 CDCs do compromise the same result. The lesson from this analysis is that the process of defining CDCs needs to be further developed in future research projects.

Validations of the average measurement of the 14 critical dispute characteristics (CDCs) are performed using the measured data set. First, measurements between 1980s and 1990s are compared to determine if data are statistically significant. These data are tested using t-test under the condition that two samples assume unequal variance. The results show that 13 CDCs are assumed to come from the same data set. The analysis results of 1980s data is concluded to be not substantially different from that of the 1990s.

Second, all the data of 1980s and 1990s show that the data set came from the same population. Therefore, the separate new data set is prepared for the validation of findings from the 1980s and 1990s data. Separate dispute cases are selected from 1993, and a validation data set is tested against all of the cases from the 1980s and 1990s. Results show that the 1980s and 1990s as well as the 1993 data are not significantly different from each other, except in one of the CDCs. Table 29 and 30 summarize validation results of the analysis.

5.5 Synopsis

In this chapter, data analysis criteria and final data analysis results were presented. Data analysis criteria were described by data measurement criteria and data analysis procedures. Analysis procedures were summarized in eight stages of actions. Final data analysis results are described by 80 dispute keywords and 14 critical dispute characteristics. Validation of the research findings were made through a comparison of means of the research and validation data. The validation results show that two separate samples of data came from the same population within this research design.

Chapter VI. RESEARCH RESULTS AND PRODUCT

6.1 Introduction

This chapter describes the results and products of this research study, including the final set of Critical Dispute Characteristics (CDCs) from the dispute case analysis. Eighty keywords—initially used to measure the text of dispute cases—were classified into 14 CDC groups: *defect, change, scope, cost, adjustment, bond, schedule, disputes, condition, undiscovered, definition, liability, warranty, and fraud*. The meaning and implications of these 14 CDCs are described from various perspectives of the research framework in construction operations. Practical application of CDCs is also presented to show how CDCs work in a situation of project operations.

6.2 Summary of Research Results and Procedures

This research study has sought to provide an analytic framework for understanding the causes of disputes in a construction project. Disputes in many construction projects have been managed by personal experiences and "*hearsay rules*" of the precedence projects. This research provides a scientific analysis of dispute issues from the collective knowledge of precedence project records.

This research framework is composed of selected text data and their analysis procedures. The results are presented in a final set of 14 CDCs and their frequency. The text data are a form of qualitative data from judgments in construction litigation. These court judgments contain precedence dispute knowledge without a predefined structure. Therefore, many procedures were developed to explore the underlying content of the text data. The major hurdle in the research framework was to develop procedures for effectively filtering knowledge from the vast text available for analysis.

A single case study is an intuitively appealing way of extracting knowledge from a precedence case. However, this approach is not sufficient for developing collective knowledge from numerous precedence cases. A text analysis approach of multiple precedence cases is selected to overcome this limitation. The methodology of content analysis was selected to analyze the text of the multiple dispute cases under this research framework. A set of dispute keywords, aggregated from the various sources of the literature, was used in analyzing cases selected to represent the spectrum of dispute situations.

The research results present a set 14 groups of CDCs. The final set of CDCs is developed as part of a framework and methodology that will eventually allow stakeholders to analyze project performance from a dispute issue perspective on current projects. Project stakeholders can use this CDCs framework to understand potential dispute issues and to make better judgments from the collective knowledge of the past dispute cases they represent.

The concept of CDCs aims to support stakeholders in the decisions they make, not in making the decisions for them. This concept seeks to avoid a "*black box*" approach, which presents a result without a reasoning procedure. The results and procedure of developing CDCs are summarized as follows.

The general dispute characteristics (GDCs) from literature review were presented in Table 6 of Chapter 2. This set of GDCs was reviewed against actual dispute cases in pilot study and finalized as a set of dispute keywords in Table 20 of Chapter 4. The final set includes 80 keywords in six categories. These keywords were used to select the cases and to measure their frequency in the text data of the selected dispute cases.

Dispute cases were selected from federal appellate court cases. These dispute cases may not include commonly-occurring disputes in project operations. Instead, they are probably among the worst dispute situations in project operations because they have proceeded to the last resolution stage—federal appellate court. The dispute case selection was executed by searching citation databases with a final set of keywords. Then, each case was reviewed against a final set of keywords in the summary part of the judgment text. The 233 dispute cases were selected to measure the frequency of keywords from the federal appellate court. The details of the selected court cases are summarized in Tables A30 through A44 of the Appendix A. An additional 31 cases were selected for validation of the main data set. The details of the validation cases are summarized in Tables A47 and A48 of the Appendix A.

The frequency of the final set of 80 dispute keywords was measured in the text of the selected dispute cases. The measurement of each case is summarized in Tables A10

through A27 of the Appendix A. A measurement summary is presented in Figure 21 with a graph showing measurement trends for the 80 keywords. The final CDCs were developed based on the frequency and context in the text with which the keywords appeared. Trends in the frequency of use of CDCs between 1980s and 1990s are presented in Tables 26 and 27.

6.3 Results of Critical Dispute Characteristics (CDCs)

The measurements from the set of dispute keywords present the trends of keyword usage in the text of court judgments. The measurement results of all 233 cases are presented in Tables A10 through A27 of the Appendix A. A summary of all the measurement showing the means of 80 keywords is summarized in Table A49 through A51 of the Appendix A. This measurement, depicted in the graph of Figure 21, shows the trend of the 80 keywords measurements. The trends of 1980s and 1990s are presented for comparison to the graphs in Table 26.

6.3.1 Outline of CDCs

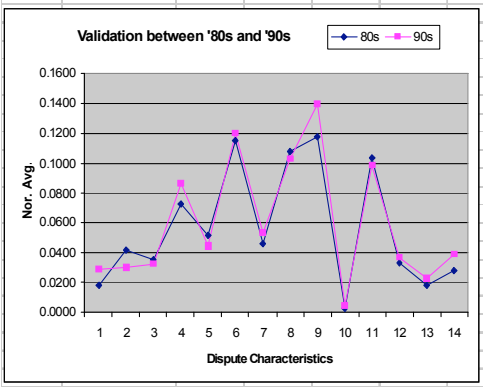
The measurement of 80 keywords presents details of dispute issues in the text. However, although large numbers of keywords are effective in capturing broad dispute issues, they make it difficult to interpret the dispute issues in a case. Therefore, a set of 80 keywords needs to be reduced to represent the major dispute issues according to their

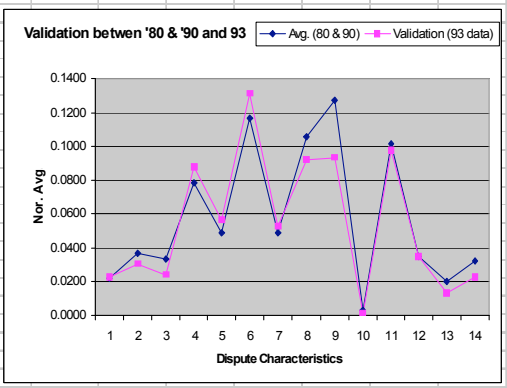
usage in the text. The reasoning of keyword groupings is presented in Table 25 of Chapter 5.

Critical dispute characteristics (CDCs) in 14 groups represent the major dispute issues measured from the dispute text. These limited numbers of major dispute characteristics can be used to identify and manage dispute issues effectively in project operations. A summary of the frequency of measurement of the 14 CDCs is presented in Tables A50 and A51 of the Appendix A. The normalized average of CDCs per year is summarized in Table A55. The comparison of measurements in 1980s and 1990s is summarized in Table 31.

Table 31. Summary of Trends in CDCs

Normalized Value		YR 1984	YR 1985	YR 1986	YR 1987	YR 1994	YR 1995	YR 1996	YR 1997	Sub-1980'	Sub-1990'	Total	1993
Cases		25	31	36	42	22	27	33	17	134	99	233	
Tatal Count		1804	3021	3196	4921	3206	2671	3912	2527	12942	12316	25258	
Avg. per Case		72.1600	97.4516	88.7778	117.1667	145.7273	98.9259	118.5455	148.6471	96.5821	124.4040	108.4034	
St. Devi.		48.7739	79.4392	81.1123	89.5523	106.4094	91.4111	85.5304	109.8322				
										Avg. - 80	Avg. - 90	Avg.	
	S-Parties	0.0980	0.0988	0.0750	0.1294	0.0678	0.0602	0.0655	0.1331	0.1018	0.0762	0.0909	0.0682
A1	S-Defect	0.0184	0.0196	0.0254	0.0099	0.0391	0.0216	0.0297	0.0241	0.0179	0.0286	0.0224	0.0229
A2	S-Change	0.0436	0.0375	0.0334	0.0504	0.0234	0.0143	0.0507	0.0256	0.0416	0.0304	0.0368	0.0305
A3	S-Scope	0.0313	0.0318	0.0409	0.0340	0.0276	0.0241	0.0391	0.0377	0.0348	0.0322	0.0337	0.0241
A4	S-Cost	0.0610	0.0644	0.0710	0.0867	0.0928	0.0515	0.1162	0.0741	0.0725	0.0862	0.0783	0.0884
A5	S-Adjustment	0.0602	0.0502	0.0531	0.0463	0.0418	0.0346	0.0461	0.0609	0.0516	0.0446	0.0486	0.0564
A6	S-Bond	0.0665	0.0865	0.1485	0.1349	0.0955	0.1358	0.1110	0.1425	0.1146	0.1197	0.1168	0.1312
A7	S-Schedule	0.0763	0.0423	0.0238	0.0488	0.0824	0.0244	0.0587	0.0482	0.0457	0.0528	0.0487	0.0526
A8	S-Dispute	0.1471	0.1110	0.1074	0.0823	0.1003	0.1082	0.1117	0.0810	0.1078	0.1029	0.1057	0.0917
A9	S-Condition	0.0964	0.1769	0.0925	0.1091	0.1498	0.1821	0.1327	0.0719	0.1180	0.1395	0.1271	0.0929
A10	S-Subsurface	0.0052	0.0004	0.0011	0.0049	0.0076	0.0031	0.0039	0.0026	0.0029	0.0043	0.0035	0.0015
A11	S-Defintion	0.1119	0.0955	0.1195	0.0896	0.1113	0.1077	0.0711	0.1209	0.1031	0.0986	0.1012	0.0976
A12	S-Liability	0.0203	0.0353	0.0401	0.0334	0.0365	0.0325	0.0361	0.0446	0.0332	0.0367	0.0347	0.0348
A13	S-Warranty	0.0273	0.0268	0.0148	0.0084	0.0166	0.0351	0.0156	0.0279	0.0179	0.0233	0.0202	0.0131
A14	S-Fraud	0.0283	0.0280	0.0221	0.0325	0.0337	0.0646	0.0195	0.0419	0.0278	0.0388	0.0325	0.0227
	Sub-Excluded	0.1081	0.0950	0.1318	0.0995	0.0735	0.1002	0.0926	0.0631	0.1087	0.0854	0.0988	0.1716
	Total	1	1	1	1	1	1	1	1	1	1	1	1



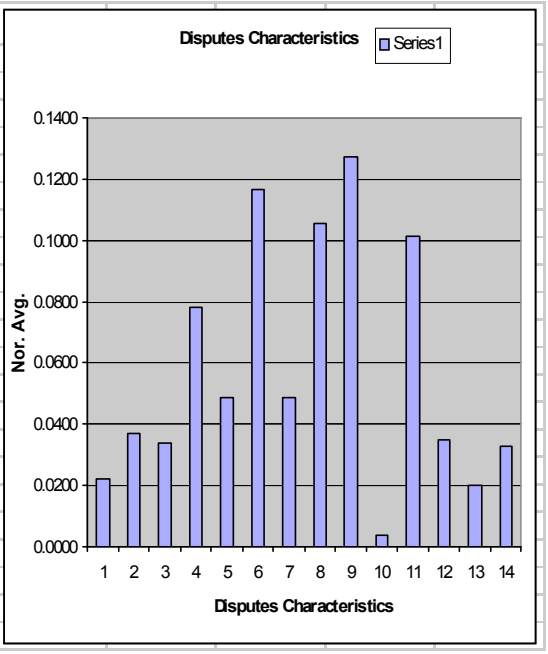


6.3.2 List of CDCs

Two groups of CDCs are noticed from the final analysis of CDCs as depicted in Table 32. The frequency of CDCs forms two groups, above and below 6 percent. This percentage is the number of keyword counts out of the total word counts per case. However, this six-percent threshold is used to develop two groups but does not indicate any critical meaning in the analysis.

Table 32. Summary of CDCs

Normalized Value		Sub-1980'	Sub-1990'	Total
Cases		134	99	233
Tatal Count		12942	12316	25258
Avg. per Case		96.5821	124.4040	108.4034
St. Devi.				
		Avg. - 80	Avg. - 90	Avg.
	S-Parties	0.1018	0.0762	0.0909
A1	S-Defect	0.0179	0.0286	0.0224
A2	S-Change	0.0416	0.0304	0.0368
A3	S-Scope	0.0348	0.0322	0.0337
A4	S-Cost	0.0725	0.0862	0.0783
A5	S-Adjustment	0.0516	0.0446	0.0486
A6	S-Bond	0.1146	0.1197	0.1168
A7	S-Schedule	0.0457	0.0528	0.0487
A8	S-Dispute	0.1078	0.1029	0.1057
A9	S-Condition	0.1180	0.1395	0.1271
A10	S-Subsurface	0.0029	0.0043	0.0035
A11	S-Defintion	0.1031	0.0986	0.1012
A12	S-Liability	0.0332	0.0367	0.0347
A13	S-Warranty	0.0179	0.0233	0.0202
A14	S-Fraud	0.0278	0.0388	0.0325
	Sub-Excluded	0.1087	0.0854	0.0988
	Total	1	1	1



The higher frequency groups show between 6 and 13 percent keyword frequency. *Cost* (A4), *bond* (A6), *disputes* (A8), c*ontract conditions* (A9), and *contract definitions* (A11) issues are marked in the higher frequency groups.

Cost (A4) issues cover the causes and results of the litigation in a dispute situation. The litigation is started to seek compensation for a stakeholder's damages. Therefore, the litigation seeks monetary compensation from any party unjustly enriched in construction operations. Therefore, seeking compensation and payment are basic issues of disputes. Cost issues involve the keywords such as *expense*, *overhead,* and *profit*. The *Eichleay formula* is a method of calculation for head office overhead. Therefore, many disputes start from cost issues and seek redress of cost issues in the dispute.

Bond (A6) issues are also popular issues in litigation. If the bond needs to be utilized in the project operations, the performance of the project is already in a risky situation. *Default*, *surety*, *lien* are grouped together under this category. The *Miller Act,* which is the government payment bond requirement is closely related to bond issues. *Quantum meruit* describes a way for subcontractors to recover reasonable value from the owner without a direct contractual relationship. All these keywords present complicated contractual disputes under the bond issue during the performance of project operations.

Disputes (A8) and *damage* are common terms in many dispute cases. These keywords represent the general issues of a dispute and the seeking of compensation for damage. Litigation is a venue for resolving disputes and for seeking monetary compensation for damages suffered. This measurement of frequency presents a kind of indicator of the significance of a dispute situation.

Contract conditions (A9) and *definitions* (A11) are marked with a relatively high frequency because conditions and definitions are major issues in disputes in project operations and litigation. Therefore, this higher frequency indicates that any potential

dispute needs to be reviewed with regard to the contractual conditions and definitions. Many dispute cases reveal that stakeholders have different interpretations of the contract definitions and conditions, which become grounds for seeking third-party judgment in the court. Therefore, any clarification of contract definitions and conditions needs to be made as early as possible in the life cycle of project operations. Any dispute issue lacking a contractual foundation presents a relatively weak position in the dispute situation.

Lower frequency groups show two to five percent keyword frequency. *Defect* (A1), *change* (A2), *scope* (A3), *adjustment* (A5), *schedule* (A7), *undiscovered* (A10), *liability* (A12), *warranty* (A13), and *fraud* (A14) are marked in the lower frequency groups.

Defects (A1) are one of the major issues in disputes. Disputes where obvious defects become evident may not appear in appellate court because the evidence is physically apparent. Therefore, although the keyword *defect* appears in the lower frequency group, it does not indicate that the defect issue is unimportant.

Change (A2) and *scope* (A3) are common issues in any construction project. If the change and scope issues are not clearly defined in the contract, these issues cause numerous disputes in project operations. Change as a keyword is related to many legal terminologies, such as *directive*, *purchase order*, *replace*, *extra work*, and *delete*. The keyword *scope* includes *complete* in its category. Since these groups of keywords are closely related with other groups of contractual terms, they do not appear in relatively high frequency in this measurement.

Adjustment (A5) shows a meaning similar to the *cost* CDCs group. The intention of defining the adjustment group is to present the result of dispute process in litigation. *Equitable adjustment* is a common legal term in most litigation processes. Keywords of *recovery*, *retainage,* and *loss* are also common issues in litigation. *Liquidated damage* is a method of adjustment in project operations. Since these issues are all cross-related with other contractual issues, their lower frequency of measurement does not indicate they are less important issues in disputes.

Schedule (A7) is a core concept of project operations. Any delay in the project schedule causes potential problems for every stakeholder. Keywords of *acceleration*, *delay*, and *suspension* are ways of describing a change of schedule. Keywords of *progress* and *withhold* also refer to broader schedule issues. These issues are also related to many other disputes in contractual issues. Therefore, their lower frequency of appearance does not indicate that they are less important in disputes of project operations.

Undiscovered (subsurface) (A10) conditions are described as a major cause of disputes in the literature. The keyword of subsurface is measured with *force majeure* and *differing site condition*. However, the measured frequency is very low in the litigation cases. It is assumed that subsurface conditions seem to be too obvious to continue the dispute in litigation. Low frequency in this group demonstrates an example that there is difference between a common belief in construction operations and the explicit collective knowledge from litigation cases. In spite of being low in frequency, the importance of this issue still exists with many other contractual terms in the litigation cases.

Liability (A12) and *warranty* (A13) are low frequency CDCs. Keywords of *misconduct*, *misrepresent*, *mistake*, and *negligent* are included in the liability group. The keyword *guarantee* is grouped with *warranty*. These keywords are closely related to the contractual definitions. Therefore, these low frequency keywords do not indicate they are less important in the dispute issues in litigation.

Fraud (A14) is measured with *bad-faith* which is a part of an organizational dispute from the definitions of dispute in Chapter 2. Some litigation cases reveal the malicious intent of a party. This is not addressed in this research study because the research scope does not include organizational interactions in the disputes. However, these keyword groups are presented with many contractual terms in the disputes. Therefore, the keyword fraud is measured to show how much fraud becomes a subject in the litigation cases.

The final results of 14 CDCs are summarized in Table 27. The average measurement of CDCs from all 233 cases is presented by the 14 CDC groups. In summary, there are five higher groups of frequencies between 6 and 13 percent. And there are nine lower groups of frequencies from 2 to 5 percent. The two groups of frequency are noticed consistently in 1980s and 1990s from the court cases in Table 31.

There is no distinction between high and low frequency groups in this research framework. The low frequency keywords are not necessarily less important because they still frequently appear with regard to the dispute issues in the text data. Therefore, the meaning of distinction between groups is not pursued in this research. Any specific relationship among CDCs groups is also not pursued in this research framework.

The methodology of building collective knowledge does not present a specific reference case as a result from the keyword measurement. Presenting a related case is a typical case study approach used in legal research. Therefore, these research results present collective knowledge as a measurement of keywords and CDCs. A methodology of searching related dispute cases is outlined in the future research section to fill the gap between the collective knowledge and legal case study results.

6.3.3 Validation of CDCs

Tests of means are executed in two stages to validate the major findings of the research. The first stage is to test the results between the means of 1980s and 1990s for the consistency of the trends. The sample sizes in each group are 134 cases from the 1980s and 99 from the 1990s. The second stage is to test the results of all the samples and the separate set of validation data for 1993. The mean values from the sample 233 1980s and 1990s cases are tested with the results of the 31 validation cases from 1993.

A comparison of means of keyword measurements is executed by both t-test and Mann-Whitney test for the validation of consistency. The level of significance in these tests is summarized in the tables and graphs in Tables A52 through A58 of the Appendix A. If the tests result in a significance level below 0.05, the null hypothesis is rejected which means two independent samples came from different populations. If the results of significance are above 0.05 level, the null hypothesis is accepted which means there is no evidence to support the notion that the two samples came from different populations.

The following validation results show that the means are not significantly different. Therefore, all the samples in the two test cases, 1) between the 1980s and the 1990s and 2) between the samples of the 1980s, the 1990s, and 1993, are believed to be from the same population. In other words, the measurement trends of keywords are consistent in this research design.

6.3.4 Comparison with Precedence Research Results

The results of this research need to be compared with the precedence research to contrast the similarity and advancement in the dispute research domain. The Dispute Potential Index (DPI) is selected for comparison in detail because it is one of the major research studies in construction disputes issues [Diekmann, 1994]. In DPI research, 38 dispute attributes were defined, which is the same framework as 80 numbers of *keywords* in this research framework. Then, dispute attributes were developed under three major categories of *people*, *process* and *project* as summarized in Table 5.

People issues were found to be more important in the process of settling disputes by DPI research. The contractor's personnel in people issues have the greatest opportunity to make an impact on the dispute climate of a project. People issues are considered as an organizational dispute in this research which is impossible to generalize in CDCs because it is a part of human interaction.

Process issues were defined by two groups of pre-construction planning and construction contract. In a group of construction contract attributes, five attributes were defined as realistic obligations, risk identification/allocation, adequacy of technical

plans/specifications, formal dispute resolution process and operating procedures. Because CDCs are developed from contractual dispute issues, this research framework can be considered as an advancement of the construction contract attributes of the DPI framework. The difference and advancement are contrasted in the Table 33.

Table 33. Comparison of DPI and CDCs in contractual issues.

DPI (Construction contract issues in Process group)	**CDCs** (14 CDCs as contractual dispute issues)
• realistic obligation • risk identification/allocation • adequacy of technical plans/specifications • formal dispute resolution process • operating procedures	• defect • change • scope • cost • adjustment • bond • schedule • disputes • condition • undiscovered • definition • liability • warranty • fraud.

Project issues in DPI research are considered as technical disputes in this research framework which is excluded from this research scope. Project issues attributes were mentioned in DPI research in that they did not affect the project dispute performance to a great extent.

In conclusion, this research framework shows similarity with the *construction contract* issues under the *process* group of DPI research after comparing major issues in both research studies. The advancement of this research is achieved by developing much more detailed numbers of dispute characteristics (14 numbers) through analyzing text data as listed in Table 33.

Further analysis can be made among major research studies on dispute issues in Table 3. Numerous sets of dispute characteristics are suggested by many authors. The comparison of research results can reveal the nature of dispute characteristics.

6.4 Practical Application of CDCs

The final development of CDCs presents a set of collective knowledge in dispute issues. This collective knowledge can be developed as an application to diagnose a dispute situation in a project. In this research design, an application tool is not included in the research scope to exclude an approach of developing a model of dispute prediction before defining a framework and methodology. However, the application process in dispute diagnosis can be demonstrated to show how the research results can be used to diagnose potential dispute issues in project operations.

6.4.1 Interpretation of CDCs in Application

The final set of 14 CDCs presents a profile of the dispute characteristics which has resulted from the measurement of keywords by percentage. In addition to that, the actual dispute cases are provided to describe the details of dispute issues. The following example shows how the CDCs result can be utilized in a potential dispute situation.

The concept of CDCs application is composed of three major parts of *input data*, *analysis process* and *output results* as depicted in Figure 22. *Input data* are any potential dispute issues, dispute key words, and legal arguments raised during project operations. These issues can be handled individually in project operations, but it is less sufficient to manage dispute issues than to utilize collective knowledge of precedence cases. *Output results* are given in following two groups: CDCs groups and relevant dispute cases selected from CDCs database. A dispute keyword in input data produces a group of

keywords in CDCs group as output results. These results help to identify the dispute issues in the context of project operations. Related dispute cases are helpful to assist the user of the CDCs applications for their decision letting the situation make instead of making decision for them.

Analysis process of text data can be achieved in the CDCs applications if text data are available. This analysis process of text data can be used to produce the output accurately rather than utilizing dispute keywords only as an input data. Text analysis produces the measurement of keywords which can be reviewed with the research results of CDCs.

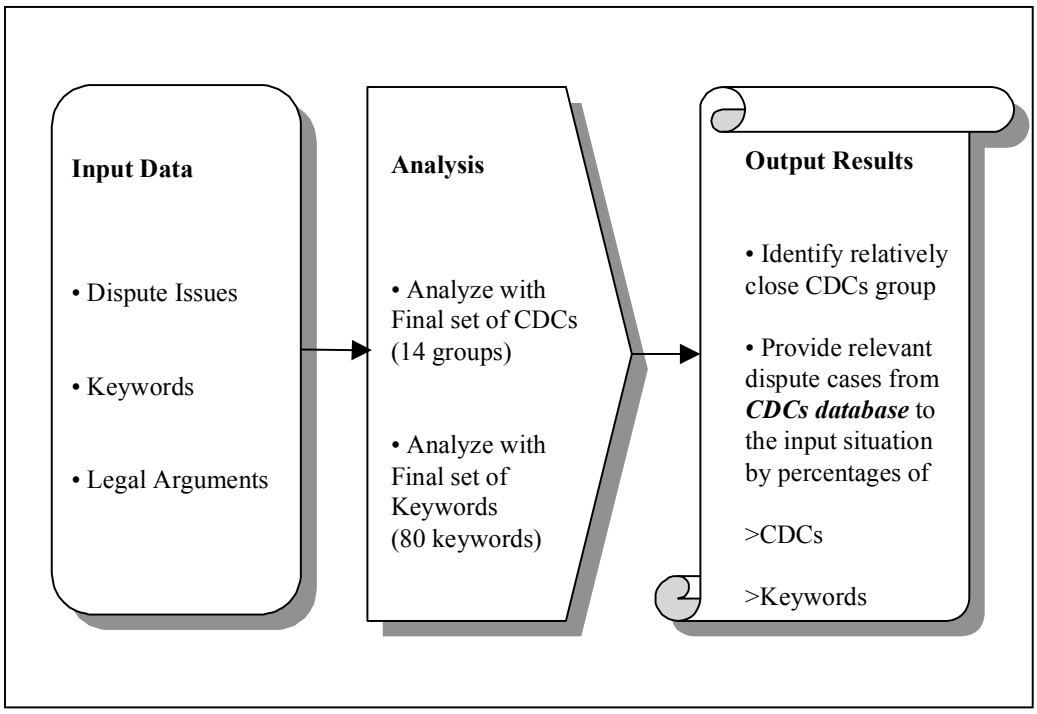


Figure 22. Concept of CDCs applications.

In the CDCs research results, the high percentage of CDCs indicates relatively high occurrence of the dispute characteristics. If a potential dispute issue is related with any CDCs, the group of keywords in CDCs needs to be reviewed to diagnose other potential dispute issues in project operations. If the input data are related with a high percentage group of CDCs, that high percentage group needs to be investigated in detail for the same reason. Under this circumstance, low percentage groups need to be considered in case it does not indicate less important but broadly related other issues. These broad categories of dispute characteristics indicate that an actual dispute issue is really complex and cross-linked with many other dispute issues. This analysis approach leads the users to both high percentage groups of focused characteristics and a broad spectrum of other potential dispute characteristics.

The output results lead the users to review past dispute cases for their own discretion and judgments. Reviewing past dispute cases is a helpful way of diagnosing a complex dispute situation. Past dispute cases are provided by a CDCs database in the proposed CDCs applications. These selected dispute cases are different from the search results of the general legal database because the proposed CDCs database is analyzed under CDCs framework and methodology.

Searching of dispute cases in currently available commercial databases–such as the Lexis-Nexis legal database–is executed by selected words and their combinations. However, the search method is not structured to find the context of related dispute issues but executed to find words in the text by Boolean (i.e. A and/or B) and proximity (i.e. A within 2 words of B) operations. The difference in search between commercial database

and the CDCs database is in the accuracy of searching by the content and context of dispute issues for the intended search. Once dispute issues are entered as input data, output results are very detailed because of utilizing text analysis results. The level of detail in this CDCs applications is much more detailed and focused to develop precedence cases and collective knowledge by the available CDCs case data.

6.4.2 Example of CDCs Applications

An example application is demonstrated in Figure 23 from an actual dispute case which is an exhibit of case number 5 in 1993 as citation reference no. 1 F. 3d. 1005, and the full text is attached in the Appendix B.

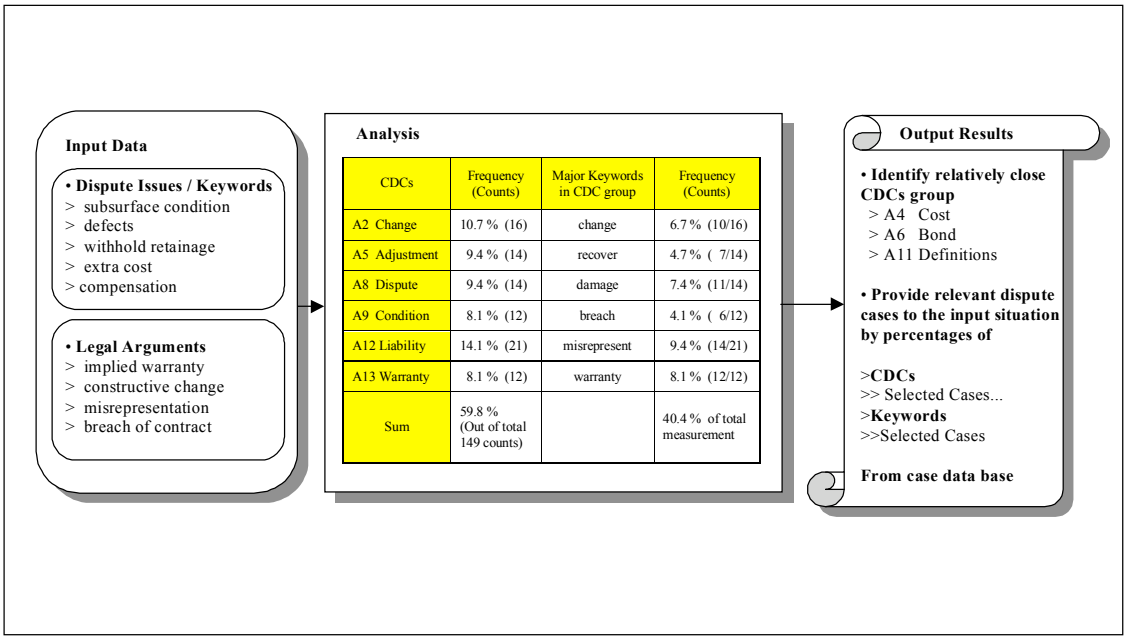


Figure 23. An example application of CDCs

An example application presents three stages along the process. First of all, the input data are extracted from the "background" part of a judgment statement which simulates collected keywords during project operations. Two groups of input data are composed of dispute issues and legal arguments. Dispute issues include subsurface condition, defects, withhold retainage, extra cost, and compensation. Legal arguments include implied warranty, constructive change, misrepresentation, and breach of contract.

These input data are reviewed with the research results of CDCs. Therefore, the output results of a CDCs application are summarized in three CDCs groups of *cost*, *bond*, and *contract definitions*. These three CDCs and keywords in each group need to be focused for diagnosis of potential disputes in project operations.

Based on the output results of selected CDCs and keywords included in CDCs groups, relevant past dispute cases are provided from the CDCs database. These selected dispute cases help the users of the CDCs applications to make better decision based on collective knowledge of past cases.

If any text data in project operations are available for detailed analysis, the data can be measured to find the frequency of each keyword. The percentage of measured frequency is used to determine related keywords and their CDCs groups. This analysis process produces new knowledge from the text data which is hidden until executing the text analysis.

The process of utilizing the CDCs applications is expanded for future development of a dispute management system in Chapter 7.

6.5 Synopsis

In this chapter, the research results and products of CDCs were summarized. Research procedures were summarized to outline the steps of the research by defining disputes keywords, selecting dispute cases, and measuring disputes keywords. The results are presented by outlining the 14 CDCs groups, a list of CDCs, and their validation results. Practical application of the CDCs is presented to show how the CDCs applications work in a situation of project operations. Interpretation of the CDCs applications and an example were introduced.

In the next chapter, the research results are expanded to include research contributions and future extensions. Further research is outlined in the context of the research results and the contribution of the CDCs.

CHAPTER VII. RESEARCH CONTRIBUTION, EXTENSIONS AND CONCLUSIONS

7.1 Overview

This chapter summarizes the research contributions, further extensions, and conclusions. The research contributions present dispute characteristics and a framework and methodology of creating knowledge from retrospective dispute data. With the result of defined critical dispute characteristics (CDCs), the research contribution summarizes the creation of knowledge by a new approach in construction operations from a perspective of the construction engineering management research domain.

The concept of knowledge creation is explained by the role of dispute management and the process of knowledge creation in construction operations. The concept of a future dispute management system is proposed as a part of knowledge management in construction operations. The contribution of CDCs development and future research directions are described to close this research study. These contributions are:

- Critical Dispute Characteristics (CDCs) are defined.
- A framework and methodology to analyze dispute cases are defined.
- The concept of a dispute management system (DMS) is proposed
- The concept of *disputability* is proposed.
- A knowledge management model in construction operations is proposed.

- A text analysis methodology is applied in construction research domain.
- Profiling, monitoring, and diagnosing processes with dispute characteristics are proposed.
- The value of non-structured data in text form is established for project operations.
- A methodology of analyzing precedence knowledge in construction operations is demonstrated and validated.

7.2 Research Contribution

The contribution of the research is in developing a framework and methodology of characterization of construction disputes. This research project advances knowledge of disputes in construction operations by converting precedence disputes into a source of valuable knowledge for identification of dispute characteristics. This research seeks to explore a methodology of creating new knowledge of disputes from available data and precedence knowledge.

Dispute characteristics are part of a framework and methodology that will eventually permit the analysis of project performance from a dispute issue perspective for current projects. Dispute characteristics contain multiple functions, helpful to the identification and understanding of disputes and their potential. These functions are summarized in Figure 24. Functions of *characterization*, *profiling*, *monitoring*, *diagnosis*, and *prescription* are defined as follows [AHCD, 1993]: characterization and profiling are included in this research scope, and the rest are part of proposed future research.

Characterization is defined as the description of qualities or peculiarities. Characterization of construction disputes is a research problem destined to be solved by this research. This way, dispute characteristics form a framework which can be derived from the analysis of data in previous dispute cases and current project operations.

Profiling is defined to produce a formal summary or analysis of data representing distinctive features or characteristics. Further, a process of profiling disputes can be developed as a methodology to analyze retrospectively dispute cases in construction litigation. Profiling is central to research project objectives.

Monitoring is defined as to keep track of systematically with a view to collecting information. As a function of characteristics, this allows project stakeholders to keep track of project operations highlighting any dispute potential.

Diagnosis is defined as a critical analysis of the nature of something, as well as the conclusion reached by such analysis. Diagnosis contains two aspects which are critical to the analysis as a process and the conclusion as a product. The first, critical analysis as a process, is a tool to be developed in future research for identification of potential disputes. The second, conclusion as a product, is the future goal of a dispute management system outlined in Figure 24.

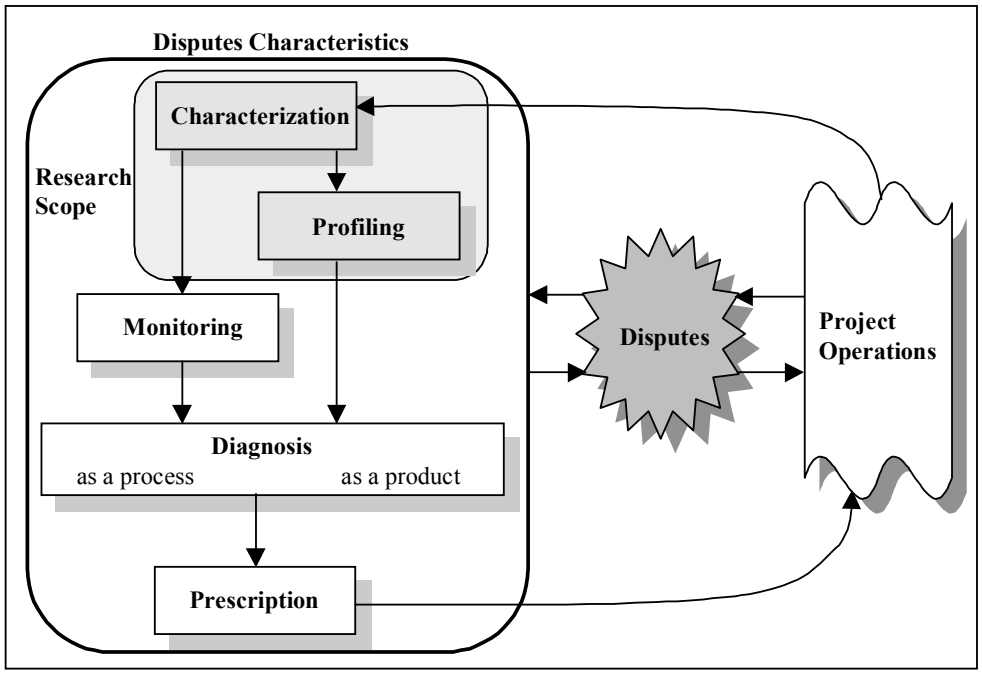


Figure 24. Proposed functions of dispute characteristics

Finally, *prescription* is defined as an act of establishing official rules, laws, or directions. Prescription can be a tool to manage disputes with rules and directions

obtained from carefully defined dispute characteristics and precedence dispute knowledge.

There is a need to develop new tools that can assist in monitoring construction projects from a dispute point of view, proactively diagnosing the potential for disputes in a project, and prescribing possible preventive actions. This research defines dispute characteristics which provide the cornerstone for the future development of integrated monitoring, diagnosis, and prescription systems to identify potential disputes during construction operations and provide alternative courses of action to prevent them.

The role of CDCs in the evolution of disputes research is depicted in Figure 25. In the past, dispute research studies were focused on resolution, prevention, avoidance, and predictability issues. While there are numerous lessons-learned from construction disputes, there are still many disputes in construction operations. CDCs are proposed as a foundation for the framework and methodology necessary to create dispute knowledge from retrospective analysis of dispute cases. In the future, these CDCs will provide the cornerstone for the development of an integrated monitoring, diagnosis, and prescription system needed to identify potential disputes during project operations. This is proposed as a dispute management system (DMS) for further research.

The contribution of this research to DMS development is the framework and methodology of knowledge creation formulated by dispute cases, characterization, and CDCs depicted in Figure 26.

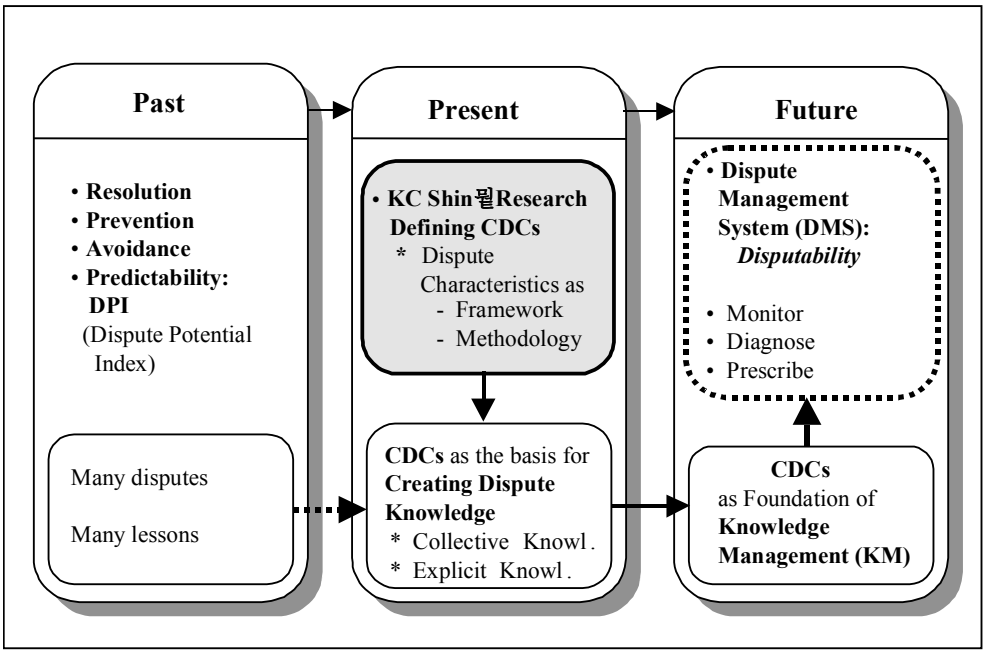


Figure 25. CDCs and Dispute Management System (DMS) in future

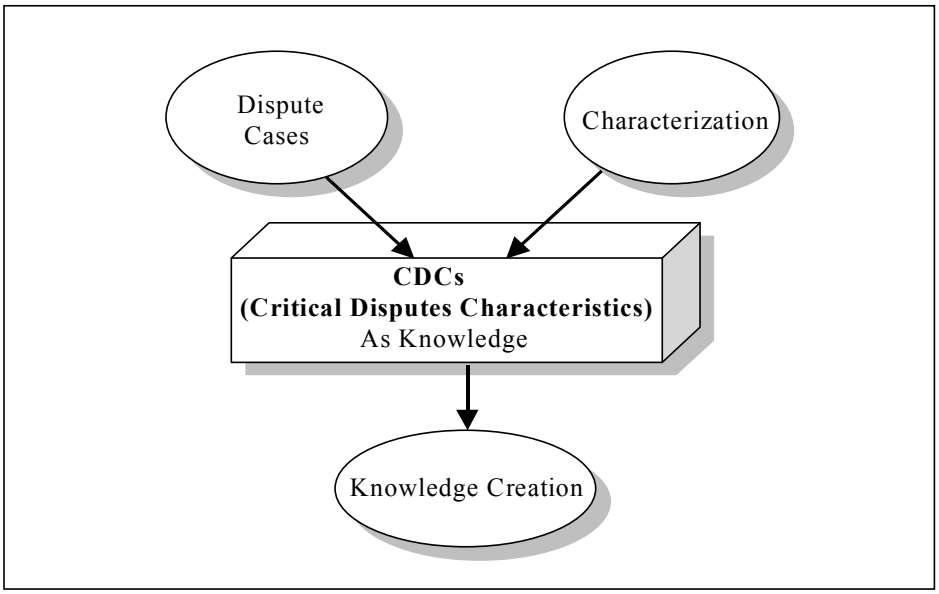


Figure 26. Disputes, CDCs and Knowledge creation

7.3 The Concept of Knowledge Creation

7.3.1 Overview

In this section, the concept of knowledge creation is reviewed for the extension of future research on dispute management issues. The role of dispute management is reviewed under the practices of knowledge management. The knowledge issue is reviewed from the research on constructability and general management research issues. The role of precedence knowledge is reviewed in legal research. From the literature review in knowledge management issues, the process of knowledge creation is developed for future research extension.

Because of the rapid development of information technologies including database models and the Internet, more knowledge can be stored in a databases, and more users can utilize knowledge through flexible interfaces such as the Internet. In this research, a dispute is considered as data and needs to be stored in a database. A user can be a project stakeholder at any location including the project site and local and global headquarters. Using the method developed in this research, a user can search a database of dispute to find precedence cases, experiences, and lessons learned. Therefore, a dispute needs to be reviewed as a role of knowledge created from data in project operations.

The knowledge of a project includes everything from tangible data to intangible knowledge. Quantitative data, such as cost and schedule, were always the focus of data in project operations. However, qualitative data, such as lessons learned, experiences,

and knowledge, need to be focused to improve construction operations from a knowledge management perspective.

7.3.2 The Role of Dispute Management in Knowledge Management

Dispute management needs to be considered a part of project management. Therefore, each stakeholder needs to include dispute knowledge in the organizational knowledge base for project management. Stakeholders in a project can both build and utilize knowledge for future projects.

The dispute management process is developed in the concept of creating knowledge from past dispute cases. However, the dispute issue needs to be analyzed through a proactive approach to construction operations. Lessons learned from past dispute cases need to be utilized to create knowledge for the future operations. In this context, the concept of dispute management needs to be developed as a part of the overall knowledge management process in a project.

Dispute management in a project is linked to knowledge management in an organization. The concept of knowledge management in dispute issues is achieved by identifying critical dispute characteristics (CDCs) in this research. The research framework consists of scientific methodology, sound data, and a global framework of a dispute management system (DMS).

The research framework can be extended, not only to identify the dispute issues, but also to manage potential knowledge issues in project operations. This research strategy

needs to be expanded further with another knowledge set in project management. This research framework has provided a foundation for further research in knowledge management in terms of what the knowledge is and how to approach to the knowledge. This whole research project is summarized as creating new knowledge in an organization based on past data and experiences.

Knowledge, information and data

To develop this research framework, definitions are required for the concepts of knowledge, information, and data within the context of dispute management. Knowledge derives from information as information derives from data [Davenport, 1998].

Data consist of facts and figures that are not processed and are relatively less meaningful to users than information. Data are most usefully described as structured records of transactions. Therefore, data are defined as a set of discrete, objective facts about events [McLeod, 1998]. In this research, dispute cases served as data.

Information is defined as processed data or meaningful data. Information is described by Peter Drucker as data endowed with relevance and purpose, which suggests that data by themselves have little relevance or purpose. Information is a message, in the form of a document. Information is meant to change the way the receiver perceives something; to have an impact on his judgment and behavior [McLeod,1998].

Knowledge is defined as a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information [Davenport, 1998].

These key concepts are used in the following discussions and expanded in the development of this research framework.

Knowledge issues in the literature

The knowledge issues in construction, which are precedence and lessons learned, have found since the concept of *constructability* research study. Therefore, the concept of knowledge in constructability research is compared with the recent development of knowledge issues in general management subjects.

A research study conducted by the Construction Industry Institute (CII) task force defined "*Constructability is the optimum use of construction knowledge and experience in planning, engineering, procurement, and field operations to achieve overall project objectives*" [Tatum, 1987].

In the context of knowledge and experiences in construction operations, this research proposes a framework of collecting, analyzing, and utilizing past knowledge from dispute cases. This research frame can be expanded to develop the concept of "*disputability*" which can serve various functions of dispute prediction in project operations. This research result will be a part of the proposed "*disputability*" concept which needs to be explored further in succeeding research.

In research on general management subjects, the topic of knowledge management advanced considerably in 1990s. The concept of knowledge management developed in the general management literature to include the following topics: "managing codified knowledge" [Zack, 1999], "create, improve, enhance, and manage knowledge" [Davenport, 1998], "managing technological knowledge" [Bohn, 1994], "building a learning organization" [Garvin, 1993], "tacit knowledge and explicit knowledge" [Nonaka, 1991], and the "information based organization" [Drucker, 1988]. These concepts from popular managerial buzzwords form a point of departure for knowledge management in construction operations.

Knowledge creation process

In this context, successful project management can be achieved by creating knowledge from explicit and tacit knowledge and by creating a new knowledge cycle of dispute management in an organization, as depicted in Figure 27. The concept of knowledge creation in an organization is developed in the following steps.

New knowledge always begins with the individual. An individual's personal knowledge needs to be transformed into organizational knowledge, which is valuable to the organization as a whole. The central process of creating knowledge is to transform personal knowledge into shared knowledge in an organization as proposed in DMS model..

Creating knowledge in an organization was classified into four basic patterns as follows: from tacit to tacit, from explicit to explicit, from tacit to explicit, from explicit to tacit [Nonaka, 1991]. *Explicit knowledge* is formal and systematic. It can be easily communicated and shared in either product specifications, a scientific formula, or a computer program. *Tacit knowledge* is highly personal. It is hard to formalize and difficult to communicate to others.

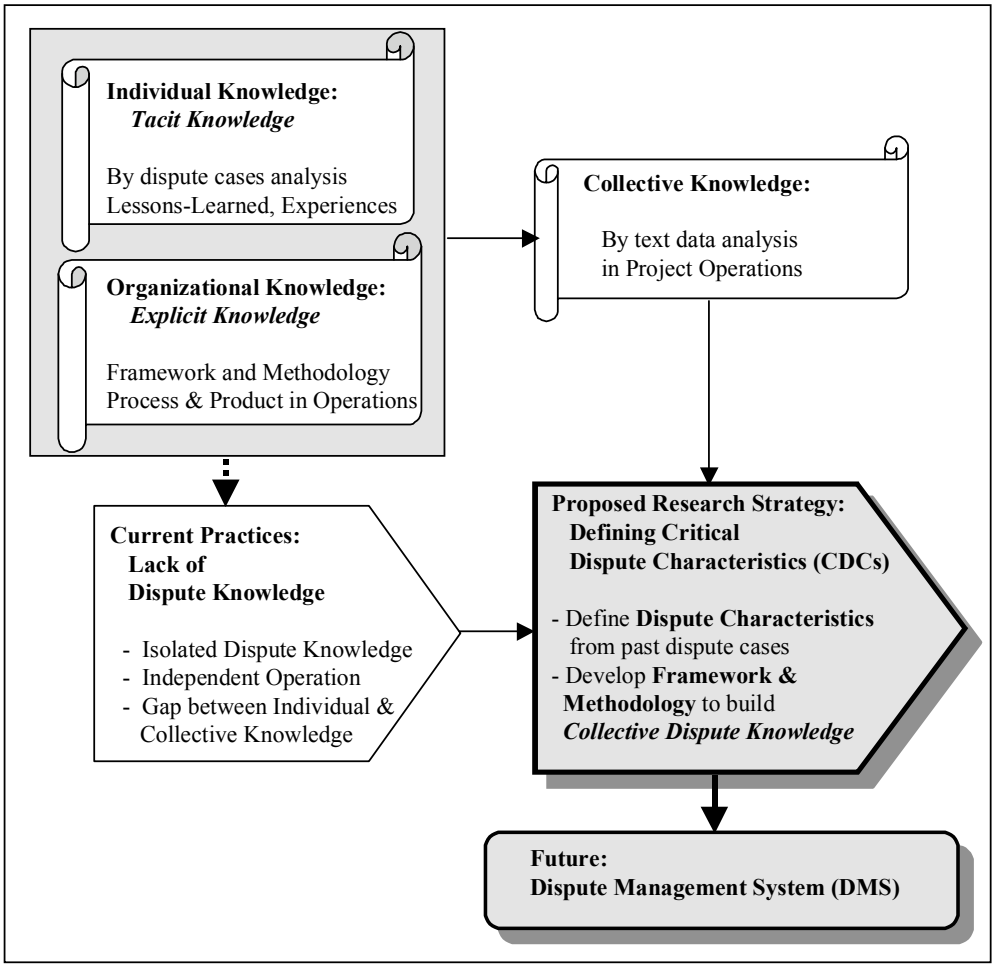


Figure 27. The concept of knowledge creation in dispute management

This research proposed a framework and methodology to integrate organizational *explicit knowledge* from retrospective data, and individual *tacit knowledge* from professional judgment by stakeholders to create *dispute knowledge* in project operations.

In current practices of project operations as depicted in Figure 27, knowledge management in disputes suffers from the following problems: isolated dispute knowledge without an appropriate framework; independent project operation without proper reference system across projects; and a knowledge gap between individuals and their organizations. Therefore, the proposed framework of knowledge management is intended to develop a system for dispute management by creating dispute knowledge, new knowledge cycles, and methodology. This research provides an explicit methodology of foundation for the dispute management system as a part of dispute knowledge management in construction operations. In this framework, knowledge can be transferred implicitly and explicitly to other project operations and organizations.

How to share the knowledge, lessons learned, and experience are important issues in any project operation and organization. However, it is very difficult to share systematically without the proper methodology. Therefore, knowledge needs to be analyzed to find its hidden characteristics from a project operations perspective. Knowledge can be transferred to other processes in construction operations, if its characteristics are defined. In this context, identifying characteristics in dispute knowledge is the fundamental step in the general knowledge management of the future.

7.3.3 The Process of Knowledge Creation in Construction Operations

A construction project used to be operated independently under its contract and technical requirements. Therefore, there is a gap of knowledge between project operations if there is not enough organizational control across multiple project operations. This research is intended to develop a research framework to fill the gap in the dispute management process of construction operations. The concept of creating explicit knowledge in disputes is developed from analyzing precedence lessons learned for past dispute cases. This research asserts that *critical dispute characteristics (CDCs)* need to be managed properly to avoid or mitigate the effects of disputes and to create future dispute knowledge in project operations.

There is no global standard in problem solving for construction projects since each project is unique by its nature. Therefore, creating knowledge is the key operation in each new construction project based on sound data and methodology. Creating new dispute knowledge is important in the general knowledge creation process of construction operations.

In construction operations, all precedence, lessons learned, experience, and knowledge need to be synthesized within a framework of scientific methodology by both the individuals and the organizations. This practice needs to become standard practice in construction operations. In addition to dispute issues, this proposed process could be extended to other subjects to achieve better project operations because there is substantial precedence knowledge in construction operations held by individuals, project stakeholders, or organizations such as corporations on a variety of topics.

7.4 Further Extensions

Research topics of *project knowledge capture and reuse*, *data mining,* and *knowledge discovery in AEC industry* were one of the themes of recent conference sessions of the 8th International Conference on Computing in Civil and Building Engineering at Stanford University. Research studies, such as *semantic documentation in engineering* [Bruggemann, 2000], *generating construction knowledge with knowledge discovery in databases* [Soibelman, 2000], and *a knowledge discovery case study for the intelligent workplace* [Buchheit, 2000] presented the methodologies to manage knowledge issues in construction operations. These approaches of knowledge issues need to be developed further to create new frameworks and methodologies for knowledge management available to construction stakeholders involved in project operations.

A research on retrieval of project knowledge from heterogeneous architecture-engineering-construction (AEC) documents presented the concept of text analysis and clustering based on the frequency of the words [Scherer, 2000]. The concept of text analysis presents a great potential in future development of research studies on dispute issues. The results of this research provide a foundation for text data analysis in construction operations under the framework of dispute knowledge management. The fundamental issues in this research study are to develop a framework of what and how to measure the text data. This methodology needs to be developed further to refine the knowledge creation procedure in future research.

Chapter 6 describes the new knowledge found in dispute issues and the confirmed existing knowledge resulting from this research. The advancement in dispute knowledge

between new and existing knowledge needs to be explored further to establish a solid framework and methodology in the future.

7.5 Conclusions

7.5.1 Overview

This research defines Critical Dispute Characteristics (CDCs). CDCs are project characteristics defined by retrospectively analyzing dispute cases in construction litigation which helps us to understand disputes and dispute potential. The CDCs are developed as part of a framework and methodology that will eventually allow stakeholders to analyze project performance from a dispute issue perspective on current projects.

There is a need to develop new tools that can assist stakeholders in monitoring construction projects from a dispute point of view. These tools must be able to proactively diagnose the potential for disputes in a project and prescribe possible preventive actions. As a foundation for the development of such tools, this research project: (1) defines a framework and methodology to analyze retrospectively dispute cases in construction litigation, as a profiling method for the characterization of dispute characteristics, and (2) establishes a fundamental set of Critical Dispute Characteristics (CDCs). These CDCs provide the cornerstone for the future development of an integrated monitoring, diagnosis, and prescription system to identify potential disputes

among project stakeholders during project execution, and provide possible alternative courses of action to prevent them.

This research proves that most dispute cases in projects reveal specific, identifiable causes of disputes through their dispute characteristics. This starting point paves the way for the eventual development of a diagnosis and prescription tool that will identify what actions at a project can take to avoid disputes based on their initial characteristics. Therefore, potential disputes can be identified from the defined dispute characteristics that result from this research. Without a proper procedure for categorizing dispute characteristics into usable form, precedence knowledge cannot be utilized because there is no methodology to relate it to potential disputes. The concepts of exploring precedence knowledge in past disputes and defining CDCs for potential disputes are developed through the text analysis of construction dispute cases.

The data collection for this research was achieved by selecting 233 construction-related dispute cases from federal appellate court judgments. Dispute cases were selected according to the presence of dispute keywords in the summary of particular judgment statements. Dispute keywords were selected from the previously mentioned keywords obtained in the literature review. Next, the text of dispute cases was collected using an electronic library database (Lexis-Nexis). Finally, data analysis was performed according to the following sequential stages: measuring dispute characteristics by content analysis, analyzing measurements by statistical analyses, and validating analysis results.

The frequency of keywords was the criteria used to develop CDCs in the research framework due to the fact that frequency can be objectively measured from text data by

counting keyword. While frequency is the most important criteria for measurement, severity is also an important factor in dispute issues. However, since severity is relatively difficult to measure objectively, it was excluded for text analysis and development of CDCs in order to eliminate subjective factors from the analysis process.

Through retrospective data analysis of dispute cases in federal appellate court judgments, 14 CDCs were defined: *defect, change, scope, cost, adjustment, bond, schedule, disputes, condition, undiscovered, definition, liability, warranty,* and *fraud*. Using content analysis methodology, this final set of 14 CDCs were obtained according to the frequency and context of the CDCs within a set of 80 keywords. Finally, the importance of these 14 CDCs and the relationships among them are analyzed from various perspectives in construction operations.

It is important to note a difference between perceived common beliefs and CDCs results in dispute issues. For example, undiscovered (subsurface) issues are measured as having very low frequencies in litigation cases. This does not mean that undiscovered issues are less important or rarely occurring in construction operations, but rather that CDCs result only indicate that undiscovered issues are not the major issues found in appellate court cases. Truth be known, undiscovered issues are probably too obvious for placement of the dispute in the jurisdiction of the appellate court. This difference between common belief and CDCs results needs to be investigated further, identifying the underlying factors of CDCs present in today's basic construction operations.

This research only focused on identification of CDCs found with consistent frequency in selected research data. The applications of CDCs need to be expanded to

uncover potential additional relationships among them. High frequency CDCs groups indicate that some dispute issues occur relatively often in litigation cases. These dispute issues found in high frequency CDCs groups can be viewed as an aspect worth of managerial concern during project operations. Therefore, the application of CDCs needs to be extended to include education of dispute issues amongst project management personnel. In addition, given the multitude of contractual terms and issues in construction law, the high frequency CDCs group can be a focus of construction law education, assisting in the selection of relevant topics in the class and research.

Further, this approach can be extended to include construction law practices. The CDCs framework can assist the legal professionals from construction operations perspective. Given the relevance of CDCs to dispute issues, CDCs need to be expanded, further developing relationships among them in both high and low frequency CDCs groups.

The contribution of this research is the development of a framework and methodology able to characterize construction disputes. Moreover, this research project advances dispute knowledge in construction operations by converting the inherent precedence of disputes into a valuable knowledge resource for the identification and characterization of dispute characteristics.

7.5.2 Synopsis

This research explored a methodology of creating new knowledge of disputes from available data and precedence knowledge. This research project advances knowledge of disputes in construction operations by converting precedence disputes into a source of valuable knowledge for current dispute identification. The process of analyzing precedence knowledge in construction operations adapts and extends the concept of knowledge management in general management issues. This research develops a better understanding of disputes in construction operations for all construction stakeholders, including owners, architects, engineers, contractors, and other project-related professionals.

APPENDIX A

Table A1 (C-1). Disputes characteristics - Initial.

	Characteristics		Characteristics
1	change-addition	23	cost-indirect cost (w/ potential risk)
2	change-deletion	24	cost-impact cost (disruption)
3	change-revision	25	cost-overhead (site/head office)
4	change-scope	26	cost-additional payment (claim/liquidated damage)
5	change-numbers	27	cost-payment withheld
6	change-change order-issuance	28	project risk-bad faith/misconduct
7	change-change order-directive	29	project risk-complexity
8	change-change order-procedure (include oral)	30	project risk-site access
9	design/specification-defiance	31	project risk-weather condition
10	design/specification-error/omission	32	project risk-subsurface condition
11	design/specification-ambiguity	33	project risk-defective works
12	contract condition-clarification	34	project risk-code compliance/requirement
13	contract condition-price type(unit/fixed)	35	project risk-warranty/guarantee
14	contract condition-ambiguity/conflict	36	project risk-practical completion
15	contract condition-breach of contract	37	project risk-waiver
16	contract condition-termination	38	project risk-dispute resolution procedure(ADR)
17	contract condition-liability	39	dispute-disputant-prime v. owner
18	contract condition-notice requirement	40	dispute-disputant-prime v. subcon/supplier
19	contract condition-payment condition(pay if paid)	41	dispute-liable party-owner
20	time-acceleration	42	dispute-liable party-prime
21	time-delay	43	dispute-liable party-subcontractor
22	cost-direct cost		

Table A2 (C-2). Disputes characteristics - For pilot study: 1st.

work	work	1	**cost**	cost	30	**Project Risk**	access - site	52	inadequate	82
	add	2		compensation	31		ambiguity	53	interpret	83
	alteration	3		Eichleay formula	32		arbitration	54	interruption	84
	corrective	4		equitable adjustment	33		bid	55	liability	85
	defect	5		increase	34		breach	56	lien	86
	deficiency	6		liquidated damage	35		claim	57	misconduct	87
	delete	7		overhead	36		clarify	58	misrepresent	88
	extra	8		payment	37		code - comply	59	mistake	89
	improve	9		payment withheld	38		complaint	60	negligent	90
	increase	10		penalty	39		complete	61	notice requirement	91
	modify	11		profit	40		complexity	62	obligation	92
	overrun	12		recover	41		comply	63	omission	93
	quality	13		retainage	42		conflict	64	performance	94
	repair	14		**bond**	43		controversy	65	progress	95
	revision	15		- payment bond	44		damage	66	quantum meruit	96
	scope	16		- performance bond	45		default	67	remedy	97
	workmanship	17					definition	68	risk	98
	change	18	**Architect**	Architect	46		dispute	69	settlement	99
	- change order	19		design	47		duty	70	union	100
	- directive	20		specification	48		error - omission	71	unjust enrichment	101
	- purchase order	21		drawing	49		expert witness	72	waiver	102
							express	73	warranty	103
schedule	schedule	22	**Surety**	Surety	50		faith - bad	74	weather - condition	104
	acceleration	23		Miller Act	51		faith - good	75	**contract**	105
	delay	24					fitness for purpose	76	- contracting officer	106
	expedite	25					force majeure	77	**termination**	107
	extension	26					fraud	78	termination-convenience	108
	interruption	27					guarantee	79	**subsurface**	109
	suspension	28					implement	80	- differing site condition	110
	withhold	29					imply - implicitly	81		

Table A3 (C-3). Disputes characteristics - For pilot study: 2nd.

Work	work	1	**schedule**	schedule	43	**Project Risk**	express	86
	add	2		acceleration	44		faith - bad	87
	alteration	3		delay	45		faith - good	88
	corrective	4		expedite	46		Tort	89
	error	5		extension	47		fraud	90
	defect	6		interruption	48		**force majeure**	91
	deficiency	7		suspension	49		weather - condition	92
	delete	8		withhold	50		implement	93
	extra (work)	9		extra time	51		imply	94
	improve	10	**Architect**	Architect	52		implicitly	95
	increase	11		design	53		interruption	96
	modify	12		plan	54		**liability**	97
	overrun	13		specification	55		misconduct	98
	quality	14	**Surety**	Surety	56		misrepresent	99
	replace	15		Miller Act	57		mistake	100
	repair	16	**Project Risk**	access - site	58		negligent	101
	revision	17		bid	59		obligation	102
	scope	18		**breach**	60		**notice requirement**	103
	workmanship	19		claim	61		order	104
	change	20		**code - comply**	62		penalty	105
	- change order	21		comply	63		performance	106
	- directive	22	**Project Risk**	**complete**	64		progress	107
	- purchase order	23		fitness for purpose	65		quantum meruit	108
Cost	cost	24		incentive	66		failure	109
	budget	25		**damage**	67		remedy	110
	compensation	26		**default**	68		requirement	111
	Eichleay formula	27		**definition**	69		responsibility	112
	equitable adjustment	28		ambiguity	70		risk	113
	expense	29		clarify	71		settlement	114
	increase	30		complexity	72		suspension	115
	liquidated damage	31		controversy	73		union	116
	loss	32		discrepancy	74		unjust enrichment	117
	overhead	33		error - omission	75		**waiver**	118
	payment	34		inaccuracy	76		**warranty**	119
	payment withheld	35		inadequate	77		guarantee	120
	profit	36		interpret	78		**contract**	121
	recover	37		omission	79		- contracting officer	122
	retainage	38		**dispute**	80		**termination**	123
	bond	39		arbitration	81		termination-convenience	124
	- payment bond	40		complaint	82		**subsurface**	125
	- performance bond	41		conflict	83		- differing site condition	126
	extra cost	42		**duty**	84		**Contract dispute act**	127
				expert witness	85		**lien**	128

Table A4 (C-4). Disputes characteristics from pilot study results.

		Included	31	Excluded	31	Excluded	31			Included	31	Excluded	31	Excluded	31
Work	1	**add**	13	increase	19			**Project Risk**	44	breach	22	access site	6		
	2	extra (work)		overrun	2				45	comply	10	bid	19	interruption	1
	3	**defect**	10	error					46	complete	25	claim	29		
	4	deficiency	7	correct(ive)					47	contracting officer	11				
	5	repair	7						48	damage	17	fitness for purpose			
	6	**delete**	3						49	default	9	incentive	3		
	7	**change**	14	alter(ation)		alternative			50	**definition**	4			contract	
	8	change order	8	revis(ion)	8				51	ambiguity	7	complexity	2		
	9	directive		modify	16				52	clarify	9	controversy	3		
	10	purchase order	6						53	error	17	discrepancy	1		
	11	replace	6						54	omission	5	inaccuracy	2	inadequate	6
	12	**scope**	10	quality	7	dissatisfaction			55	interpret	21	insufficient	9		
	13			improve		displeasure			56	**dispute**	20	arbitration	1		
	14			workmanship	1				57	complaint	19	controversy	3		
	15			work					58	conflict	11				
Cost	16	**cost**	26	budget	18				59	duty	18				
	17	compensation	3	extra cost	3				60	expert witness	4	express	19		
	18	expense	13						61	**failure**	22				
	19	overhead	6						62	**fraud(ulent)**	13				
	20	Eichleay formula	12						63	faith - good	10	tort	3		
	21	payment	22	withhold	0				64	faith - bad					
	22	profit	9						65	**force majeure**	1	weather condition	5		
	23	Increase (cost)	14						66	**liability**	16	implement	3	imply	11
	24	**equitable adjustment**	7	unjust enrichment	2				67	misconduct	1			implicitly	7
	25	liquidated damage	4						68	misrepresentation	9				
	26	recover	25						69	mistake	7				
	27	retain(age)	9						70	negligent	8	obligation	22	responsibility	10
	28	loss	15	waiver	6				71	**notice requirement**	3	order	25	penalty	2
	29	**bond**	14						72	**progress**	5	performance	26	suspension	4
	30	payment bond							73			remedy	17		
	31	performance bond							74	**quantum meruit**	4	requirement	30		
	32	surety	17						75	termination	9	termination-convenience	1		
	33	Miller Act	12						76	**subsurface**	3	settlement	11		
Schedule	34	**schedule**	8	extra time	2				77	differing site condition	4	union	10		
	35	accelerat(ion)	9	expedite	2				78			waiver			
	36	delay	11	interruption	1				79			risk	9		
	37	extension	8						80	warranty	4				
	38	suspension	5						81	guarantee	9				
	39	withhold	5						82	plans	15	design	20		
Parties	40	Architect	4						83	drawings	8				
	41	Engineer	18						84	specification	13				
	42	subcontractor	21	contractor	30				85	Contract Dispute Act	4				
	43								86	lien	6				

Table A5 (C-5). Disputes characteristics – For measurement.

Parties	Architect	1	**Cost**	**cost**	25	**Project Risk**	**Contract condition**	46	omission	67
	Engineer	2		compensation	26		**breach**	47	**plans**	68
	Subcontractor	3		expense	27		comply	48	drawings	69
	Contracting Officer	4		overhead	28		**damage**	49	**specification**	70
Schedule	**schedule**	5		Eichleay formula	29		**dispute**	50	**Liability**	71
	acceleration	6		payment	30		complaint	51	misconduct	72
	delay	7		profit	31		conflict	52	misrepresent	73
	extension	8		increase	32		expert witness	53	mistake	74
	suspension	9		**equitable adjustment**	33		**CDA**	54	negligent	75
	withhold	10		liquidated damage	34		**duty**	55	**warranty**	76
	progress	11		recover	35		**failure**	56	guarantee	77
Work	**defect**	12		retainage	36		**force majeure**	57	**fraud(ulent)**	78
	deficiency	13		loss	37		**notice requirement**	58	faith - bad	79
	repair	14		**bond**	38		**subsurface**	59	faith - good	80
	change	15		payment bond	39		- differing site condition	60		
	- change order	16		performance bond	40		**termination**	61		
	- directive	17		Surety	41		**Contract definition**	62		
	- purchase order	18		Miller Act	42		ambiguity	63		
	- replace	19		**default**	43		clarify	64		
	add	20		**lien**	44		error	65		
	extra (work)	21		**quantum meruit**	45		interpret	66		
	delete	22								
	scope	23								
	complete	24								

Table A6 (P-1A). Pilot study process - Initial: Part – A.

			c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22	c23	c24	c25	c26	c27	c28	c29	c30	c31	Sum	AVG
1	**work**	work																																0	0.000
2		add	4	4	5	1					1	1		22		6	4	1		1								1		7	3	3	5	69	2.226
3		alteration																																0	0.000
4		corrective																																0	0.000
5		error																																	
6		defect	10				1										20	1				6	9	1				7		1				56	1.806
7		deficiency	1						1				2				6		1			1	1	3				12			4			32	1.032
8		delete		1											2							7												10	0.323
9		extra (work)																																0	0.000
10		improve	5	1				3?							1		4							1										12	0.387
11		increase																																0	0.000
12		modify																																0	0.000
13		overrun																																0	0.000
14		quality																																0	0.000
15		replace	4	1										27			4					13						9							
16		repair	5														2		1					2		2		7						19	0.613
17		revision																																0	0.000
18		scope		1				1							2	1		1	1		5			4					1		1		18	0.581
19		workmanship																																0	0.000
20		**change**					8					9	3		8	3	3		1					2				1	2	9	11	3	11	74	2.387
21		- change order					1						1		3	1				6		1		3						1				17	0.548
22		- directive																																0	0.000
23		- purchase order			15										5			7		24								1	1					53	1.710
24	**cost**	cost	5	25		2	2	8		3	3	7	53		23	10	35	2	3	5	4	6		21		7	1	19	4	27	16	2	13	306	9.871
25		budget																																0	0.000
26		compensation																																0	0.000
27		Eichleay formula																																0	0.000
28		equitable adjustment																																0	0.000
29		expense																																0	0.000
30		increase	5								1	1	1	2	1		1	1	3		4							1		6	1		1	29	0.935
31		liquidated damage																																0	0.000
32		loss																																0	0.000
33		overhead		1									1							1			5			4				1				13	0.419
34		payment		6	6	2	16	2		15	3	2	6		4		10	1	1	2	3			13			15	2	57	1	18	12		197	6.355
35		payment withheld																																0	0.000
36		profit		3		11									4					6	2					4				1	1			33	1.065
37		recover	1	9	3		10			24	1	6	35		7	2	17	9	1	16	15	1		48		1	5	6	6	18	5	15	4	265	8.548
38		retainage																																0	0.000
39		**bond**				1	12	1		18			38	2									3	4		3	2	6	4	2		4		100	3.226
40		- payment bond																																0	0.000
41		- performance bond																																0	0.000
42		extra cost																																	
43	**schedule**	schedule					2					5	1		16							3	6	4				2						39	1.258
44		acceleration																																0	0.000
45		delay										17	18		6	2		13			6		5	5				3				16	10	101	3.258
46		expedite																																0	0.000
47		extension	1	12		1?							2sion		3		1													1			2	20	0.645
48		interruption																																0	0.000
49		suspension										5		108	1	1	1																	116	3.742
50		withhold																																0	0.000
51		extra time																																	
52	**Architect**	Architect																																0	0.000
53		design																																0	0.000
54		plan																																0	0.000
55		specification																																0	0.000
56	**Surety**	Surety				2	106	1			37		8						3	6	1		7				6	5	5	2		19		208	6.710
57		Miller Act				2			5	22			31					13		23	21			23			8		13	25		40		226	7.290
58	**Project Risk**	access - site																																0	0.000
59		bid																																0	0.000
60		**breach**	4	14	14	8	4					3	35		8		2	6	1	1	7			41	2	1		13	5	9	7	6	1	192	6.194
61		claim	19	25	1	28	18	107?		18	12	28	79	12	9	8	67	58	37	5	15	3	6	55	2		2	7	58	34	98	33	5	742	23.935
62		**code - comply**			9	5		2																										16	0.516
63		comply				1	1			1		1	2				8	1					2							1	1			19	0.613

Table A7 (P-1B). Pilot study process - Initial: Part – B.

			c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22	c23	c24	c25	c26	c27	c28	c29	c30	c31	Sum	AVG
64	Project Risk	complete	8	10	5	1	22				28	8	7	34	18	4	4	2	1	6		17	25	33	4	2		3	11		4	4	1	262	8.452
65		fitness for purpose																																0	0.000
66		incentive																																0	0.000
67		damage	1	3			4					2	12		8		14	1			1		1	3	1	4		1		7		1	1	65	2.097
68		default		1		2	9	3			4		1		1								16						1					38	1.226
69		definition																																0	0.000
70		ambiguity		1neg								5	1						2			25			7				3					43	1.387
71		clarify		1	2	1							3	7	11		5								1						1			32	1.032
72		complexity																																0	0.000
73		controversy																																0	0.000
74		discrepancy																																0	0.000
75		error - omission	1	3	2	1neg							32		24	1	2				1	1	1	6		1	5	13	1			2		96	3.097
76		inaccuracy																																0	0.000
77		inadequate																																0	0.000
78		interpret		13	3			4		3		10	1	3	4	7	27		8	2	1	40		8	8	1		2	10		1		12	168	5.419
79		omission				1							3			1	1							1										7	0.226
80		dispute		1		1		31				4	1	5	4		5	1	20	2		1		8	3		1	2	2		18	1	1	112	3.613
81		arbitration																																0	0.000
82		complaint	8	2	1	1		3	2	1			5		1	1		1	5				2	1				3	2	8	3		1	51	1.645
83		conflict			2										2	1	2	4				3		8		1	2	3	6					34	1.097
84		duty																																0	0.000
85		expert witness		1									14				2											2						19	0.613
86		express	2	2			1	2		5		3	1			1	3	1	1				1	10	8			1	7	1	3		1	54	1.742
87		faith - bad		51-/1+								1-	1+/2	1-			2+	1-				1-		6						18	1			25	0.806
88		faith - good																																0	0.000
89		Tort																																0	0.000
90		fraud	12	2	4			12				1	1			1	10	2				1		2				2		3				53	1.710
91		force majeure																																0	0.000
92		weather - condition																																0	0.000
93		implement			2		4	1																										7	0.226
94		imply	5							2		1		2					2			1		3	1			3	1		1			22	0.710
95		implicitly		1						1				1	1		1												1		1			7	0.226
96		interruption																																0	0.000
97		liability		1		5	7			1		2	7	1			5	1			3			1			1	4	2	2		5		48	1.548
98		misconduct	1																															1	0.032
99		misrepresent																																0	0.000
100		mistake																																0	0.000
101		negligent	6	2									3		2									2	1			1	2					19	0.613
102		obligation																																0	0.000
103		notice requirement					2			5																			4					11	0.355
104		order																																0	0.000
105		penalty																																0	0.000
106		performance	1	28		14	31	2		1		23	24	79	13	10	24	7	2	8		5	10	57		8	3	11	13	11	9	7	8	409	13.194
107		progress		1									1										8	2				2						14	0.452
108		quantum meruit																																0	0.000
109		failure		3	1	2	3	1				5	17	2	6	1	3	1	1	2			7	7	2			6	2	2	1	1		76	2.452
110		remedy																																0	0.000
111		requirement																																0	0.000
112		responsibility																																0	0.000
113		risk																																0	0.000
114		settlement																																0	0.000
115		suspension										5			1		2																	8	0.258
116		union																																0	0.000
117		unjust enrichment																																0	0.000
118		waiver																																0	0.000
119		warranty	10									3										6						3						22	0.710
120		guarantee				1	4			3			2	1	1													2	1	1				16	0.516
121		contract																																0	0.000
122		- contracting officer																																0	0.000
123		termination		2		56	1	4							24		1						32	11						72			203	6.548
124		termination-convenience																																0	0.000
125		subsurface										3				24																	7	34	1.097
126		- differing site condition										1				9	3																1	14	0.452
127		Contract dispute act							27			4					8														29			68	2.194
128		lien									1				4					1	1			2					2					11	0.355

Table A8 (P-2A). Pilot study cases: Part – A.

	Group	Characteristics	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22	c23	c24	c25	c26	c27	c28	c29	c30	c31	Sum	AVG
1	**work**	**add**	2	1	0	0					1	1		21	2	4	5	1		1								0		2	0	3	0	44	1.419
2		extra (work)		1				1				2			4		4	16						6								3		37	1.194
3		**defect**	10				1										20	1				6	9	1				7		1				56	1.806
4		deficiency	1						1				2				6		1			1	1	3				12			4			32	1.032
5		repair	5														2		1					2		2		7						19	0.613
6		**delete**		1											2							7												10	0.323
7		**change**					8					9	3		8	3	3		1					2				1	2	9	11	3	11	74	2.387
8		- change order					1						1		3	1				6		1		3						1				17	0.548
9		- directive																																0	0.000
10		- purchase order			15										5			7		24								1	1					53	1.710
11		- replace	4	1										27			4					13						9						58	1.871
12		**scope**		1				1							2	1		1	1		5			4						1		1		18	0.581
13	**cost**	**cost**	5	25		2	2	8		3	3	7	53		23	10	35	2	3	5	4	6		21		7	1	19	4	27	16	2	13	306	9.871
14		compensation																																0	0.000
15		expense		8				1			2	1	3	27		2							2	3		5		2	3			7		66	2.129
16		overhead		1									1							1			5			4			1				13	0.419
17		Eichleay formula												69																				69	2.226
18		payment		6	6	2	16	2		15	3	2	6		4		10	1	1	2	3			13			15	2	57	1	18	12		197	6.355
19		profit		3		11									4					6	2			1		4				1	1			33	1.065
20		increase	5								1	1	1	2	1		1	1	3		4							1		6	1		1	29	0.935
21		**equitable adjustment**										1	1			8						1								1	9		12	33	1.065
22		liquidated damage			1		1																3							3				8	0.258
23		recover	1	9	3		10			24	1	6	35		7	2	17	9	1	16	15	1		48		1	5	6	6	18	5	15	4	265	8.548
24		retainage		1			67				5						5		5				1			1	2		1					88	2.839
25		loss		5		2	6				2			3	4		19						1	4	1	2			1	3	1	1		55	1.774
26		**bond**				1	12	1		18			38	2									3	4		3	2	6	4	2		4		100	3.226
27		payment bond																																0	0.000
28		performance bond																																0	0.000
29		Surety				2	106	1			37		8						3	6	1		7				6	5	5	2		19		208	6.710
30		Miller Act				2			5	22			31					13		23	21			23			8		13	25		40		226	7.290
31	**schedule**	**schedule**					2					5	1		16							3	6	4				2						39	1.258
32		acceleration		3			1	1			1			2	1		1						1						1					12	0.387
33		delay										17	18		6	2		13			6		5	5				3				16	10	101	3.258
34		extension	1	12		1							2		3		1												1				2	23	0.742
35		suspension										5		108	1	1	1																	116	3.742
36		withhold					12				1												2	1					1					17	0.548

Table A9 (P-2B). Pilot study cases: Part – B.

	Group	Characteristics	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	c21	c22	c23	c24	c25	c26	c27	c28	c29	c30	c31	Sum	AVG
37	**Parties**	Architect	1										3												7			1						12	0.387
38		Engineer		1								2			1	2	6	1																13	0.419
39		Subcontractor																																0	0.000
40		Contracting Officer					7	23				7		2		4			8			4	2							1	37		7	102	3.290
41	**Project Risk**	**breach**	4	14	14	8	4					3	35		8		2	6	1	1	7			41	2	1		13	5	9	7	6	1	192	6.194
42		comply				1	1			1		1	2				8	1					2							1	1			19	0.613
43		**complete**	8	10	5	1	22				28	8	7	34	18	4	4	2	1	6		17	25	33	4	2		3	11		4	4	1	262	8.452
44		**damage**	1	3			4					2	12		8		14	1			1		1	3	1	4		1		7		1	1	65	2.097
45		**default**		1		2	9	3			4		1		1								16						1					38	1.226
46		**definition**																																0	0.000
47		ambiguity		1								5	1						2			25			7				3					44	1.419
48		clarify		1	2	1							3	7	11		5								1						1			32	1.032
49		error (- omission)	1	3	2	1							32		24	1	2				1	1	1	6		1	5	13	1			2		97	3.129
50		interpret		13	3			4		3		10	1	3	4	7	27		8	2	1	40		8	8	1		2	10		1		12	168	5.419
51		omission				1							3			1	1							1										7	0.226
52		**dispute**		1		1		31				4	1	5	4		5	1	20	2		1		8	3		1	2	2		18	1	1	112	3.613
53		complaint	8	2	1	1		3	2	1			5		1	1		1	5				2	1				3	2	8	3		1	51	1.645
54		conflict			2										2	1	2	4				3		8		1	2	3	6					34	1.097
55		**duty**		2		30	10					1	1		2		1	3	1	1		2	3	1				7	26	6	1		1	99	3.194
56		expert witness		1									14			2												2						19	0.613
57		**failure**																																0	0.000
58		failure		3	1	2	3	1				5	17	2	6	1	3	1	1	2			7	7	2			6	2	2	1	1		76	2.452
59		**fraud(ulent)**	12	2	4			12				1	1			1	10	2				1		2				2		3				53	1.710
60		faith - bad		52								1	3	1			2	1				1		6					18	1			86	2.774
61		faith - good																																0	0.000
62		**force majeure**		6																														6	0.194
63		**liability**		1		5	7			1		2	7	1			5	1			3			1			1	4	2	2		5		48	1.548
64		misconduct	1																															1	0.032
65		misrepresent	4									9	1				1	3					3	1				2		3				27	0.871
66		mistake		1										3	53	1		1			1							1						61	1.968
67		negligent	6	2									3		2									2	1			1	2					19	0.613
68		**notice requirement**					2			5																			4					11	0.355
69		**progress**		1									1										8	2				2						14	0.452
70		**quantum meruit**								2			21											43								8		74	2.387
71		**termination**		2		56	1	4							24		1						32	11							72			203	6.548
72		**subsurface**										3				24																	7	34	1.097
73		- differing site condition										1				9	3																1	14	0.452
74		**warranty**	10									3										6						3						22	0.710
75		guarantee				1	4			3			2	1	1													2	1	1				16	0.516
76		**plans**										6																						6	0.194
77		drawings																																0	0.000
78		**specification**										11	1	2	12	4	3		1				1	3				2						40	1.290
79		**Contract dispute act**							27			4					8														29			68	2.194
80		**lien**									1				4					1	1			2					2					11	0.355

Table A10 (D-1A). Dispute data in 1984: Part - A.

		84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
1984A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Parties	Architect		3									14	1								1					1
	Engineer			3			4	4						8	2				1					4	11	
	Subcontractor	2					8	26	1	3		1	4	9	17				1	5	1	1		3		11
	Contracting Officer							3		1	3				4		1						30			
Work	**defect**	1	11																					16		4
	deficiency																				1					
	repair		1												1	1							2			1
	change		2		3		2	10		15	5	2		14			2	1	4		1	2	2	10	1	
	- change order									6													1	28		
	- directive																									
	- purchase																									2
	- replace		9				0																			
	add																									
	extra (work)						0	1						1			1		3							
	delete																							1		
	scope					1				1			1	0		1		1		1				2	1	
	complete		1		1		1			2	3	1	3	6	2		1	1	1		2	3	7	11	2	1
Cost	**cost**		4	1	1		6	11	4	4	3	2		14			2		3		2	3	15	1	1	
	compensation		1		1		0	1	1		1			8	1							1	3			
	expense						0		1	1				1			2									
	overhead						18	1				2		1								2	1			
	Eichleay						14																			
	payment		1		5			1							16					1	2	3	20	6	1	4
	profit				1									1			1					7				
	increase						3				2	2		6					4				16		1	
	equitable	1						4			7												2		7	
	liquidated																									
	recover	1	3				11	1	6	6	5	2	2	4	2		1		1			8	1			1
	retainage														6									3		
	loss						1		8					1			1		1	1				1		2
	bond						1	1				1	1	0	20					14	2			1		5
	payment bond																									
	performance																									
	Surety	1											1		1					10						
	Miller Act	1										1			24							2				8
	default					1								1	4				1			1				1
	lien							1							3											
	quantum													4								3				
Schedule	**schedule**							2	1				1	0					1		1			1		
	acceleration																									
	delay						16	1		31		6		14	1			2	16	1	12		1	1		2
	extension		1	1	2	3	17	2		7	1	1	1	1					2	1		1		0	1	
	suspension						9												1		2					
	withhold			2							2															
	progress						2			1		2		5	3						1				2	

Table A11 (D-1B). Dispute data in 1984: Part - B.

Project	Contract																									
Risk	**breach**		4			2	1	3	2			1		5	2			1		1	1	3	1	13	1	1
	comply					1									1											
	damage	4	25			4	10	2	4	4		7	2	10	1		5	2	17			16	2	2		1
	dispute				2	16	1	2	1	1	1	1	5	1			10	12		3		1	11		11	1
	complaint		1			2									11		3	1			2					1
	conflict					2		1										1	1	1			1	1	2	
	expert																									
	CDA																						7			
	duty		2									2		0	4	1		2	6	3	1				2	
	failure	2	2				1	1		2		1		4	6	5	1	2	5		1		2	7	2	2
	force majeure																									
	notice																									
	subsurface									1	4			2							2				1	
	- differing																									
	termination					1						2										1				
	Contract																									
	ambiguity												4		1											
	clarify					5										1							1			
	error (-		6		6	1		2					2	1		7			2				3	1	2	2
	interpret					1		3			6	1		5			2		1		1		1	1	5	
	omission											6			2	1			1							
	plans		1	3	1			1		2	1	2	4	2					1		4			7	2	
	drawings									2	42		3	12											2	3
	specification							9		1	2	1	4	1											19	6	3
	Liability		3						2				2	1	2				2			1	2	1		
	misconduct																									
	misrepresent		1					1			5												3			
	mistake				1			1						1								2		2		
	negligent		1												7				2		1					
	warranty		12	1	1						1					2								50		
	guarantee							1			5				1									1	1	
	fraud(ulent)		8	2	2	1		1	1						1	1			1				1			
	faith - bad							1	5			2							1			1	3			2
	faith - good																									
SUM		13	103	13	27	41	126	99	37	91	99	63	41	144	146	20	33	26	80	42	41	62	139	196	66	56
																		SUM	1804		AVG.	72.16		SD	48.773866	

Table A12 (D-1AN). Dispute data in 1984 – Normalized value calculation: Part A.

		84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84		
1984A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	SUM	AVG
Parties	Architect	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.32	0.0127
	Engineer	0.00	0.00	0.23	0.00	0.00	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.17	0.00	0.57	0.0229
	Subcontractor	0.15	0.00	0.00	0.00	0.00	0.06	0.26	0.03	0.03	0.00	0.02	0.10	0.06	0.12	0.00	0.00	0.00	0.01	0.12	0.02	0.02	0.00	0.02	0.00	0.20	1.22	0.0486
	Contracting Officer	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.03	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.35	0.0138
Work	**defect**	0.08	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.07	0.34	0.0135
	deficiency	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.0010
	repair	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.10	0.0040
	change	0.00	0.02	0.00	0.11	0.00	0.02	0.10	0.00	0.16	0.05	0.03	0.00	0.10	0.00	0.00	0.06	0.04	0.05	0.00	0.02	0.03	0.01	0.05	0.02	0.00	0.88	0.0351
	- change order	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.00	0.00	0.22	0.0086
	- directive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	- purchase order	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.0014
	- replace	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.0035
	add	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	extra (work)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.0034
	delete	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.0002
	scope	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.05	0.00	0.04	0.00	0.02	0.00	0.00	0.00	0.01	0.02	0.00	0.20	0.0079
	complete	0.00	0.01	0.00	0.04	0.00	0.01	0.00	0.00	0.02	0.03	0.02	0.07	0.04	0.01	0.00	0.03	0.04	0.01	0.00	0.05	0.05	0.05	0.06	0.03	0.02	0.58	0.0234
Cost	**cost**	0.00	0.04	0.08	0.04	0.00	0.05	0.11	0.11	0.04	0.03	0.03	0.00	0.10	0.00	0.00	0.06	0.00	0.04	0.00	0.05	0.05	0.11	0.01	0.02	0.00	0.95	0.0379
	compensation	0.00	0.01	0.00	0.04	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.19	0.0078
	expense	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.0042
	overhead	0.00	0.00	0.00	0.00	0.00	0.14	0.01	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.23	0.0092
	Eichleay formula	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.0044
	payment	0.00	0.01	0.00	0.19	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.14	0.03	0.02	0.07	0.70	0.0279
	profit	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.19	0.0075
	increase	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.03	0.00	0.04	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.12	0.00	0.02	0.00	0.30	0.0119
	equitable adjustment	0.08	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.11	0.00	0.31	0.0123
	liquidated damage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	recover	0.08	0.03	0.00	0.00	0.00	0.09	0.01	0.16	0.07	0.05	0.03	0.05	0.03	0.01	0.00	0.03	0.00	0.01	0.00	0.00	0.13	0.01	0.00	0.00	0.02	0.80	0.0320
	retainage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.06	0.0023
	loss	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.22	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.04	0.34	0.0135
	bond	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.14	0.00	0.00	0.00	0.00	0.33	0.05	0.00	0.00	0.01	0.00	0.09	0.67	0.0269
	payment bond	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	performance bond	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	Surety	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.0139
	Miller Act	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.14	0.43	0.0173
	default	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.11	0.0042
	lien	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.0012
	quantum meruit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.08	0.0030
Schedule	**schedule**	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.11	0.0045
	acceleration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	delay	0.00	0.00	0.00	0.00	0.00	0.13	0.01	0.00	0.34	0.00	0.10	0.00	0.10	0.01	0.00	0.00	0.08	0.20	0.02	0.29	0.00	0.01	0.01	0.00	0.04	1.32	0.0527
	extension	0.00	0.01	0.08	0.07	0.07	0.13	0.02	0.00	0.08	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.02	0.00	0.00	0.02	0.00	0.60	0.0241
	suspension	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.13	0.0053
	withhold	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.0070
	progress	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.03	0.00	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.17	0.0067

Table A13 (D-1BN). Dispute data in 1984 – Normalized value calculation: Part B.

Project	Contract condition																											
Risk	**breach**	0.00	0.04	0.00	0.00	0.05	0.01	0.03	0.05	0.00	0.00	0.02	0.00	0.03	0.01	0.00	0.00	0.04	0.00	0.02	0.02	0.05	0.01	0.07	0.02	0.02	0.49	0.0194
	comply	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.0012
	damage	0.31	0.24	0.00	0.00	0.10	0.08	0.02	0.11	0.04	0.00	0.11	0.05	0.07	0.01	0.00	0.15	0.08	0.21	0.00	0.00	0.26	0.01	0.01	0.00	0.02	1.88	0.0751
	dispute	0.00	0.00	0.00	0.07	0.39	0.01	0.02	0.03	0.01	0.01	0.02	0.12	0.01	0.00	0.00	0.30	0.46	0.00	0.07	0.00	0.02	0.08	0.00	0.17	0.02	1.80	0.0720
	complaint	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.09	0.04	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.02	0.33	0.0132
	conflict	0.00	0.00	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.02	0.00	0.00	0.01	0.01	0.03	0.00	0.18	0.0071
	expert witness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	CDA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.0020
	duty	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.05	0.00	0.08	0.08	0.07	0.02	0.00	0.00	0.00	0.03	0.00	0.41	0.0163
	failure	0.15	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.00	0.02	0.00	0.03	0.04	0.25	0.03	0.08	0.06	0.00	0.02	0.00	0.01	0.04	0.03	0.04	0.86	0.0343
	force majeure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	notice	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	subsurface	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.02	0.00	0.13	0.0052
	- differing site	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	termination	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.07	0.0029
	Contract definition	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	ambiguity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.0042
	clarify	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.18	0.0072
	error (- omission)	0.00	0.06	0.00	0.22	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.35	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.01	0.03	0.04	0.85	0.0339
	interpret	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.06	0.02	0.00	0.03	0.00	0.00	0.06	0.00	0.01	0.00	0.02	0.00	0.01	0.01	0.08	0.00	0.35	0.0141
	omission	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.01	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.0069
	plans	0.00	0.01	0.23	0.04	0.00	0.00	0.01	0.00	0.02	0.01	0.03	0.10	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.10	0.00	0.00	0.04	0.03	0.00	0.64	0.0256
	drawings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.42	0.00	0.07	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.00	0.66	0.0263
	specification	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.01	0.02	0.02	0.10	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.05	0.48	0.0194
	Liability	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.01	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.21	0.0085
	misconduct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
	misrepresent	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.09	0.0037
	mistake	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.10	0.0039
	negligent	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.11	0.0043
	warranty	0.00	0.12	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.60	0.0238
	guarantee	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.09	0.0035
	fraud(ulent)	0.00	0.08	0.15	0.07	0.02	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.44	0.0177
	faith - bad	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.02	0.00	0.00	0.04	0.26	0.0105
	faith - good	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
SUM		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	25.00	1.00

Table A14 (D-2A). Dispute data in 1985: Part A.

		85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1985A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Parties	Architect											14					7					1	1			18				3		6
	Engineer			2			2	4			8	8					4		22	1						12	4	1	1			
	Subcontractor		3	4	1	1	2		3	15		4	14			6		1			19		1	1	1	5	7	7		13		17
	Contracting Officer				7															20							4	2				
Work	**defect**			1	1	16	1	1			2	1							2			3	1			2	7			4	1	
	deficiency			2	4												1							1		1					
	repair			1		1					1	1			1		3									2	1					
	change				13			1				1					2	1	1	9	1	1	1	1		1	5			2	1	1
	- change order				5																					1					
	- directive																															
	- purchase order																									4						
	- replace					25					1						1		15				2			4				14		
	add																															
	extra (work)	1		3			1					1					1			9			1	1		1	1			15		
	delete										2								0											1		
	scope		3	4							1							1	1	1				7		2				1		5
	complete	1		11		2	5		0	2	1						2		4	5		2	6	1		1	5	8		3		1
Cost	**cost**			2	5	6	8		14		5	4			2				3	35	1	6	1		1	3	2		1	54		
	compensation		1	4		2			0											2		3		2			3			2		
	expense			1		2						1	1			1			1	16		7				1				2		1
	overhead																			4							2					
	Eichleay																															
	payment	1	3	3			6		3	13	2	1				3				1	18	13			3		9	25		8		1
	profit			2												1				6						2	14					
	increase																1		1	3		1				2				1		
	equitable							3												7												
	liquidated																															
	recover		5	2	5	14	3		1	2	11	7	1			4	1			2	3	18				7	11	7		2		
	retainage			2																								9				
	loss			1		1		1			17	15					1	2		6		6				11	3					
	bond	5	1	1	1		1		3	42				1							8							9				1
	payment bond																															
	performance																															
	Surety	4		2	3		2		5	1				1							1						2	55				2
	Miller Act			1			1		0	4				1							2						1	6				3
	default	6	1		15											4												12		1		11
	lien								0	2						1																4
	quantum			1			1									1											19					
Schedule	**schedule**		1	5															1	2			1					2		4		4
	acceleration																															
	delay		3	1		1			0			4							2	43		2	5	3		1			2	76		2
	extension		1	2	2					5		2		11			3	3	2	3								2				
	suspension																			13								1				1
	withhold		1																													
	progress			2	1		3																					15				

Table A15 (D-2B). Dispute data in 1985: Part B.

Project	Contract condition																															
Risk	**breach**	1	1	4	6	19	8		1		14	5	4			1	3	3		4		26	1			8	14	2	1	8	2	6
	comply		1	1			1				3				2					1	1					5						
	damage	2	1	7	5	37	8		0		20	11	3				6	27		33		9	3			7	15			32		13
	dispute		6	3	5			2	3	1	1	4	1				1			43	1	2	8	23	1	1	2	5		2	2	17
	complaint	3			2						1		8	15	2		4	16		5		3					2	12		1	8
	conflict	1			4	2										1						1	2			3					
	expert																															
	CDA				26																											
	duty	1						1			4	5	3					14				15	3			8		5		1		5
	failure		1	1		21		1	1		2	1	4	7			2	1	1	6	1	2	2		2	3	3	2		1		2
	force majeure																															
	notice													1																		
	subsurface																															
	- differing site																										2					
	termination			3	21																					1	3	1	1			
	Contract definition																															
	ambiguity			1				5		1	6									1												
	clarify							2		1	4				2													1				
	error (- omission)			1	2	6					10	2	1				1			5		6	2		3	1	1			5	3	
	interpret	2	2	2	5	1		5	0	4		5	2						1			1	1	10	2	6						1
	omission																	1														
	plans		1				2	1		1	26	2			5		2		10	1			2			5	3		1			
	drawings				2			4												1			1			1						1
	specification			4				1			1	1			4					2				1		65	14			5		6
	Liability	1	2		4	9			0	2	9	5	2			1		3		8		14				5		2	1	7		7
	misconduct										1																					
	misrepresent			7		4					16															2						
	mistake			1									2														1					1
	negligent					1					18	2					1	3								3						
	warranty				3	37					1	2					3	2								2					4	1
	guarantee										3					6				2						5					1	
	fraud(ulent)			3	23			1			4	1				15	1	1		1				4		1		2				
	faith - bad	3						1														5				3		2		1		
	faith - good																															
SUM		32	38	98	171	208	55	34	34	96	195	110	46	37	18	45	51	81	65	301	56	147	45	55	13	216	158	185	20	268	15	128
																								SUM		3021	AVG		97.45	SD		79.44

Table A16 (D-3A). Dispute data in 1986: Part A.

		86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86
1986A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Parties	Architect			25			1	1						1	4				0	14				7						1						
	Engineer	1		14	3		2		3						4	2				13			4	8	1			1	1		1		2	3		1	
	Subcontract	1		2					1	2	2	1	13	1		1	3	10	10	13	2					3							1	4			10
	Contracting													9														4				1		6		2	
Work	**defect**			1			19	5												1	4		6	1			1		10						1		
	deficienc						1	1															3			1			4							
	repair			2			3	11					1								1			6					2							
	change		0				3		1			4		1	1				6	29	1		1		2	2			0		24		2	1		1
	- change																		1	7						1					4					
	-																																			
	-																															10				
	- replace				1			17													1		2	1		2							1			
	add		0				5				5	7				2	2							5	1	4	3	8	5				3		12		1
	extr								2			6				1			2	19						7		2		0						
	delete																			2																
	scope		3	1				1				1			2	1			5	3		1			4					1	1				1	
	complet	1		1		2	3	2	3	1		3		2		3	1	1	0	6	2	2	2					7	3	2	1			5	2	3
Cost	**cost**	3				1	1	13	3			13		11	1	3	1		1	51	2		7	2	1	1	1	32	9	1		12	1	4	2		8
	compen							2				4			2	3			1	27	1			1		5			3			1					
	expense				2			4				1			1	4				3	1		2	2				4	4	0		3					
	overhead							1				2		1						1												25					
	Eichl																																				
	payment	3			2	2		8	2	3	3	1	8			13	1	1	2	2	7				1	5	1	2	1	2	1		17		4		22
	profit										2			1						3			2								3					
	increase							3				2								14								1	1	3		1		2			
	equitable																															2		4		2	
	liquidate																																				
	recover					10					4	2		2	1	18	7	1		15		4	8	3		2		2	2	1		2	13	4	1		4
	retainag												1							2																
	loss							48								21				8			2	1					17							
	bond			4	9			1		3	27		23			29	13	25		3	10					2						3		1		45
	payment																																				
	performa																																				
	Surety							1		3	8		12			30	3	5	1	3	6					1						2				6
	Miller				4											17	1				19					2						13				
	default													1		3		1		3		2						16			3					
	lien				3						1	1	11			2											5					1				4
	quantu																																				
Schedule	**schedule**		1						1			1							1	6									1				7			
	accelera																																				
	delay							2			1	3	1						0	2								3		0		17			8		
	extensio	1	2	5	1	1	2	2				1	1	1		1			4	3	2	4	6		2	2		3	3	0		2			4	1	5
	suspensi																			6								1					1			
	withh								3			1				1												3								
	progres								1							1				1						4						4				

Table A17 (D-3B). Dispute data in 1986: Part B.

Project	Contract																																				
Risk	**breach**			3			1				1	5				2				44	1	10	21	1		2	4	3	4		6		4		1		
	comply										3								1	1			2								1							1
	damage			2		6		82	1			3				2	1			56		11	18	14				15	35			3	2		4		
	dispute		3			4	1		1			3	3			7		1	14	6	1	7	3		2	4	3	7		8	11	2	1	1	4	4	
	compl						1				1				1	1				2	7	2	1				4	3	4	3					3		
	confli						1		1				2	1					0	1					1	1					8		11	2		
	expert			7																				5												
	CDA																																			
	duty	1		1					2		1				1					14			1			6			11	0		4		1		
	failure		0	7				3	1		2	3		1	3		1			3	2		10		2	4	1	4	5	1	3		2		1		
	force																																				
	notice											1																									
	subsurf														2					1																	
	-																																				
	termina		1																	5								11				1		1		
	Contract																																				
	ambiguit							2											3										1			1		4		1	
	clarify			1										1						1						1							2		1		
	error (-	4	1	4			7		15			4		13	2								6	3	4	2		2	1					13		
	interpret		0	1				13	2	1	1	3	3	1		1			28	2	2	4							1	2		7	1	5	2	1	9
	omission													1	3					1															2		
	plans	2	0	1		2			3			3			4				0	5			39		7	5		1	4		1		1	2	1	1	8
	drawi		1										1		3				0	5	1	1											26		5		
	specific			22				4	1				1	2	6				0	5			2		1	3		1	3				3	21		6	2
	Liability	1						29			2		1		4	8		1		8	6		11				1		27	0					1		1
	miscond								2			3																1									
	misrepre			1					1			5			3																						
	mistake	2					1							18					0						1				3								
	negligent			1											6					2			1														
	warrant		0	2			1																4		1					0		1					
	guara		0	1			1						2	2		33					2		20							0							9
	fraud(ulent						1		24			16		1						1					1			3	2								
	faith -				2							1	1	1			2											2		0				3			
	faith -																																				
SUM		20	12	109	27	28	55	256	74	13	64	104	85	73	54	210	36	46	80	423	81	48	184	60	32	68	28	142	167	23	30	120	92	107	77	29	139
																													SUM	3196		AVG	88.78		SD	81.11	

Table A18 (D-4A). Dispute data in 1987: Part A.

		87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87	87
1987A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Partie	Archite												14						1				5		11	41	1					2			3			13					
	Enginee		3									3		1	1	2		2	1				2			14	10			7	1	1		3	1			2	4	2	1	8	1
	Subcon	42		3			37	16			5	7	9		2	3	1	1	2	3	8		1	16	2	8		1	22	1	4	7	3			1	5		3			35	29
	Contrac		3	3		12			9			1		2			47		2									17	4	3		19						1		3		
Work	defect	1			1				1		4				3		1		3							5			1			2	1	1				1			4	1	
	defi								1					1	1															1		1	3					1		1		3	
	repa										2								2											2								3				2	1
	chang	12	1		5				5	1	1	8					3	2	6			2	1			4	8			10	9	1	8	2	5	3		14		2	4	4	
	-	1										3	1						2								6			2					4			9				3	
	-																																										
	-											7											9																				
	-						1						1	2				2											1	14			1					1				1	
	add	8	3			1	3	4	2	1	2			4	4	1	3					1		2	4			3	1			5		10	4		6	5		1		10
		11		1	1						4							2								2	4		4		7	1						1			8	1
	del								1																					1		1									1	
	scope	1			1	1			2			1			1		1		1				2			1			2	3		1	1									4	
	co	6	4	1	1	12	1	6	1	1	2	1	2	1	1		4	6	8	1		1			3	7	3		1	3	1		19		6		3	16		2	3	21	3
Cost	cost	16	5		2		1		8		3	4	1	41	2		2	13	12			1	2		1	2	4		3	5	2	7	23		2		1	3	3		2	19	
	com	5				1	1												6								4			5		2	1		5				2		11	2
	exp	1			1						3	2	2										1				2				2		2	4						1	3	
	over	3										4		31			1																									
	El													10																												
	pay	5			2	1	18	23	33	3	2	3		4	3	3		8	5	1	7			13	1	24		5			6	18	1	3	3	2	5	3	2	1	1	19	4
	profi	2			32									4				1								2						4								2	
	incr	3	1						4			4	1	4			1	4	2				1				1				2	5			1			2	1	4	1	
	equita		1	1					4			2					2					3					4		5		3			1	3					5		
	liqui																										1															
	reco	12	1		7		12	1	1	2	12	1		26	5	2		3	3				1	3		2			3	1	7	7	4		1		2		3	1		46	1
	retai	4									1															1						1										
	loss	6			17				1		1	3	1	9					1					2		2	1					1	3							1		3	
	bond						28	2		5	1	3	1		4			5	27		2			50	1	2		6				3				10	15				5	4
	pay																																									
	perf																																									
	Sure						14	14			1				3			1	29					6		5		1								15	24				5	13
	M						37			9	4	13			30				9					18				15				8				19				23	16
	def		4		3	32					34							1	5					5		1		1				3	45			1	1					
	lien	1					25								1																										3	
	qua										3																														41	
Sched	sched	4	2	1	2	1					1					1		5									3						16								4	
	acc	38																																								
	dela	3			8	7	1		4			15		24			8	5	2				1		1	1	6				3	14	5				2	6		2		11	
	exte	4	5			3	1	2	5	2		4	3	2		1	3	3							1	6	8	1	2			3	2				1	10	7	4	1	4	1
	sus				2			15	1					11			1				4					1																
		1					1		1			1																			1					1							
	pro				2	1					1	1	1			1		5								20	1					6			1	5				2	

Table A19 (D-4B). Dispute data in 1987: Part B.

Proje	Contr																					
Risk	br	24	1		4		1				6	11	1			2		5	21			
	co		3			1	1		1		4	1						2				
	da	57			8	2			6		31	30	1	4				36	24			
	dis	8	1	1	1	1	1		8			2		9	8		27	2	5	3		3
					3		2		1	2	2		6		31			2		1		
			1	1		2	2		1			5			1							
					1																	
						2													17			
	du		1	1	3		3	1				1	2				1			2		2
	fai	5		1		1	1	1	5		2	1		1	4		6	5	2			
	for																					
	no																					
	su																					
	-																					
	ter				1	29			1		5					1		6	12			
	Contr																					
	am	1		10				1								1		2				7
	cla	1									1							1				1
	err	5	10	1	4	1						2	1		1			1	7			
	int	7	1	8			1	12	2			2			1		1	10		1		8
	om										4				1							
	pl	5			10				1		1		11			1		1	3			
		1	7	1								1										1
	sp		26		1				2			1	1				1	1	1			6
	Liabil	19	2		1		4	5	1	2	2	3	1	7	1		1	17	23		1	
	mi																					
	mi								1													
	mi	1	9		1				2			1										
	ne	11										1	2									
	w								1	1		1						1				
						1		2			1					1			1			
	fraud(	1			3				1			2		1					2			
	fait					8					1			1			2	1	24			
	fait																					
SUM		336	95	34	128	120	197	105	118	29	147	156	63	200	109	20	117	162	271	12	22	36

Proje	Contr																					
Risk	br				4		1				5			7							38	
	co	1		2				4			1											1
	da	3		1	8	2	4	1			20	12				1	4			1	32	2
	dis			10	5	2	1	14	1	4	2	4	8	2		3	1	2		2	7	
					1		4	1			4	3		2	1				2	2	1	
						1		3			1	1	1				4	2	2		8	
						1																
								19				5										
	du			2	6		1	1	1		1						1	16	2		1	
	fai	2		2	4			7		1	2	5					1		7		7	
	for																					
	no					1																2
	su													3				7		2		
	-					2														1		
	ter				24							54			13				1		11	
	Contr																					
	am					1		3				1					1			2		
	cla										1											
	err	1			2						1	1					1		3		20	1
	int	2			2	4		2	1		2	2		1		1	9	8	1	6	8	2
	om																					
	pl	2				1	1				1								1	3	2	
		2						1			1			1			1	1				
	sp	3			2	2		17			14	5	1				2	6		13		
	Liabil	1	1		5	1	2			1	5	2			6	20	1		4		2	
	mi																		2			
	mi							2						1		1				1	1	
	mi				2							1					3					
	ne				4																2	
	w		1								1		1				1			7	1	
		1	2					1														
	fraud(	6			1			3		1	4			4		4			70		2	
	fait				2			7	1	1	1					4	5	2			7	
	fait																					
SUM		50	119	42	223	85	44	150	64	59	156	268	25	66	56	113	128	75	114	70	443	94
													SUM	4921		AVG		117.17	SD		89.55

Table A20 (D-5A). Dispute data in 1994: Part A.

		94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
1994A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Parties	Architect									4											2	5	
	Engineer		1					1		2				8		1	1			2	5		
	Subcontractor			12	1	2	3		19	17	1	2	0	1	17	2	4	1		10	2	39	
	Contracting Officer		6					21	4			1	1						2				2
Work	**defect**	2		1				1	1	3	6							17			11		7
	deficiency			1							1												
	repair								1	2	4												35
	change		1					4	2	20		20	2	1	1				0	2	6	1	2
	- change order									1		4									2	1	
	- directive								1														
	- purchase																	1					
	- replace										6	1			1			2					
	add		12	4			6	0															
	extra									2		1		1	1				1	1	1		
	delete									1	2												
	scope					1				3		2			1						1		
	complete	1	7	3			3	5	1	10	5	5		3	6	2	10	1		5	4	7	1
Cost	**cost**		67	2	2		2	1	4	20	20	12	4	4	7		2	1		34	5		1
	compensation		14	1				9		7		1		4						1	37		
	expense		18				8		1	4	5	5	2	3	3						4		
	overhead		81							2		13								7	1		
	Eichleay		36																				
	payment	1	8	3	3		12			9		17			10	6				1	24	44	1
	profit			1				1				8						1		6	1		
	increase		3					2		9		1		3	4		1			7			
	equitable		2					1					3	2					0		6		
	liquidated																						
	recover	5	5	3	3				4	21		7	1			1				4	5		
	retainage											2										4	
	loss					1		0		3	18	7			39								
	bond		1	33	2		1					4			77	13	6				1	11	
	payment bond																						
	performance																						
	Surety			26								3			2	5	5					23	
	Miller Act				2		1					8											
	default	5		43	2					1		1			1	2						19	
	lien				1					10				1	4							33	
	quantum									2		5									1		
Schedule	**schedule**		6				3			29		6			2					6	1	2	
	acceleration						3			4													1
	delay		58	15			9	41		56	9	2		3		1		1		69		1	
	extension	2	1						4														
	suspension		3																				
	withhold			1								1										1	
	progress		1							24		3								2		28	1

Table A21 (D-5B). Dispute data in 1994: Part B.

Project	Contract																						
Risk	**breach**	2		27				0		4	3	25		9	1		12	9			33	1	1
	comply								4	9							8	1	1				
	damage	3	1	21	1	6	5	2	5	35	38	45		4	6	2	2	1		34	18	1	5
	dispute	1	8	2			1	4	4	0	2	1	1	4		10	4	1	1	1	2	1	21
	complaint	2		1	1		1	0		4	7	1				6		1	3	1			3
	conflict					1		0			2										1	1	1
	expert							0															
	CDA		3					23	12										3				23
	duty	2		6			1	0	1	2	5		4			1	8			2	1	1	5
	failure			2	2		2	3		7	10	1	1	2	4		2	1	1	2	1	2	2
	force																						
	notice									2													
	subsurface													7							1		
	- differing													2					1				
	terminatio			7				0	1	2		9			2	1	1			1		2	
	Contract																						
	ambiguity			6		11	5	0		1	3		23	1								1	
	clarify	1			1								9	1	1	1				1			
	error (-				4			1		0	5	4	0	1	2			2			6		
	interpret	1		1	4			0		0	3		15	8	1	2					1		1
	omission			1	2								2							1			
	plans		1							16	3	3		5	2	1				1	29		
	drawings									6			7								1		
	specificatio		1					0		9			18	4	1	1	5	10			7	1	1
	Liability	2		23		4	2	5		0	6				1	1	2			5	5	1	
	misconduct																						
	misrepresen	1								7				1							5		
	mistake				4			0		0										1			
	negligent	1			1					4				2							5		
	warranty	1									1							1			19		16
	guarante									2				8	4								1
	fraud(ulent)	2	1						2	7					32				1				
	faith - bad		1					0	11	2	1	1				7	7	1	1		1		
	faith - good																						
SUM		35	347	246	36	26	68	125	82	385	166	232	93	93	233	66	80	53	15	207	256	231	131
															SUM	3206.00		AVG	145.73		SD	106.41	

Table A22 (D-6A). Dispute data in 1995: Part A.

		95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
1995A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Parties	Architect								3						13			4		1					33				
	Engineer									11		2			2		1								12				1
	Subcontractor	1	7			2	6	1	3				4	3			1		2	2	1		2	1	21				
	Contracting				3	16		4	1							12													1
Work	**defect**			1		1					1				3	1	8		3					2					1
	deficiency											1		1															
	repair			4		1								1	1				2							1			
	change	2			3				13		1														3				2
	- change	29										1																	
	- directive																								1				
	- purchase										7																		
	- replace		1																8										
	add	2	0		1					2																			
	extra	2							2																				
	delete																									1			
	scope					1			4		1	6													4				
	complete	1	1		6				5		12	3	1				6			4	2	1		2	2				
Cost	**cost**		5	2	88	13			7	4	2		1		1	11		3	8	1				1	13	4			1
	compensati				3				9		4	1							3			2			2				1
	expense		3		3				13	4	1		1			1								1					
	overhead															2													
	Eichleay																												
	payment	5	5	1	3	3			3		2		9	7			1			1	2		5	6	1	1	1		
	profit								2			1				1			2										
	increase				9	2			2	3	1							3							3				1
	equitable				4	1			1											1									
	liquidated																												
	recover		1		13		1		12		1	2		2	16	1	1		10	2			1	4	7				
	retainage	1											4																
	loss								1	3					3				31		1			1	5				
	bond		4				1	5	31			3		9	1	1	15				1		3	12	4		1		
	payment						2	5						5							1		1						
	performance						2					2		1			5												
	Surety						8	16						1			2						10	4	2				
	Miller		4				14	9						22							7		12			8			
	default		3						17			1													2				
	lien	3	13																					1					
	quantum																												
Schedule	**schedule**	1									6	2	1			1		1		2					4				
	acceleration																		1						3				
	delay	5	1		6	2			4		1		1		1			2			1		2		31				
	extension					4														16									
	suspension																												
	withhold								5				1																
	progress								1		1														1	1			

Table A23 (D-6B). Dispute data in 1995: Part B.

Project	Contract																										
Risk	**breach**	4	3	1				1	17	2	5	1	6		39	3	1		4	8	1	1	1	5	2		1	
	comply				1								1						1					1		3		
	damage	9		1					31	10	2	11	4		25	1	2		22	15		4		1	31			1
	dispute	1	12	1	21	4	1	5	33	10	4		2	4	1	2	1	18		5	1	3	2	5	2			1
	complaint	1						5	6	3	1	25		6	2			2	3	3	1	1	1	1	1	3		8
	conflict	1			2			2	7		2		1				2	1	1	3		2				1	3	
	expert																											
	CDA				26	16																						4
	duty	2	1					17	3	2		10			18			1	1	3			4	1				
	failure		1			1	2	5	6	2		6			2		2		1	4		0	8	2	3	2		1
	force																											
	notice																								4			
	subsurface									1																		
	- differing									5																		
	terminatio		1		1				139		1					27				1								
	Contract																											
	ambiguity	6			1					4	1	10	2			1					1			1	7			
	clarify			1	7										1			20							2			1
	error (-	2			1			2	1	2	7	6	4			6		1		3			1	2	9			
	interpret	1	1	1	8	4	4	2	14	3	4	9	8			4	2	3	2	2	1	0		1	11		4	
	omission										1	6								4								
	plans								7			6			1	2	1	2	2	1				1	11			
	drawings								1		2	3			6	1									1			
	specificatio					1			12			8	9		6	6	1	1	3						5			1
	Liability		2	2	3			3	3		4	19	2						7	11			1	2	3			
	misconduct											1																
	misrepresen	3						2							1				10									
	mistake											2				2									5			
	negligent							5							7				3									
	warranty	1		8		1			5		2	6			17		1		4	4	1		1	2	1			
	guarante											2					15		1									
	fraud(ulent)	25			2										22	1			19	2	1	2			4	11		
	faith - bad				1				13				2		1	10				1		2	17	8	6			
	faith - good																											
SUM		108	69	23	216	73	41	89	437	71	77	156	64	62	190	97	68	62	154	100	23	18	72	68	262	28	18	25
																				SUM		2671	AVG		98.93	SD		91.41

Table A24 (D-7A). Dispute data in 1996: Part A.

		96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
1996A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Parties	Architect		1										1		1			6						1										
	Engineer				5				1						1					1	2	3		12	1	4	1		3	3		3		
	Subcontractor		2	2					11	15	10	3	2		4	10	1	9			2	2	7	1	2	11		3	1		10	1		
	Contracting								9					2	1							1							33	14			7	
Work	**defect**		8	4			1		10	1			3	8										7			12		3					
	deficiency		1						1			1		1	1								1	11										
	repair		10	6			9														2			8			8							
	change	1			2	1	1		4	1		1	4		4			4		12				1		2			9	20		6		6
	- change								1									3		5												3		
	- directive																																	
	- purchase									4														1		1								25
	- replace		4	2	1	7			1															9			1				1		
	add															2																		
	extra			1	4								2		2			1		22				2		1		2	1			22		
	delete				1																													
	scope	4			1		2		2				2		2		2	4		4										10		3		2
	complete	5	7	3	6	3	1	1	21	3	1	5	3	11		3	1	6		1	1	1		4		11	4		4	2	1	18		1
Cost	**cost**	8	5	1	16	6	3		4			1	2		1	1		6		2	6	2	1	19	2	4	1	2	13	11		64	12	2
	compensatio	1			1	2		1	1				1		5		6	1						3			1	1	6			6	1	
	expense	4		1	7	2								2				1	3	2	4			2	4	3	1	2			1	3		
	overhead				1	12												1			3										2		
	Eichleay					13																												
	payment	1			7	1		3	17	2	6	9	2	9		3	4	29	9	13		8	20	2		51		1	20	2	25	18		6
	profit				5																4						1	1	5	3		15		
	increase	1			7	1			4				1		1			2						1		1			1	4			2	1
	equitable														2														9				12	
	liquidated																																	
	recover	2	2		6	1	3				1		3			10	1	3	4	1	1		5	6	2	6	3		5		6	6	4	
	retainage				1													8																
	loss	1		1	5	2	1			1				1		1	2		2		2				8	1	24		1		1	5		2
	bond					6		3		4	5	7		4			4	1	22		3		2	5		6					46	2		
	payment																																	
	performance																																	
	Surety				1			4			5	14	1	7					7				6	3		6				6	4		
	Miller Act							4															7			12				2	1		
	default	9			1				31		3		2	14			1									4	1			1			
	lien									2	9					39	2	14								2							2
	quantum																														3			
Schedule	**schedule**	1			2				6		1			7				2				1		1					4		2		11
	acceleration				2									1																				
	delay	3			3	24		1	4	1			2	5	2		1	25		4				11					1		45	14	10
	extension	4	1	1	12	1		9	5	3				1	1	1	2	5	3			1	1	4	5	1	4		3	2	2	5	2	
	suspension					17			1				1																	2				
	withhold												1	1						6						1								
	progress			1	3				6					13								1		2		5		1	4					1

Table A25 (D-7B). Dispute data in 1996: Part B.

Project	Contract																																		
Risk	**breach**	15	2	2	14								2		1	8			1		1			13		4	3		7	13	2	31	1	1
	comply	1										3		2		2		3	1	1										1					
	damage	7	3	13	20	14	33		14	1	3		30	5	1	2	2	7		1	10		2	45	3	1	25		1	4		92	1	2
	dispute	16		4	1			2	12	1	2		3	1	10	6		5	8			1	3	2	1	2	1	5	21				3	7
	complaint	2	7	7	2		6			3	1	1	3			8	2	6	4					2		2	1	4	3		1	7	1	
	conflict									3	1							1			1		1	3	1	5	1					2		
	expert				1																			2				8				4		
	CDA								3																				28					
	duty	3		9	1		11			2	1			3		5		1		3				6		19	3		1	2	1	3	1	
	failure	4		2	3		2	1	7		1	3	3	7		4		1	3	3		1		6		2	3	1	1			6		
	force				5																													1
	notice																									5						1		
	subsurface																															1	7	
	- differing																																1	
	termination	6	2		38		1		36					28			4												63	64		1		
	Contract																																	
	ambiguity	1			1		2						1				2	1							6	1				4				
	clarify	3			2		1						1											3	1				1					
	error (-	3	1	7	6				5				4	1		4	2				1	6	4	25		1		1		1				1
	interpret	6			13		6			1	1	6			6			1	2		1			2	15	10			1	2	1	2	12	
	omission													2		1	2							2	4									
	plans	1	1		2				4	2				2		1	1	1		1				4			22			1			4	
	drawings									1										1				16						2				
	specificatio								1	2			1											2		1	1		1	4	2			
	Liability			3	1		1			5	1	4	3		1	13	2		6	3			1	4	1	2	7					1		
	misconduct		1																															
	misrepresent		4										8	3										2										
	mistake				1				4													6		1						1			1
	negligent		2				2						1											1	5		1				2		
	warranty		10	4	5			1	2				1											4			15			1	2	2		3
	guarantee								2										5					1		1	3								
	fraud(ulent)	1	11	0	2			0	3				1				1							2							6		
	faith - bad			1	41			2	1										8										1	14		8		
	faith - good																																	
SUM		114	85	75	259	113	86	32	234	58	52	58	95	141	47	124	45	158	88	86	44	34	61	264	61	189	148	32	255	186	111	407	85	85
																										SUM		3912	AVG		118.55	SD		85.53

Table A26 (D-8A). Dispute data in 1997: Part A.

		97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
1997A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Parties	Architect						6		2			13						
	Engineer							19	5			6	28					3
	Subcontractor	4	4		94	4	2	5	2	17	9			5		33	7	
	Contracting Officer									0			45		2			7
Work	**defect**			4	7	3	18		1			7	2					
	deficiency							1				2						
	repair			3		1	1			1				1				
	change							33		1		6	1					9
	- change order					1		4					4					
	- directive														3			
	- purchase							12										
	- replace						5							1		3		
	add			1			1			2				3		4		
	extra (work)							15	1		1							5
	delete							1		1		2						
	scope					4		38		1				4	3			
	complete			1	11	15	1	16		1	5		7	4	3		10	9
Cost	**cost**	1		8	5	4	3	5	4	3	1	2	3	5	2	3	3	4
	compensation		1		3	8		8		3				2		1	1	7
	expense		2		3	1	2							2			2	1
	overhead					2												
	Eichleay																	
	payment		1	1	16	11	0	33		16	6	3	6	16		22	5	2
	profit		3			2		4	1									
	increase				1	1		3									1	2
	equitable														2			1
	liquidated																	
	recover	3		12	8	11	0	7	1		4	3		3		23	1	5
	retainage				7	6				1							2	
	loss	3	5				1	4	1	2				2			2	
	bond				12	3				15				14		16	11	
	payment bond																	
	performance																	
	Surety				40	2				8		1		28		3	26	
	Miller Act					15				12				7		20		
	default		1			1	0			2							16	
	lien			1	1	2				25	33						1	
	quantum										7					2		
Schedule	**schedule**					11		17		1		1			20			5
	acceleration							31									1	
	delay			1	17	12	0	1			1	2	7					15
	extension				3	7	0	5			1	2	2	2	4	4	2	6
	suspension											1						4
	withhold			1	12					1				5				
	progress				1	1		1				2					1	1

Table A27 (D-8B). Dispute data in 1997: Part B.

Project	Contract																	
Risk	**breach**	1		12	12	5	2	2			3							3
	comply						0				1					1		
	damage	10	3	21	29	13	1	13	1	13		22					1	7
	dispute	1		3	6	4	0	5				4	12	5	2			5
	complaint										3	9		1		1		
	conflict					1	1	2						1	7			
	expert																	
	CDA												15					4
	duty	1		2		1	1			2		12			5			1
	failure		1	4	2	6	1	7	1	1	7	6	1					5
	force majeure																	
	notice															5		
	subsurface						2											3
	- differing																	1
	termination		1			1				4	1							
	Contract																	
	ambiguity			26				11	4		1	4		1	15			5
	clarify			23		1		4							2			
	error (-			15	1	2	2	4			1							1
	interpret			5		1	0	12	3			1	2	4	23	4		9
	omission			1				1										
	plans			1	1		6	11			1				3	1		11
	drawings							41			2	5	2		6			1
	specification		1		2		17	21				4			14			11
	Liability	1	1		7	2	2		2		1	17		9		1	1	2
	misconduct																	
	misrepresent	2	2					8				1						8
	mistake	2		1	1			1			1			1				
	negligent	1										5						
	warranty	1			2	7	21	1	2		1	1		1	1			4
	guarantee				2		0	20								2		
	fraud(ulent)		7			1		55					1	3				1
	faith - bad				5	37	1						7	13				1
	faith - good																	
SUM		31	33	147	311	210	97	482	31	133	91	144	145	143	117	149	94	169
										SUM		2527	AVG		148.65	SD		109.83

Table A28 (F-1A). Nor. average of disputes characteristics: Part-A.

		1984	1985	1986	1987	1994	1995	1996	1997	Sub-1980	Sub-1990	Total
	Cases	25	31	36	42	22	27	33	17	134	99	233
	Tatal Count	1804	3021	3196	4921	3206	2671	3912	2527	12942	12316	25258
	Avg. per Case	72.16	97.45	88.78	117.17	145.73	98.93	118.55	148.65	96.58	124.40	108.40
	St.Devi.	48.7739	79.439217	81.112307	89.552251	106.40944	91.411128	85.530364	109.83222			
	Norm. Avg.	1984	1985	1986	1987	1994	1995	1996	1997	Sub-1980	Sub-1990	Total
1	Architect	0.0127	0.0140	0.0145	0.0225	0.0018	0.0102	0.0026	0.0127	0.0159	0.0068	0.0114
2	Engineer	0.0229	0.0272	0.0222	0.0190	0.0072	0.0103	0.0096	0.0267	0.0228	0.0134	0.0181
3	Subcontractor	0.0486	0.0529	0.0304	0.0623	0.0407	0.0232	0.0415	0.0720	0.0486	0.0444	0.0465
4	Contracting Officer	0.0138	0.0046	0.0079	0.0256	0.0181	0.0164	0.0118	0.0217	0.0130	0.0170	0.0150
5	**defect**	0.0135	0.0117	0.0162	0.0059	0.0247	0.0112	0.0129	0.0202	0.0118	0.0173	0.0145
6	deficiency	0.0010	0.0028	0.0021	0.0019	0.0005	0.0008	0.0036	0.0009	0.0019	0.0015	0.0017
7	repair	0.0040	0.0051	0.0070	0.0022	0.0140	0.0095	0.0131	0.0029	0.0046	0.0099	0.0072
8	**change**	0.0351	0.0127	0.0175	0.0289	0.0130	0.0062	0.0189	0.0105	0.0236	0.0121	0.0179
9	- change order	0.0086	0.0011	0.0021	0.0068	0.0015	0.0102	0.0027	0.0024	0.0047	0.0042	0.0044
10	- directive	0.0000	0.0000	0.0000	0.0000	0.0006	0.0001	0.0000	0.0015	0.0000	0.0006	0.0003
11	- purchase	0.0014	0.0006	0.0030	0.0054	0.0009	0.0034	0.0113	0.0015	0.0026	0.0042	0.0034
12	- replace	0.0035	0.0158	0.0051	0.0067	0.0037	0.0025	0.0057	0.0046	0.0078	0.0041	0.0060
13	**add**	0.0000	0.0000	0.0240	0.0230	0.0063	0.0019	0.0005	0.0047	0.0117	0.0034	0.0076
14	extra	0.0034	0.0079	0.0077	0.0086	0.0045	0.0009	0.0148	0.0061	0.0069	0.0066	0.0067
15	**delete**	0.0002	0.0005	0.0001	0.0008	0.0007	0.0013	0.0001	0.0014	0.0004	0.0009	0.0006
16	**scope**	0.0079	0.0108	0.0168	0.0045	0.0029	0.0033	0.0102	0.0094	0.0100	0.0064	0.0082
17	**complete**	0.0234	0.0210	0.0240	0.0296	0.0248	0.0208	0.0289	0.0283	0.0245	0.0257	0.0251
18	**cost**	0.0379	0.0454	0.0416	0.0286	0.0417	0.0494	0.0387	0.0287	0.0383	0.0396	0.0390
19	compensation	0.0078	0.0054	0.0084	0.0079	0.0151	0.0100	0.0128	0.0112	0.0074	0.0123	0.0098
20	expense	0.0042	0.0067	0.0077	0.0081	0.0148	0.0073	0.0132	0.0080	0.0067	0.0108	0.0088
21	overhead	0.0092	0.0008	0.0069	0.0047	0.0151	0.0008	0.0057	0.0006	0.0054	0.0055	0.0055
22	Eichleay	0.0044	0.0000	0.0000	0.0012	0.0047	0.0000	0.0035	0.0000	0.0014	0.0021	0.0017
23	payment	0.0279	0.0462	0.0455	0.0574	0.0387	0.0321	0.0743	0.0460	0.0443	0.0478	0.0460
24	profit	0.0075	0.0052	0.0024	0.0074	0.0045	0.0013	0.0067	0.0083	0.0056	0.0052	0.0054
25	increase	0.0119	0.0021	0.0065	0.0086	0.0067	0.0085	0.0053	0.0022	0.0073	0.0057	0.0065
26	**equitable**	0.0123	0.0036	0.0034	0.0113	0.0041	0.0016	0.0066	0.0014	0.0077	0.0034	0.0056
27	liquidated	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
28	recover	0.0320	0.0301	0.0371	0.0263	0.0205	0.0177	0.0208	0.0343	0.0314	0.0233	0.0274
29	retainage	0.0023	0.0022	0.0005	0.0007	0.0012	0.0027	0.0017	0.0047	0.0014	0.0025	0.0020
30	loss	0.0135	0.0143	0.0121	0.0076	0.0160	0.0126	0.0171	0.0206	0.0119	0.0165	0.0142
31	**bond**	0.0269	0.0313	0.0797	0.0383	0.0399	0.0349	0.0417	0.0287	0.0440	0.0363	0.0402
32	payment bond	0.0000	0.0000	0.0000	0.0000	0.0000	0.0090	0.0000	0.0000	0.0000	0.0022	0.0011
33	performance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0014	0.0007
34	Surety	0.0139	0.0235	0.0280	0.0257	0.0166	0.0232	0.0246	0.0410	0.0227	0.0264	0.0245
35	Miller Act	0.0173	0.0063	0.0184	0.0441	0.0048	0.0656	0.0098	0.0203	0.0215	0.0251	0.0233
36	**default**	0.0042	0.0176	0.0086	0.0207	0.0226	0.0036	0.0137	0.0130	0.0128	0.0132	0.0130

Table A29 (F-1B). Nor. average of disputes characteristics: Part-B.

37	**lien**	0.0012	0.0024	0.0137	0.0035	0.0102	0.0086	0.0209	0.0342	0.0052	0.0185	0.0118
38	**quantum**	0.0030	0.0055	0.0000	0.0027	0.0014	0.0000	0.0002	0.0053	0.0028	0.0017	0.0023
39	**schedule**	0.0045	0.0058	0.0057	0.0066	0.0097	0.0066	0.0093	0.0178	0.0057	0.0108	0.0082
40	acceleration	0.0000	0.0000	0.0000	0.0027	0.0028	0.0007	0.0004	0.0044	0.0007	0.0021	0.0014
41	delay	0.0527	0.0286	0.0093	0.0209	0.0591	0.0141	0.0327	0.0166	0.0279	0.0306	0.0293
42	extension	0.0241	0.0185	0.0246	0.0205	0.0049	0.0080	0.0263	0.0132	0.0219	0.0131	0.0175
43	suspension	0.0053	0.0018	0.0009	0.0099	0.0004	0.0000	0.0053	0.0018	0.0045	0.0019	0.0032
44	withhold	0.0070	0.0008	0.0021	0.0013	0.0006	0.0010	0.0028	0.0052	0.0028	0.0024	0.0026
45	**progress**	0.0067	0.0052	0.0057	0.0074	0.0098	0.0020	0.0080	0.0024	0.0063	0.0056	0.0059
46	**Contract**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
47	**breach**	0.0194	0.0429	0.0291	0.0171	0.0393	0.0361	0.0207	0.0148	0.0271	0.0277	0.0274
48	comply	0.0012	0.0073	0.0031	0.0050	0.0117	0.0055	0.0042	0.0010	0.0042	0.0056	0.0049
49	**damage**	0.0751	0.0586	0.0483	0.0384	0.0689	0.0503	0.0733	0.0637	0.0551	0.0641	0.0596
50	**dispute**	0.0720	0.0524	0.0591	0.0439	0.0313	0.0579	0.0384	0.0173	0.0569	0.0362	0.0465
51	complaint	0.0132	0.0598	0.0154	0.0199	0.0226	0.0386	0.0237	0.0064	0.0271	0.0228	0.0250
52	conflict	0.0071	0.0049	0.0087	0.0069	0.0030	0.0183	0.0055	0.0051	0.0069	0.0080	0.0074
53	expert	0.0000	0.0000	0.0041	0.0005	0.0000	0.0000	0.0082	0.0000	0.0011	0.0021	0.0016
54	**CDA**	0.0020	0.0049	0.0000	0.0054	0.0325	0.0185	0.0037	0.0075	0.0031	0.0155	0.0093
55	**duty**	0.0163	0.0207	0.0103	0.0172	0.0163	0.0200	0.0188	0.0122	0.0161	0.0168	0.0165
56	**failure**	0.0343	0.0281	0.0202	0.0130	0.0181	0.0209	0.0167	0.0184	0.0239	0.0185	0.0212
57	**force majeure**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0002	0.0001
58	**notice**	0.0000	0.0009	0.0003	0.0008	0.0002	0.0006	0.0009	0.0020	0.0005	0.0009	0.0007
59	**subsurface**	0.0052	0.0000	0.0011	0.0040	0.0036	0.0005	0.0026	0.0023	0.0026	0.0022	0.0024
60	- differing	0.0000	0.0004	0.0000	0.0009	0.0040	0.0026	0.0004	0.0003	0.0003	0.0018	0.0011
61	**termination**	0.0029	0.0075	0.0055	0.0238	0.0061	0.0236	0.0385	0.0045	0.0099	0.0182	0.0140
62	**Contract**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
63	ambiguity	0.0042	0.0065	0.0037	0.0151	0.0365	0.0119	0.0067	0.0313	0.0074	0.0216	0.0145
64	clarify	0.0072	0.0067	0.0021	0.0012	0.0086	0.0167	0.0027	0.0110	0.0043	0.0097	0.0070
65	error (-	0.0339	0.0233	0.0369	0.0092	0.0112	0.0168	0.0217	0.0094	0.0259	0.0148	0.0203
66	interpret	0.0141	0.0278	0.0294	0.0305	0.0207	0.0393	0.0293	0.0286	0.0255	0.0295	0.0275
67	omission	0.0069	0.0004	0.0039	0.0009	0.0039	0.0034	0.0042	0.0005	0.0030	0.0030	0.0030
68	**plans**	0.0256	0.0279	0.0289	0.0116	0.0123	0.0077	0.0109	0.0119	0.0235	0.0107	0.0171
69	drawings	0.0263	0.0054	0.0170	0.0055	0.0043	0.0035	0.0030	0.0125	0.0135	0.0058	0.0097
70	**specification**	0.0194	0.0254	0.0265	0.0272	0.0260	0.0161	0.0034	0.0275	0.0246	0.0183	0.0214
71	**Liability**	0.0085	0.0210	0.0197	0.0253	0.0228	0.0217	0.0195	0.0236	0.0187	0.0219	0.0203
72	misconduct	0.0000	0.0002	0.0017	0.0004	0.0000	0.0002	0.0004	0.0000	0.0006	0.0001	0.0004
73	misrepresent	0.0037	0.0059	0.0035	0.0015	0.0035	0.0045	0.0049	0.0115	0.0036	0.0061	0.0049
74	mistake	0.0039	0.0022	0.0115	0.0039	0.0053	0.0019	0.0067	0.0056	0.0054	0.0049	0.0051
75	negligent	0.0043	0.0060	0.0036	0.0022	0.0049	0.0042	0.0047	0.0039	0.0040	0.0044	0.0042
76	**warranty**	0.0238	0.0189	0.0027	0.0052	0.0114	0.0262	0.0127	0.0243	0.0127	0.0186	0.0157
77	guarantee	0.0035	0.0079	0.0120	0.0031	0.0053	0.0089	0.0029	0.0036	0.0066	0.0052	0.0059
78	**fraud(ulent)**	0.0177	0.0220	0.0160	0.0229	0.0139	0.0397	0.0065	0.0215	0.0197	0.0204	0.0200
79	faith - bad	0.0105	0.0060	0.0060	0.0096	0.0198	0.0249	0.0130	0.0205	0.0080	0.0195	0.0138
80	faith - good	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table A30 (L-1A). Dispute cases list in 1984: Part-A.

1984A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1984	725 F.2d 650	11th C.	Fl.	Reverse, remand		UNITED STATES of America for the Use and Benefit of AETNA DRYWALL CONTRACTORS, INC., a Florida Corporation, Plaintiff-Appellant, v. AETNA CASUALTY AND SURETY COMPANY, a Connecticut Corporation, et al., Defendants-
2	1984	726 F.2d 149	8th C.	Mn.	Affirm		The County of Hennepin, a body politic and corporate in the State of Minnesota, Appellant Cross-Appellee, and Alpana Aluminum Products, Inc. and Midwest Industries, Inc., a joint venture, Appellee Cross-Appellant, v. AFG Industries, Inc.,
3	1984	728 F.2d 444	10th C.	Oklahoma	Affirmed.		UNITED STATES OF AMERICA, Plaintiff-Appellee, v. METROPOLITAN ENTERPRISES, INC., and DANIEL P. KAVANAUGH, Defendants-Appellants
4	1984	728 F.2d 682	5th C.	Texas	Affirmed.		UNITED STATES of America, Plaintiff-Appellee, v. YOUNG BROTHERS, INC., Contractors, Defendant-Appellant
5	1984	729 F.2d 334	5th C.	Texas	Affirmed		COMMERCE PARK AT DFW FREEPORT, Plaintiff-Appellant, v. MARDIAN CONSTRUCTION COMPANY, Defendant-Appellee
6	1984	729 F.2d 743	Fed. C.	GSBCA	AFFIRMED IN PART; REVERSED IN PART; AND REMANDED.	CONCUR	CAPITAL ELECTRIC COMPANY, Appellant, v. THE UNITED STATES, Appellee
7	1984	731 F.2d 810	Fed Cir	DOEBCA	Affirmed		ERICKSON AIR CRANE COMPANY OF WASHINGTON, INC., * Appellant, v. THE UNITED STATES, Appellee
8	1984	731 F.2d 183	4th C.	VA	Affirmed		G & C Construction Corp., Appellant, v. St. Paul Fire and Marine Insurance Co., Appellee
9	1984	731 F.2d 805	Fed. Cir.	GSBCA	Vacated and remanded.		WILLIAM F. KLINGENSMITH, INC., Appellant, v. UNITED STATES, Appellee
10	1984	732 F.2d 913	Fed. Cir.	Claims cou	Affirmed (but partially different reasons)		P.J. MAFFEI BUILDING WRECKING CORPORATION, Appellant, v. THE UNITED STATES, Appellee
11	1984	735 F.2d 433	11th C.	GA	VACATED and REMANDED.		James R. FRENCH, Plaintiff-Appellant, v. JINRIGHT & RYAN, P.C. ARCHITECTS, Defendant-Appellee
12	1984	735 F.2d 437	11th C.	GA	Affirmed		CECIL'S, INCORPORATED, Plaintiff-Appellee, v. MORRIS MECHANICAL ENTERPRISES, INC., and Transamerica Insurance Company, Defendants-Appellants
13	1984	736 F.2d 1007	5th C.	Mississippi	Affirm , in favor of Sub	DISSENT	AFFHOLDER, INC., a Missouri corporation, Plaintiff-Appellee, v. SOUTHERN ROCK, INC., a Mississippi corporation, Defendant-Appellant
14	1984	739 F.2d 1287	7th C.	Ill	Affirmed		JOHN V. ARVANIS, d/b/a, INDUSTRIAL CONTRACTORS, Plaintiff-Appellant, v. NOSLO ENGINEERING CONSULTANTS, INC., NOSLO ENGINEERING CORPORATION, and the UNITED STATES OF AMERICA, Defendants-Appellees;

Table A31 (L-1B). Dispute cases list in 1984: Part-B.

15	1984	741 F.2d 730	5th C.	Texas	Affirmed		UNITED STATES of America, Plaintiff-Appellee, v. BI-CO PAVERS, INC., Defendant-Appellant
16	1984	741 F.2d 675	3rd C.	Penn.	Affirmed		COCO BROTHERS, INC., Appellant v. SAMUEL PIERCE, Secretary of U.S. Department of Housing and Urban Development, and the ALLEGHENY COUNTY HOUSING AUTHORITY, Appellees
17	1984	742 F.2d 811	4th C.	NC	Affirmed		County of Durham, Appellant, v. Richards & Associates, Inc., Appellee
18	1984	742 F.2d 965	6th C.	Michigan	Affirmed		JOHN E. GREEN PLUMBING AND HEATING COMPANY, INC., Plaintiff-Appellant, v. TURNER CONSTRUCTION COMPANY, Defendant-Appellee
19	1984	742 F.2d 274	6th C.	Tenn	Affirmed (Motion granted)		EXCHANGE MUTUAL INSURANCE COMPANY, Plaintiff-Appellant, v. THE HASKELL COMPANY, Defendant-Appellee, ROGERSVILLE PAVING COMPANY, INC., JOHN MACK PIERCE, MACK SLAUGHTER, Defendants
20	1984	743 F.2d 1519	11th C.	Fl.	Reversed and remanded for further proceedings		AMERICAN MANUFACTURERS MUTUAL INSURANCE COMPANY, Plaintiff-Appellant, v. EDWARD D. STONE, JR. & ASSOC., Defendant-Appellee
21	1984	745 F.2d 595	9th C.	Washingtor	AFFIRMED in part, REVERSED in part and REMANDED.		UNITED STATES OF AMERICA for the use of MORGAN & SON EARTH MOVING, INC., a Washington Corporation, Plaintiff-Appellee, v. TIMBERLAND PAVING & CONSTRUCTION COMPANY, a Washington Corporation, and AMERICAN
22	1984	745 F.2d 34	Fed. Cir.	ASBCA	affirm in part and reverse in part.	DISSENT	RECON PAVING, INC., Appellant v. THE UNITED STATES, Appellee
23	1984	746 F.2d 1166	6th C.	Ohio	Reversed	CONCUR	DUGAN & MEYERS CONSTRUCTION CO., INC. and THE GOETTLE CO., Plaintiffs-Appellees, v. WORTHINGTON PUMP CORPORATION (USA), Defendant-Appellant
24	1984	748 F.2d 573	11th C.	Ala	Affirmed		RUBY-COLLINS, INC., Plaintiff-Appellee, v. CITY OF HUNTSVILLE, ALABAMA, Defendant-Appellant
25	1984	750 F.2d 759	9th C.	Hawaii	Affirmed (the summary judgement)		UNITED STATES OF AMERICA, for the use and benefit of MARTIN STEEL CONSTRUCTORS, INC., Plaintiff-Appellees, v. AVANTI CONSTRUCTORS, INC., Defendant, and HARVIS CONSTRUCTION, INC., SEABOARD SURETY COMPANY,

Table A32 (L-2A). Dispute cases list in 1985: Part-A.

1985A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1985	750 F.2d 1492	11th C.	GA	AFFIRMED IN PART, REVERSED IN PART and REMANDED.		ROUSE CONSTRUCTION, INC., Plaintiff-Appellee, v. TRANSAMERICA INSURANCE COMPANY, Defendant-Appellant
2	1985	754 F.2d 847	9th C.	Nevada	Affirmed		HOWARD ELECTRICAL AND MECHANICAL COMPANY, INC., a Colorado Corporation, Plaintiff-Appellee, v. FRANK BRISCOE COMPANY, INC., a New Jersey Corporation, et al., Defendants-Appellants
3	1985	755 F.2d 1264	6th C.	Kentucky	AFFIRMED		J.I. HASS COMPANY, INC., and SEABOARD SURETY COMPANY, Plaintiffs-Appellees, Cross-Appellants, v. JONES-TEER, a joint venture of J. A. JONES CONSTRUCTION CO., and NELLO L. TEER CO., Defendants-Appellants, Cross-
4	1985	757 F.2d 1273	Fed. Cir.	Claims C.	AFFIRMED.		JOSEPH MORTON CO., INC., Appellant/Cross-Appellee, v. THE UNITED STATES, Appellee/Cross-Appellant
5	1985	758 F.2d 266	8th C.	Missouri	AFFIRMED.		R.W. Murray, Company, The Citadel, Ltd., Robert Kresko, Harlan R. Crow, George A. Shutt, Appellees/Cross-Appellants, v. Shatterproof Glass Corporation, Appellant/Cross-Appellee
6	1985	759 F.2d 253	2nd C.	NY	Vacated and Remanded		UNITED STATES OF AMERICA for Use of N. MALTESE AND SONS, INC., Plaintiff-Appellant, Cross Appellee v. JUNO CONSTRUCTION CORP. and INSURANCE COMPANY OF NORTH AMERICA, Defendants-Appellees, Cross
7	1985	760 F.2d 1288	Fed. C.	ASBCA	Affirmed		FORTEC CONSTRUCTORS, Appellant v. THE UNITED STATES, Appellee
8	1985	760 F.2d 58	3rd C.	Penn	Remanded	DISSENT	COST BROTHERS, INC. v. THE TRAVELERS INDEMNITY COMPANY, Appellant
9	1985	760 F.2d 74	3rd C.	Penn.	Reversed and Remanded		NICHOLSON CONSTRUCTION COMPANY, Appellee, v. THE STANDARD FIRE INSURANCE COMPANY, THE GENERAL REINSURANCE CORPORATION, NORTH AMERICAN REINSURANCE CORPORATION, THE REINSURANCE
10	1985	761 F.2d 1218	7th. C.	Ill.	Remanded		ADAMS LABORATORIES, INC., Plaintiff-Appellee, Cross-Appellant, v. JACOBS ENGINEERING CO., INC., Defendant-Appellant, Cross-Appellee
11	1985	762 F.2d 1192	4th C.	VA	Affirmed		Bryant Electric Company, Inc., Appellant v. City of Fredericksburg and Malcolm Pirnie, Inc., Appellees
12	1985	764 F.2d 619	9th C.	Guam	Reverse and Remand		ELECTRICAL CONSTRUCTION & MAINTENANCE COMPANY, INC., Plaintiff-Appellant, v. MAEDA PACIFIC CORPORATION, Defendant-Appellee
13	1985	764 F.2d 707	9th C.	Cal.	AFFIRMED.		UNITED STATES for the use and benefit of TYRONE E. DELOSS dba T.E. DELOSS EQUIPMENT RENTALS, Plaintiff-Appellant, v. KENNER GENERAL CONTRACTORS, INC. and UNIVERSAL SURETY COMPANY, Defendants-
14	1985	765 F.2d 16	2nd C.	Conn.	Affirmed.		UNITED STATES OF AMERICA, Appellee, v. TOWN OF WINDSOR, CONNECTICUT; and JERRY J. COLUMBUS, Building Inspector and Zoning Enforcement Officer of the Town of Windsor and his successors in office,
15	1985	762 F.2d 1292	5th C.	Louisiana	Reverse.		B & G CRANE SERVICE, INC., Plaintiff-Appellee v. DOLPHIN TITAN INTERNATIONAL, INC., Defendant-Appellant

Table A33 (L-2B). Dispute cases list in 1985: Part-B.

16	1985	767 F.2d 457	8th C.	Nebraska	Affirmed		The City of Omaha, a municipal corporation; Board of the Omaha Public Library, a Public Body, and City of Omaha Library Facilities Corporation, a Non-Profit Corporation, Appellants, v. Hellmuth, Obata and Kassabaum, Inc., Appellee
17	1985	767 F.2d 810	11th C.	Fl.	Affirmed.		TRIZEC PROPERTIES, INC., d/b/a Clearwater Mall Co., Plaintiff, v. BILTMORE CONSTRUCTION CO., INC., et al., Defendants, and DECKS, INC., OF FLORIDA, Defendant-Third-Party Plaintiff-Appellee, v. The HOME INDEMNITY CO., et al.,
18	1985	769 F.2d 84	2nd C.	NY	Reversed.	DISSENT	DORIS J. BRITT, ROBERT F. and MAJORIE L. GASCON, CARL E. and THELMA V. SCHENK, RYAL and ALICE DEVOIST, GILBERT KNAPP, NAN MOODY, MEDICAB OF ROCHESTER, INC., VIC & IRV'S REFRESHMENT, INC., d/b/a
19	1985	769 F.2d 1114	6th C.	Tenn.	AFFIRM	CONCUR	MASSMAN CONSTRUCTION CO., Plaintiff-Appellant, v. TENNESSEE VALLEY AUTHORITY, Defendant-Appellee
20	1985	770 F.2d 862	9th C.	Cal.	Reversed and Remanded		UNITED STATES OF AMERICA, for the use of SAN JOAQUIN BLOCKLITE, a California Corporation, Plaintiff-Appellant, v. LLOYD E. TULL, INC., EL CAMINO CONSTRUCTION COMPANY, and THE OHIO CASUALTY INSURANCE
21	1985	771 F.2d 579	1st C.	Mass.	Affirmed		LIBERTY MUTUAL INSURANCE CO., Plaintiff, Appellant, v. CONTINENTAL CASUALTY CO., Defendant, Appellee; LIBERTY MUTUAL INSURANCE CO., Plaintiff, Appellee, v. CONTINENTAL CASUALTY CO., Defendant, Appellant
22	1985	772 F.2d 78	4th C.	VA	REVERSED AND REMANDED.		Henry A. Knott Company, Division of Knott Industries, Inc., a Maryland corporation, Appellant, v. The Chesapeake and Potomac Telephone Company of West Virginia, A West Virginia corporation, Appellee
23	1985	773 F.2d 633	5th C.	Louisiana	Vacated and Remanded		MAR-LEN OF LOUISIANA, INC., Plaintiff-Appellee, v. PARSONS-GILBANE, a Joint Venture, Defendant-Appellant
24	1985	775 F.2d 1572	11th C.	Fl.	REVERSED		Richard MILLER, Petitioner-Appellant, v. C.L. NORVELL, Sheriff, St. Lucie County Jail, Dr. Barbara Greadington, Commissioner, FPPC and Louie L. Wainwright, Respondents-Appellees
25	1985	775 F.2d 781	7th C.	Ill.	Affirmed and Remanded	CONCUR, DISSENT	THE WALDINGER CORPORATION, Plaintiff-Appellee v. CRS GROUP ENGINEERS, INC., CLARK DIETZ DIVISION, Defendant-Appellant; THE WALDINGER CORPORATION, Plaintiff-Appellant v. ASHBROOK-SIMON-
26	1985	775 F.2d 1202	4th C.	SC	Affirmed in Part and Reversed and Remanded in Part		W. F. Magann Corporation, a Virginia Corporation, Appellant, v. Diamond Manufacturing Company, Inc., d/b/a Marine Constructors, a Georgia Corporation and Aetna Casualty and Surety Company, A Connecticut Corporation, Appellees,
27	1985	775 F.2d 1158	Fed. C.	Claims C.	Vacate and Remanded		BALBOA INSURANCE COMPANY, Appellant v. THE UNITED STATES, Appellee
28	1985	776 F.2d 1414	9th C.	Nevada	Dismissed		FRANK BRISCOE COMPANY, INC., a corporation, Plaintiff-Appellant, v. MORRISON-KNUDSEN COMPANY, INC., a corporation, et al., Defendants-Appellees
29	1985	776 F.2d 198	7th C.	Ill.	Remanded		CHICAGO COLLEGE OF OSTEOPATHIC MEDICINE, Plaintiff, v. GEORGE A. FULLER COMPANY, Defendant-Appellant, Cross-Appellee, and ED HOFFMAN EXCAVATING, INC., Cross-Claimant-Appellee, Cross-Appellant
30	1985	778 F.2d 196	4th C.	Maryland	AFFIRMED.		Coakley and Williams, Inc., a Maryland corporation; Neil T. Coakley; Geraldine L. Coakley; Fred G. Williams; Jean Williams, Appellants, v. Shatterproof Glass Corporation, a Delaware corporation, Appellee and Washington Plate Glass Co.,
31	1985	779 F.2d 974	4th C.	VA.	VACATED AND REMANDED WITH INSTRUCTIONS		Maxum Foundations, Inc., Appellee, v. Salus Corporation and United Pacific Insurance Company, Appellants, and 8201 Corporation, Third-party Defendant; Maxum Foundations, Inc., Appellant, v. Salus Corporation and United Pacific

Table A34 (L-3A). Dispute cases list in 1986: Part-A.

1986A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1986	783 F.2d 1157	4th C.	N.C.	Affirmed		United States of America, Appellee, v. W. F. Brinkley & Son Construction Company, Inc. and William F. Brinkley, Jr., Appellants
2	1986	785 F.2d 1123	3rd C.	Penn	Reversed	CONCUR, DISSENT	UNITED STATES OF AMERICA, Appellant, v. SARGENT ELECTRIC CO., LORD ELECTRIC CO., INC., W.V. PANGBORNE AND CO., INC., J.A. BRUCE PINNEY
3	1986	785 F.2d 1154	4th C.	Maryland	Affirmed in part, reversed in part and remanded.		Friendship Heights Associates, and Illinois Joint Venture, c/o First Condominium Development Co., Appellants, v. Vlastimil Koubek, A.I.A., Tnemec Company, Inc., A Missouri Corporation, Appellees; Friendship Heights Associates, an Illinois Joint
4	1986	785 F.2d 468	4th C.	Virginia	Affirmed		United States for the Use of Sunbelt Pipe Corporation, Appellant, v. United States Fidelity and Guaranty Company; American Manufacturers Mutual Insurance Company, Appellees, and Lumbermens Mutual Casualty Company, Defendant
5	1986	786 F.2d 1275	5th C.	Texas	AFFIRMED IN PART, REVERSED IN PART, AND REMANDED FOR ENTRY OF MODIFIED JUDGMENT		MARTHA WRIGHT, Independent Executrix of the Estate of E.J. Wright, Plaintiff, v. DEL E. WEBB CORPORATION, Defendant-Third Party Plaintiff-Appellee, v. DFW REGIONAL AIRPORT BOARD, Third Party Defendant-Appellant
6	1986	786 F.2d 1386	9th C.	Arizona	AFFIRMED.		UNITED STATES OF AMERICA, Plaintiff/Appellant, v. LEMBKE CONSTRUCTION
7	1986	786 F.2d 22	1st C.	Mass.-IMPei_B	Reversed and Remanded		AMERICAN HOME ASSURANCE CO., Plaintiff, Appellee, v. LIBBEY-OWENS-FORD CO., Defendant, Appellant; AMERICAN HOME ASSURANCE CO., Plaintiff, Appellant, v. LIBBEY-OWENS-FORD CO., Defendant, Appellee
8	1986	789 F.2d 809	10th C.	Oklahoma	Affirmed		UNITED STATES OF AMERICA, Plaintiff-Appellee, v. WASHITA CONSTRUCTION COMPANY, and BILLY RAY ANTHONY, Defendants-Appellants
9	1986	790 F.2d 852	11th C.	GA	Affirmed		AUGUSTA IRON & STEEL WORKS, INC., Plaintiff-Appellant, v. UNITED STATES FIDELITY & GUARANTY COMPANY, Defendant-Appellee and Third Party Plaintiff, v. Warren E. QUARLES, Sr., et al., Third Party Defendants
10	1986	790 F.2d 41	7th C.	Ill.	Affirmed		CONCRETE STRUCTURES OF THE MIDWEST, INC., a Corporation, Plaintiff-Appellant, v. FIREMAN'S INSURANCE COMPANY OF NEWARK, NEW JERSEY, a Corporation, Defendant-Appellee
11	1986	791 F.2d 1334	9th C.	Cal.	Affirmed.		LAFARGE CONSEILS ET ETUDES, S.A. Plaintiff v. KAISER CEMENT & GYPSUM CORP., Defendant-Counterclaimant/Appellant, v. THE HOWARD P. FOLEY COMPANY, Counterdefendant/Appellee
12	1986	793 F.2d 767	6th C.	Tenn.	REVERSED and REMANDED		INRYCO, INC., Plaintiff-Appellee, v. EATHERLY CONSTRUCTION COMPANY and SAFECO INSURANCE COMPANY OF AMERICA, Defendants-Appellants
13	1986	794 F.2d 669	Fed. C.	GSA BCA	Affirmed		BROMLEY CONTRACTING COMPANY, INC., Appellant, v. THE UNITED STATES, Appellee
14	1986	795 F.2d 980	11th C.	GA	REVERSED and REMANDED		GULF CONTRACTING, Plaintiff-Cross Claim Appellant, v. BIBB COUNTY, Defendant-Third Party Plaintiff, Dore Wrecking Company and Reliance Insurance, Third Party Defendants-Cross Claim Defendants-Appellees. GULF CONTRACTING,
15	1986	795 F.2d 404	5th C.	Louisiana	VACATED and REMANDED		UNITED STATES OF AMERICA For the Use and Benefit of BALBOA INSURANCE COMPANY, Assignee, Plaintiff-Appellant, v. ALGERNON BLAIR, INC., et al., Defendants-Appellees
16	1986	795 F.2d 372	4th C.	S.C.	AFFIRMED		Tom Frost d/b/a Monroe Heating and Air Conditioning Company and Southern Scale and Refrigerator Company, Inc., Appellees, v. Williams Mobile Offices, Inc., and Fireman's Fund Insurance Company, Appellants

Table A35 (L-3B). Dispute cases list in 1986: Part-B.

17	1986	796 F.2d 133	5th C.	Louisiana	Dismissed?		T & R DRAGLINE SERVICE, INC., Plaintiff-Appellant, v. CNA INSURANCE COMPANY, Defendant-Appellee
18	1986	796 F.2d 657	3rd C.	N.J.	Affirmed	DISSENT	JOHN F. HARKINS COMPANY, INC. v. THE WALDINGER CORPORATION, Appellant
19	1986	797 F.2d 1298	5th C.	Missi.	AFFIRMED.		BAGWELL COATINGS, INC., Plaintiff-Appellee, Cross-Appellant, v. MIDDLE SOUTH ENERGY, INC., ET AL., Defendants-Appellants, Cross-Appellees
20	1986	797 F.2d 1041	D.C. C.	D.C.	AFFIRMED.		DISTRICT OF COLUMBIA, EX REL. AMERICAN COMBUSTION, INC. v. TRANSAMERICA INSURANCE COMPANY, Appellant
21	1986	797 F.2d 668	8th C.	S. Dakota	AFFIRMED.		Weeks Construction, Inc., Appellant, v. Oglala Sioux Housing Authority, United States of America, and Department of Housing and Urban Development, Appellees
22	1986	797 F.2d 565	9th C.	Arkansas	AFFIRMED.		Arkansas Rice Growers Cooperative Association, a corporation, d/b/a Riceland Foods, Appellees, v. Alchemy Industries, Inc.; Norman Pitt, Inc.; Sol Balkin; Janelle Balkin; Seymour DiMatoff; Eleanor DiMatoff; Robert Kahan; Dorothy E.
23	1986	797 F.2d 651	8th C.	Nebraska	?		School District No. 11 a/k/a South Sioux City Schools, Dakota County, Nebraska, Plaintiff-Appellee, v. Sverdrup & Parcel and Associates, Inc., Defendant-Appellant
24	1986	797 F.2d 1377-3	6th C.	Kentucky	AFFIRMED and the case is REMANDED		IN RE GRAND JURY PROCEEDINGS
25	1986	800 F.2d 1321	4th C.	VA	REMANDED		U.S. For the Use of Belcon, Incorporated, Appellant, v. Sherman Construction Company and Seaboard Surety Co., Appellees, v. Lester Belcher, Jr., and Lester Belcher, III, Third-Party Defendants; U.S. For the Use of Belcon, Incorporated,
26	1986	800 F.2d 325	2nd C.	N.Y.	Reversed		BETHLEHEM CONTRACTING COMPANY, a Corporation of the Commonwealth of Pennsylvania, Plaintiff-Appellant, v. LEHRER/McGOVERN, INC., a Corporation of the State of New York, LEHRER/McGOVERN, INC., as Agent for TIMKO
27	1986	800 F.2d 1256	4th C.	VA.	AFFIRMED AND REMANDED WITH INSTRUCTIONS		Square Construction Co. and La Fera Contracting Co., a joint venture, Appellants, v. Washington Metropolitan Area Transit Authority, Appellee, v. Maryland Casualty Co.; General Reinsurance Corp.; American Re-Insurance Corp.; Employers
28	1986	800 F.2d 617	6th C.	Michigan	AFFIRMED		CAPITOL REPRODUCTION, INC., a Michigan corporation, and CAPITOL AIR SURVEYS, INC., a Division of CAPITOL REPRODUCTIONS, INC., Plaintiffs-Appellees v. HARTFORD INSURANCE COMPANY, Defendant-Appellant
29	1986	800 F.2d 339	3rd C.	Penn.	?	DISSENT	BANK OF AMERICA NATIONAL TRUST AND SAVINGS ASSOCIATION, a national banking association v. HOTEL RITTENHOUSE ASSOCIATES, a Pennsylvania limited partnership, JACK L. WOLGIN, JACK L. WOLGIN
30	1986	801 F.2d 748	5th C.	Texas	Reverse		MIDWEST MECHANICAL CONTRACTORS, INC., Plaintiff-Appellee, v. COMMONWEALTH CONSTRUCTION CO., et al., Defendants-Appellants
31	1986	801 F.2d 379	Fed. C.	VABCA	Affirmed		SANTA FE ENGINEERS, INC., Appellant, v. THE UNITED STATES, Appellee
32	1986	802 F.2d 1164-1	9th C.	Arizona	AFFIRMED		UNITED STATES OF AMERICA for the use of YOUNGSTOWN WELDING AND ENGINEERING COMPANY, a corporation, Plaintiffs/Appellees/Cross/Appellants, v. THE TRAVELERS INDEMNITY COMPANY, a corporation, and A.S.C.
33	1986	803 F.2d 701	Fed. C.	VABCA	AFFIRMED		EDWARD R. MARDEN CORPORATION, Appellant, v. UNITED STATES, Appellee
34	1986	805 F.2d 1229-1	5th C.	Texas	Remand		FALCON CONSTRUCTION COMPANY, Plaintiff-Cross-Defendant-Appellant, v. ECONOMY FORMS CORPORATION, Defendant-Cross-Plaintiff-Appellee
35	1986	807 F.2d 979-1	Fed. C.	ASBCA	Affirmed		ZINGER CONSTRUCTION CO., INC., Appellant, v. THE UNITED STATES, Appellee
36	1986	808 F.2d 712-2	10th C.	Oklahoma	REVERSED.		HYDRO CONDUIT CORPORATION, Plaintiff-Appellant, v. AMERICAN-FIRST TITLE & TRUST COMPANY, HUDIBURG INVESTMENTS, INC., WOOD & SONS PAVING, INC., MALES BROTHERS PAVING, INC., and THE OHIO CASUALTY

Table A36 (L-4A). Dispute cases list in 1987: Part-A.

1987A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1987	809 F.2d 1175	5th C.	Texas	AFFIRMED IN PART, REVERSED IN PART, AND REMANDED.		MOBIL CHEMICAL COMPANY, Plaintiff-Appellee Cross-Appellant, v. BLOUNT BROTHERS CORPORATION, Defendant-Appellant Cross-Appellee, v. SAUER
2	1987	810 F.2d 1153	Fed. C.	ASBCA	AFFIRMED.		LIEBHERR CRANE CORPORATION, Appellant, v. THE UNITED STATES, Appellee
3	1987	810 F.2d 1139	Fed. C.	DOABCA	AFFIRMED.		J.B. STEEL, INC., Appellant, v. THE UNITED STATES, Appellee
4	1987	811 F.2d 1422	11th C.	GA	AFFIRMED in part, MODIFIED in part and REVERSED in part.		Lewis J. McDERMOTT, III and Criterion Mills, Inc., Plaintiffs-Appellants, v. MIDDLE EAST CARPET COMPANY, ASSOCIATED, Defendant-Appellee
5	1987	811 F.2d 593	Fed. C.	ASBCA	REVERSED AND REMANDED.		DARWIN CONSTRUCTION CO., INC., Appellant, v. UNITED STATES, Appellee
6	1987	811 F.2d 747	2nd C.	N.Y.	Reversed in part and remanded for further proceedings		ACTIVE FIRE SPRINKLER CORP., Plaintiff-Appellant, v. THE UNITED STATES POSTAL SERVICE and JOHN T. BRADY and COMPANY, Defendants-Appellees
7	1987	812 F.2d 237	5th C.	Louisiana	? - We certify the following questions to the Louisiana Supreme Court: MOTION TO		Pacific Lining Co., Inc., Plaintiff-Appellee, Cross-Appellant, v. Algernon-Blair Construction Co. and United States Fidelity & Guaranty Co., Defendants-Appellants, Cross-Appellees,
8	1987	812 F.2d 1387	Fed.C.	Claims C.	AFFIRMED		MINGUS CONSTRUCTORS, INC., Appellant, v. THE UNITED STATES, Appellee
9	1987	813 F.2d 697	5th C.	Texas	Vacated, and the action is remanded		United States of America for the Use of Texas Bitulithic Company, A Division of Apac-Texas, Inc., Plaintiff-Appellant, v. Fidelity and Deposit Company of Maryland and Gulf-Tex
10	1987	814 F.2d 1011	5th C.	Texas	AFFIRMED IN PART, REVERSED IN PART, AND REMANDED.		United States of America for the Use of M-CO Construction, Inc., Plaintiff-Appellee, v. Shipco General, Inc., Defendant-Appellant
11	1987	814 F.2d 193	5th C.	Missi.	AFFIRMED in part, REVERSED in part, REVERSED and REMANDED.		United States of America for the Use and Benefit of Control Systems, Inc., Plaintiff-Appellee, v. Arundel Corporation, et al., Defendants-Cross Defendants-Appellants, Cross-
12	1987	815 F.2d 885	2nd C.	N.Y.	Affirmed.		Irving Widett, Co-Assignee for the Benefit of Creditors of B.W. Construction Co., Inc., Plaintiff-Appellant, v. United States Fidelity and Guaranty Company, Reimann-Buechner
13	1987	816 F.2d 753	D.C.C.	D.C.	Affirmed-We reject the parties' contentions and affirm the district court in all respects.		George Hyman Construction Company, Appellant v. Washington Metropolitan Area Transit Authority, et al.; George Hyman Construction Company v. Washington Metropolitan Area
14	1987	817 F.2d 1188	5th C.	Texas	Affirmed and remanded for determination of prejudgment interest.		United States of America, for the Use and Benefit of J. R. Canion, et al., Plaintiffs, and Odell Geer Construction Co., Inc., Intervening Plaintiff-Appellee, v. Randall & Blake, and
15	1987	817 F.2d 94	11th C.	GA	Reversed and remanded with direction		T.S.I., Inc., Plaintiff-Appellee, Cross-Appellant, v. Metric Constructors, Inc., Defendant-Appellant, Cross-Appellee
16	1987	817 F.2d 1573	Fed. C.	Claims C.	Reversed and Remanded.		Pathman Construction Company, Inc., Appellant, v. The United States, Appellee
17	1987	817 F.2d 894	1st C.	Puerto Rico	Affirmed in part, reversed in part, remanded		Explosives Corporation of America, et al., Plaintiffs, Appellants, v. Garlam Enterprises Corporation, et al., Defendants, Appellees. Explosives Corporation of America, Plaintiff,
18	1987	817 F.2d 956	2nd C.	N.Y.	Affirmed in part, reversed in part, and remanded		United States of America, Plaintiff-Appellee, Cross-Appellant, v. Seaboard Surety Company and The Home Insurance Company, Defendants-Appellants, Cross-Appellees; Seaboard
19	1987	817 F.2d 1086	4th C.	VA	Affirmed.		Maxum Foundations, Inc., Plaintiff, v. Salus Corporation, Defendant & Third Party Plaintiff-Appellee, and United Pacific Insurance Co., Defendant, v. 8201 Corporation, Third Party
20	1987	819 F.2d 602	5th C.	Louisiana	Affirmed.		Pacific Lining Co., Inc., Plaintiff-Appellee, Cross-Appellant, v. Algernon-Blair Construction Company and United States Fidelity & Guaranty Company, Defendants-Appellants, Cross-
21	1987	819 F.2d 283	Fed.C.	ASBCA	Affirmed		United States, Appellant, v. Turner Construction Co., Appellee

Table A37 (L-4B). Dispute cases list in 1987: Part-B.

22	1987	819 F.2d 60	4th C.	VA	Reversed and Remanded		The Howard P. Foley Company, Plaintiff-Appellant, v. Phoenix Engineering & Supply Co.,
23	1987	820 F.2d 139	5th C.	Louisiana	AFFIRMED.		United States of America, For the Use of Gold Bond Building Products, A Division of National Gypsum Company, Plaintiff-Appellant, v. Blake Construction Co., Inc., et al.,
24	1987	823 F.2d 145	5th C.	Texas	AFFIRMED in part as modified, VACATED in part, and REVERSED in part.		Del E. Webb Construction, Plaintiff-Appellee-Cross-Appellee, v. Richardson Hospital Authority, Defendant-Cross-Plaintiff-Appellee Cross-Appellant, v. L.D.W.A./Buford and
25	1987	823 F.2d 805	4th C.	VA	REVERSED AND REMANDED		Sweeney Company of Maryland, Plaintiff-Appellee, v. Engineers-Constructors, Inc.; Rentenbach Constructors, Inc.; Federal Insurance Company; Defendants-Appellants,
26	1987	825 F.2d 41	4th C.	VA	Affirmed in part, remanded in part.		Brinderson Corporation, Appellant, v. Hampton Roads Sanitation District, Appellee, v. Gannett, Fleming, Corddry and Carpenter; Ralph B. Carter Company, Third-Party
27	1987	826 F.2d 643	7th C.	Ill.	VACATED AND REMANDED WITH DIRECTIONS		United States of America, for the use of Owens-Corning Fiberglass Corporation, Petitioner, v. Brandt Construction Company, a partnership, et al., Defendants. Charles Brandt and
28	1987	827 F.2d 1554	Fed. C.	ASBCA	Affirmed		United States, Appellant, v. Turner Construction Company, Appellee
29	1987	827 F.2d 1538	Fed.C.	Claims C.	Affirmed		John J. Kirlin, Inc., Plaintiff-Appellant, v. The United States, Defendant-Appellee
30	1987	827 F.2d 752	Fed.C.	Claims C.	Affirmed		Gevyn Construction Corp., Plaintiff-Appellant, v. The United States, Defendant-Appellee
31	1987	828 F.2d 671	11th C.	Fl.	AFFIRM IN PART, and REVERSE and REMAND IN PART WITH DIRECTIONS.		United States of America, for the Use and Benefit of Seminole Sheet Metal Company, Plaintiff-Appellant, v. SCI, Inc., f/k/a Sainer Constructors, Inc. and Fidelity and Deposit
32	1987	828 F.2d 759	Fed. C.	Claims C.	AFFIRMED-IN-PART, REVERSED-IN-PART, VACATED-IN-PART, AND		Lisbon Contractors, Inc., Appellee, v. The United States, Appellant
33	1987	829 F.2d 26	Fed.C.	COEBCA	Dismissed		J-I-J Construction Company, Inc., Appellant, v. The United States, Appellee
34	1987	831 F.2d 88	5th C.	Texas	REVERSED and the case REMANDED.		Millgard Corporation, Plaintiff-Appellant, v. McKee/Mays, a Joint Venture, Dallas County and the Commissioners Court of Dallas County, Texas, Defendants-Appellees
35	1987	831 F.2d 519	4th C.	VA	REVERSED AND REMANDED.		Graham Henderson, Plaintiff-Appellant, and United States of America, for the Use of J.E. Liesfeld Contractor, Inc.; United States of America, for the Use and Benefit of Capital
36	1987	832 F.2d 1150	9th C.	Alaska	Affirmed		United States, ex rel. Aurora Painting, Inc., a Washington Corporation, Plaintiff-Appellee, v. Fireman's Fund Insurance Company, a foreign corporation, Defendant-Appellant
37	1987	832 F.2d 463	8th C.	Misso.	Affirmed		McCarthy Brothers Construction Company, a Missouri Corporation, Appellant, v. Samuel R. Pierce, Jr., in his official capacity as Secretary of the United States Department of
38	1987	832 F.2d 574	Fed.C.	GSABCA	Affirmed		George Hyman Construction Company, Appellant, v. The United States, Appellee
39	1987	833 F.2d 867	10th C.	Colorado	REVERSE and REMAND	CONCUR	State of Colorado ex rel. Colorado Attorney General Duane Woodard, Plaintiff-Appellant and Cross-Appellee, v. Western Paving Construction Co., Defendant-Appellee and Cross-
40	1987	834 F.2d 1576	Fed.C.	Claims C.	Affirmed		Stuyvesant Dredging Company, Plaintiff-Appellant, v. The United States, Defendant-Appellee
41	1987	834 F.2d 1533	10th C.	N.M.	REVERSED IN PART AND REMANDED. Western's appeal is DENIED.		The United States of America, for the Use of C.J.C., Inc., a New Mexico corporation,
42	1987	835 F.2d 745	10th C.	Oklahoma	AFFIRMED IN PART, REVERSED IN PART AND REMANDED		United States of America, for the Use and Benefit of Ray Moody, Plaintiff-Appellee v. The American Insurance Company, Defendant-Appellant

Table A38 (L-5A). Dispute cases list in 1994: Part-A.

1994A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1994	10 F.3d 300	5th Cir.	Dis. C. of S. Texas	REVERSED AND REMANDED.		HARVEY CONSTRUCTION COMPANY, Plaintiff-Appellant, v. ROBERTSON-CECO CORPORATION, Defendant-Appellee. (Gen vs. Sub)
2	1994	12 F.3d 1574	Fed. Cir.	GSABCA	AFFIRMED.		WICKHAM CONTRACTING CO., INC., Appellant, v. DENNIS J. FISCHER, Acting Administrator, GSA, Appellee.
3	1994	17 F.3d 106	5th Cir.	Mississippi.	VACATEed and RENDERed and AFFIRMed		L & A CONTRACTING COMPANY, Plaintiff-Counter Defendant-Appellee, v. SOUTHERN CONCRETE SERVICES, INC., Defendant-Counter Claimant-Appellant, and Fidelity & Deposit Company of Maryland, Defendant-Appellant.
4	1994	21 F.3d 952	9th Cir.	D.C. of Alaska	Affirmed		UNITED STATES OF AMERICA, for the use and benefit of FAMILIAN NORTHWEST, INC., d/b/a Alaska Pipe & Supply, and FAMILIAN NORTHWEST, INC., d/b/a Alaska Pipe & Supply, Plaintiff-Appellant, v. RG&B CONTRACTORS, INC. and FIREMAN'S FUND INSURANCE COMPANY, Defendants-Appellees.
5	1994	23 F.3d 1324	8th Cir.	Missouri.	reverse and remand.		Sargent Construction Company, Inc. Plaintiff - Appellant, v. State Auto Insurance Company, Defendant - Appellee.
6	1994	23 F.3d 55	2nd Cir.	New York	Affirmed.		Kay-R Electric Corporation, Plaintiff-Appellant, v. Stone & Webster Construction Co., Inc., and The Federal Insurance Company, Defendants-Appellees.
7	1994	24 F.3d 1397	Fed. Cir.	Court of Federal Claim	VACATED and REMANDED WITH INSTRUCTIONS.	Dissent	MELVIN WILNER, d/b/a WILNER CONSTRUCTION COMPANY, Plaintiff-Appellee, v. THE UNITED STATES, Defendant-Appellant.
8	1994	25 F.3d 1006	Fed. C.	ASBCA	REVERSED AND REMANDED.		ARNOLD M. DIAMOND, INC., Appellant, v. John H. Dalton, SECRETARY OF THE NAVY, Appellee.
9	1994	26 F.3d 1057	11th C.	Florida.	Affirmed	DISSENT	MARRIOTT CORPORATION, Plaintiff-Counter-Defendant-Appellee, v. DASTA CONSTRUCTION COMPANY, Defendant-Counter-Claimant-Appellant.
10	1994	26 F.3d 581	5th Cir.	Dist. Court of Louisiana.	AIP, RIP, Remand, AFFIRMED in part, REVERSED in part and REMANDED.		RILEY STOKER CORPORATION, Plaintiff-Appellant Cross-Appellee, v. FIDELITY AND GUARANTY INSURANCE UNDERWRITERS, INC., et al., Defendants-Appellees Cross-Appellants. RILEY STOKER CORP., Plaintiff, v. FIDELITY AND GUARANTY INSURANCE UNDERWRITERS, INC., et al., Defendants. FIDELITY & GUARANTY
11	1994	29 F.3d 154	4th Cir.	Dist. C. of South C.	AFFIRMED IN PART, REVERSED IN PART, AND REMANDED WITH INSTRUCTIONS		UNITED STATES OF AMERICA, for and on behalf of TAYLOR & POLK CONSTRUCTION, INCORPORATED, Plaintiff-Appellant, v. MILL VALLEY CONSTRUCTION, INCORPORATED, as Principal; HARTFORD FIRE INSURANCE COMPANY, as Surety, Defendants-Appellees. UNITED STATES OF AMERICA, for and

Table A39 (L-5B). Dispute cases list in 1994: Part-B.

12	1994	29 F.3d 611	Fed. C.	VABCA	AFFIRMED.	Dissent	INTERWEST CONSTRUCTION, Appellant, v. Jesse Brown, SECRETARY OF VETERANS AFFAIRS, Appellee.
13	1994	32 F.3d 19	2nd C.		affirmed, reversed		IACOBELLI CONSTRUCTION, INC., Plaintiff-Appellant, v. COUNTY OF MONROE, ROCHESTER PURE WATERS DISTRICT, and CALOCERINOS & SPINA CONSULTING ENGINEERS, P.C., Defendants-Appellees.
14	1994	34 F.3d 163	3rd. Cir.	PENNSYLVANIA	vacated, remanded		UNITED STATES OF AMERICA, Appellee, v. JOHN L. "JACK" DADDONA, Appellant in Nos. 93-7338, 93-7683, and 93-7725. SIDNEY COHEN, Appellant in No. 93-7351
15	1994	35 F.3d 133	4th C.	from S.C.	dismissed, lack of jurisdiction		AMERICAN CASUALTY COMPANY OF READING, PENNSYLVANIA, Plaintiff-Appellant, v. L-J, INCORPORATED; U.S. CONSTRUCTION COMPANY, INCORPORATED, Defendants-Appellees.
16	1994	36 F.3d 540	6th C.	from Tenn.	Reverse aqnd remand		SAFECO INSURANCE COMPANY OF AMERICA, Plaintiff-Appellant, v. CITY OF WHITE HOUSE, TENNESSEE, a Municipal Corporation, Defendant-Appellee.
17	1994	37 F.3d 25	1st Cir.	PUERTO RICO	Affirmed.		JORGE RIVERA SURILLO & CO., INC., Plaintiff - Appellant, v. FALCONER GLASS INDUSTRIES, INC., ET AL., Defendants - Appellees.
18	1994	39 F.3d 312	Fed. C.	from ASBCA	Affirmed,	Dissent	WEST COAST GENERAL CORPORATION, Appellant, v. John H. Dalton, SECRETARY OF THE NAVY, Appellee.
19	1994	39 F.3d 412	2nd Cir.	District of New York	Reversed in part and remanded.		THALLE CONSTRUCTION CO., INC., Plaintiff-Appellant-Cross-Appellee, Counter-Defendant, v. THE WHITING-TURNER CONTRACTING COMPANY, INC., Defendant-Appellee-Cross-Appellant, Counter-Claimant
20	1994	41 F.3d 157	4th C.	District of South Carolina,	Affirmed		APAC CAROLINA, INC., Plaintiff-Appellant, v. TOWN OF ALLENDALE, SOUTH CAROLINA; TOWN OF FAIRFAX, SOUTH CAROLINA; WELCO CONSTRUCTION AND UTILITIES COMPANY, INCORPORATED, Defendants-Appellees, v. CRS SIRRINE, INCORPORATED, Third Party Defendant. APAC CAROLINA, INC., Plaintiff-Appellee, v.
21	1994	41 F.3d 320	7th Cir.	Illinois	Reversed and Remanded		CAPITOL INDEMNITY CORPORATION, Plaintiff-Appellee, v. UNITED STATES OF AMERICA, Defendant-Third Party Plaintiff-Appellant, v. MT. VERNON TOWNSHIP HIGH SCHOOL DISTRICT 201, Third Party Defendant-Appellee.
22	1994	43 F.3d 649	Fed. Cir.	Federal Claims	AFFIRMED		BONNEVILLE ASSOCIATES, JOHN N. OWENS, and MACHAN HAMPSHIRE PROPERTIES, LTD., Plaintiffs-Appellants, v. THE UNITED STATES, Defendant-Appellee, v. CAMCO CONSTRUCTION CO., Third Party-Defendant/Appellee.

Table A40 (L-6A). Dispute cases list in 1995: Part-A.

1995A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1995	41 F.3d 1457	11th C.	Alabama	AFFIRMED in part, REVERSED in part, and REMANDED.		VULCAN PAINTERS, INC. dba Vulcan Group, The, Plaintiff-Appellee, Cross-Appellant, v. MCI CONSTRUCTORS, INC., Defendant-Appellant, Cross-Appellee. VULCAN PAINTERS, INC. dba Vulcan Group, The, Plaintiff-Appellee, v. MCI
2	1995	45 F.3d 830	4th C.	VA	AFFIRMED IN PART, REVERSED IN PART, AND REMANDED FOR FURTHER	DISSENT	UNITED STATES OF AMERICA, for the use and benefit of Global Building Supply, Incorporated; UNITED STATES OF AMERICA, for the use and benefit of Superior Supply Associates, Incorporated, Plaintiffs-Appellees, v. HARKINS BUILDERS,
3	1995	47 F.3d 879	7th C.	Indiana	REVERSED		ELZINGA & VOLKERS, INCORPORATED, Plaintiff-Appellee, v. LSSC CORPORATION and LEGGETT & PLATT, INCORPORATED, Defendants-Appellants.
4	1995	49 F.3d 1541	Fed. C.	ASBCA	REVERSED AND REMANDED		BILL STRONG ENTERPRISES, INC., Appellant, v. John Shannon, ACTING SECRETARY OF THE ARMY, Appellee.
5	1995	49 F.3d 1563	Fed. C.	ASBCA	REVERSED AND REMANDED		H. L. SMITH, INC., Appellant, v. John H. Dalton, SECRETARY OF THE NAVY, Appellee.
6	1995	49 F.3d 1421	9th C.	Arizona	REVERSED and REMANDED.		UNITED STATES OF AMERICA, for the use of C.W. HENDERSON, and WANDA HENDERSON, husband and wife, doing business as C.W. Henderson Construction Co., a sole proprietorship, Plaintiffs-Appellants, v. NUCON
7	1995	49 F.3d 555	9th C.	Cal.	AFFIRMED.		LORAL TERRACOM, Plaintiff-Appellant, v. VALLEY NATIONAL BANK, a federally chartered bank; CITIZENS BANK TRUST CO., a Kentucky corporation and state chartered bank, Defendants-Appellees.
8	1995	49 F.3d 915	3rd C.	N.J.	AFFIRMED.	CONCUR, DISSENT	LINAN-FAYE CONSTRUCTION CO., INC., Appellant v. HOUSING AUTHORITY OF THE CITY OF CAMDEN
9	1995	50 F.3d 476	7th C.	Wisconsin	AFFIRMED.		S.A. HEALY COMPANY, Plaintiff-Appellee, v. MILWAUKEE METROPOLITAN SEWERAGE DISTRICT, Defendant-Appellant.
10	1995	51 F.3d 1229	4th C.	VA	AFFIRMED		CHESAPEAKE PAPER PRODUCTS COMPANY, Successor in Interest to Chesapeake Corporation, Plaintiff-Appellee, v. STONE & WEBSTER ENGINEERING CORPORATION, Defendant & Third Party Plaintiff-Appellant, v.
11	1995	51 F.3d 1336	7th C.	Ill.	AFFIRMED		HURST-ROSCHE ENGINEERS, INCORPORATED, Plaintiff-Appellant, v. COMMERCIAL UNION INSURANCE COMPANY, also known as AMERICAN EMPLOYERS INSURANCE COMPANY and CINCINNATI INSURANCE
12	1995	51 F.3d 910	10th C.	OKLAHOMA	REVERSED and REMANDED		DILLARD & SONS CONSTRUCTION, INC., Plaintiff-Appellee, v. BURNUP & SIMS COMTEC, INC., Defendant-Appellant.
13	1995	55 F.3d 1491	10th C.	Utah.	AFFIRMED.		THE UNITED STATES FOR THE USE AND BENEFIT OF GENERAL ROCK & SAND CORPORATION, an Arizona corporation, Plaintiff-Appellant, v. CHUSKA DEVELOPMENT CORPORATION, a New Mexico corporation; PERRY

Table A41 (L-6B). Dispute cases list in 1995: Part-B.

14	1995	55 F.3d 1126	6th C.	Michigan	REVERSE and REMAND		GARDEN CITY OSTEOPATHIC HOSPITAL, Plaintiff-Appellant, v. HBE CORPORATION; HOSPITAL BUILDING AND EQUIPMENT COMPANY, INCORPORATED; HOSPITAL DESIGNERS, INCORPORATED; and KUMMER
15	1995	55 F.3d 1578	Fed. C.	DOABCA	AFFIRMED		CALDWELL & SANTMYER, INC., Appellant, v. Dan Glickman, SECRETARY OF AGRICULTURE, Appellee.
16	1995	56 F.3d 821	7th C.	Wisconsin	AFFIRMED		MILWAUKEE METROPOLITAN SEWERAGE DISTRICT, a special purpose Wisconsin municipal, Plaintiff-Appellant, v. FIDELITY & DEPOSIT COMPANY OF MARYLAND, a Maryland corporation, Defendant-Appellee.
17	1995	57 F.3d 395	4th C.	N.C.	AFFIRMED		CNF CONSTRUCTORS, INCORPORATED, Plaintiff-Appellee, v. DONOHOE CONSTRUCTION COMPANY, a Division of the Donohoe Companies, Incorporated, Defendant-Appellant.
18	1995	60 F.3d 734	11th C.	Fl.	Affirmed		PULTE HOME CORP., Plaintiff-Appellant, Cross-Appellee, v. OSMOSE WOOD PRESERVING, INC., Defendant-Cross-Defendant-Appellee, Cross-Appellant, GEORGIA PACIFIC CORP.; LOWE'S COMPANIES; LOWE'S INVESTMENT CO.,
19	1995	61 F.3d 742	9th C.	Alaska	Affirmed		BELL LAVALIN INC., an Alaska Corporation, Plaintiff-Appellant, v. SIMCOE AND ERIE GENERAL INSURANCE COMPANY, a foreign corporation; THE PRUDENTIAL ASSURANCE COMPANY, a foreign Corporation; SECURITY
20	1995	62 F.3d 35	1st C.	Maine	Affirmed		UNITED STATES OF AMERICA ON BEHALF OF PITTSBURGH TANK & TOWER, INC., Plaintiff, Appellant, v. G & C ENTERPRISES, INC., Defendant, Appellee.
21	1995	64 F.3d 155	4th C.	VA	REVERSED AND REMANDED	DISSENT	FAIRFAX COUNTY REDEVELOPMENT & HOUSING AUTHORITY, Plaintiff-Appellant, v. W. M. SCHLOSSER COMPANY, INCORPORATED, Defendant-Appellee. FAIRFAX COUNTY REDEVELOPMENT & HOUSING AUTHORITY,
22	1995	65 F.3d 486	5th C.	Texas	Affirmed		TACON MECHANICAL CONTRACTORS, INC., et al., Plaintiffs, Tacon Mechanical Contractors, Inc. and the Walsh & Albert Company, Plaintiffs-Appellants, v. AETNA CASUALTY AND SURETY COMPANY, Defendant-Appellee. The WALSH
23	1995	66 F.3d 715	5th C.	Texas	Affirmed		TRANSAMERICA INS. CO., Plaintiff-Appellee, versus PAUL R. AVENELL and GAYLE AVENELL, Defendants-Appellants.
24	1995	67 F.3d 435	2nd C.	N.Y.	Reversed and remanded.		MORSE/DIESEL, INC. Plaintiff-Appellee, v. TRINITY INDUSTRIES, INC.; MOSHER STEEL COMPANY, and AETNA INSURANCE COMPANY, Defendants-Appellants.
25	1995	68 F.3d 1475	2nd C.	N.Y.	AFFIRMED.		NORMAN I. GOLD, Plaintiff-Appellant, v. MORRISON-KNUDSEN CO., BLACK RIVER CONSTRUCTORS, FORT DRUM CONSTRUCTORS, and NATIONAL STRUCTURES, INC., Defendants-Appellees.
26	1995	70 F.3d 1115	10th C.	OKLAHOMA	REVERSED and REMANDED		UNITED STATES for the use of B&D MECHANICAL CONTRACTORS, INC., an Oklahoma corporation, Plaintiff-Appellant and Cross-Appellee, v. ST. PAUL MERCURY INSURANCE COMPANY, a Minnesota corporation, and NORTH
27	1995	72 F.3d 883	Fed. C.	Fed. Claims	REVERSED AND REMANDED.		HARDWICK BROTHERS COMPANY II, Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.

Table A42 (L-7A). Dispute cases list in 1996: Part-A.

1996A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1996	102 F.3d 677	2nd C.	Connecticut	Affirmed.		CONNTECH DEVELOPMENT COMPANY, Plaintiff-Appellee, v. UNIVERSITY OF CONNECTICUT EDUCATION PROPERTIES, INC., Defendant-Appellant.
2	1996	102 F.3d 1173	11th C.	Fl.	Affirmed.		BERNARD SCHONINGER SHOPPING CENTERS, LTD., a successor to Schoninger Management Corporation, Plaintiff-Appellant, v. J.P.S. ELASTOMERICS, CORP., successor to J.P. Stevens & Co., Inc., Defendant-
3	1996	103 F.3d 750	9th C.	Cal.	Affirmed.		GOLDEN EAGLE INSURANCE COMPANY, Plaintiff-Appellant, v. TRAVELERS COMPANIES, Defendant-Appellee.
4	1996	103 F. 3d 1422	8th C.	Nebraska	Affirmed in part and reversed in part and remanded		Lamb Engineering & Construction Company, Appellee, v. Nebraska Public Power District, Appellant.
5	1996	105 F.3d 1418	Fed C.	ASBCA	AFFIRMED		SATELLITE ELECTRIC COMPANY, Appellant, v. John H. Dalton, SECRETARY OF THE NAVY, Appellee.
6	1996	73 F.3d 811	8th C.	Minnesota	AFFIRMED.		FIREMAN'S FUND INSURANCE COMPANY, a subrogee of Kraus-Anderson Construction Company, a member of the Devco/Kraus-Anderson Joint Venture; Plaintiff, DEVCO/KRAUS-ANDERSON JOINT VENTURE, a
7	1996	74 F.3d 972	9th C.	Guam	AFFIRMED.		UNITED STATES OF AMERICA, for the use and benefit of HAWAIIAN ROCK PRODUCTS CORPORATION, a Nevada corporation, and GUAM CONCRETE GROUP LTD., a Guam corporation, Plaintiffs-Appellees, v. A.E. LOPEZ
8	1996	76 F.3d 1573	Fed. C.	ASBCA	AFFIRMED-IN-PART, REVERSED-IN-PART, AND REMANDED		DECKER & CO., Appellant, v. TOGO D. WEST, JR., SECRETARY OF THE ARMY, Appellee.
9	1996	77 F.3d 928	7th C.	Ill.	Vacated, and the case is remanded		STROMBERG METAL WORKS, INC., and COMFORT CONTROL, INC., Plaintiffs-Appellants, v. PRESS MECHANICAL, INC., et al., Defendants-Appellees.
10	1996	78 F.3d 61	2nd C.	N.Y.	Affirmed		WEST-FAIR ELECTRIC CONTRACTORS, and L.J. Coppola, Inc., Plaintiffs-Appellees, v. AETNA CASUALTY & SURETY COMPANY, and Gilbane Building Company, Defendants-Appellants.
11	1996	79 F.3d 9	2nd C.	Connecticut	AFFIRMED.		FISHER SKYLIGHTS, INC., Plaintiff-Appellant, v. CFC CONSTRUCTION LIMITED PARTNERSHIP, Defendant, NATIONAL UNION FIRE INSURANCE COMPANY OF PITTSBURGH, PA, Defendant-Appellee.
12	1996	80 F.3d 895	4th C.	N.C.	AFFIRMED IN PART AND REVERSED IN PART		GILBANE BUILDING COMPANY, a Corporation; APPLIED RETRIEVAL TECHNOLOGY CORPORATION, Plaintiffs-Appellees, and HOLLAND GLASS COMPANY, INCORPORATED; METROMONT MATERIALS;
13	1996	81 F.3d 1093	Fed. C.	Fed. Claims	AFFIRMED		STATE OF FLORIDA, DEPARTMENT OF INSURANCE, as Receiver for Southeastern Casualty & Indemnity Insurance Company, Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee
14	1996	81 F.3d 206	D.C.C.	D.C.	Reversed in part		FINEGOLD, ALEXANDER + ASSOCIATES, INC., APPELLEE v. SETTY & ASSOCIATES, LTD., APPELLANT
15	1996	84 F.3d 263	7th C.	Indiana	AFFIRMED.		CONTROLLED DEMOLITION, INCORPORATED, Plaintiff-Appellant, v. F. A. WILHELM CONSTRUCTION COMPANY, INCORPORATED, MANSUR DEVELOPMENT CORPORATION and AETNA LIFE INSURANCE
16	1996	84 F.3d 372	10th C.	Utah	AFFIRMED IN PART, REVERSED IN PART, AND REMANDED		RELIANCE INSURANCE COMPANY, a Pennsylvania corporation, Plaintiff-Appellant, v. MAST CONSTRUCTION COMPANY, a corporation; MAST INDUSTRIAL, INC., a corporation; RONALD EARL MAST, LINDA M. MAST,

Table A43 (L-7B). Dispute cases list in 1996: Part-B.

17	1996	85 F.3d 1547	11th C.	GA	REVERSED and REMANDED		ALLGOOD ELECTRIC COMPANY, Plaintiff-Appellant, v. MARTIN K. EBY CONSTRUCTION COMPANY, INC., Federal Insurance Company, Fidelity and Deposit Company of Maryland, Defendants-Appellees.
18	1996	85 F.3d 201	5th C.	Texas	AFFIRMED		GUNDLE LINING CONSTRUCTION CORPORATION, Plaintiff, and United States Fidelity & Guaranty Company, Defendant/Third-party Plaintiff/Appellee, v. ADAMS COUNTY ASPHALT, INC., Kimbob, Inc., and Robert M. Mumma,
19	1996	85 F.3d 351	8th C.	Missouri	AFFIRMED		Dave Kolb Grading, Inc., Appellant/Cross-Appellee, v. Terra Venture Bridgeton Project Joint-Venture; American National Insurance Co., a General Partner; Bridgeton Development Company, a Kansas General Partnership; Jack W.
20	1996	85 F.3d 343	8th C.	North Dakota	Affirmed.		Triton Corporation, Appellee, v. Hardrives, Inc., Appellant.
21	1996	85 F.3d 565	11th C.	GA	REVERSED and REMANDED		McKNIGHT CONSTRUCTION CO., INC., Plaintiff-Appellee, v. DEPARTMENT OF DEFENSE, William J. Perry, Secretary; Department of the Army, Togo D. West, Jr., Secretary, Robert C. Hoffman, Contracting Office, Savannah District
22	1996	86 F.3d 332	4th C.	S.C.	AFFIRMED.	CONCUR	UNITED STATES OF AMERICA, Ex Rel., Maddux Supply Company, Plaintiff-Appellee, v. ST. PAUL FIRE & MARINE INSURANCE COMPANY; HILL CONSTRUCTION COMPANY, INCORPORATED, Defendants-Appellants,
23	1996	88 F.3d 592	8th C.	Missouri.	Affirmed in part and reversed in part.		C. L. Maddox, Inc., a Delaware Corporation, Appellee, v. The Benham Group, Inc., an Oklahoma Corporation, Appellant, Dynalogic Engineering, Inc., a Michigan Corporation, Defendant. C. L. Maddox, Inc., a Delaware Corporation,
24	1996	89 F.3d 243	5th C.	Louisiana	REVERSED AND REMANDED.		LIBERTY MUTUAL INSURANCE COMPANY; Gust K. Newberg Construction Co./Hardaway Co., A Joint Venture, Plaintiffs-Appellants, v. PINE BLUFF SAND & GRAVEL CO., INC., Defendant-Appellee.
25	1996	91 F.3d 1431	11th C.	Fl.	REVERSED and REMANDED		MACCAFERRI GABIONS, INC., Plaintiff-Appellee, Cross-Appellant, v. DYNATERIA INC., Moore & Artis, Ltd., Inc., et al. Defendants, Wilkinson & Jenkins Construction Co., Inc., Ohio Casualty Insurance Company,
26	1996	91 F.3d 1094	8th C.	North Dakota	Affirmed.		Dakota Gasification Company, Appellant, v. Pascoe Building Systems, a division of Amcord, Inc.; Del Con, Inc., Appellees.
27	1996	91 F.3d 625	4th C.	Maryland	AFFIRMED.		OPUS 3 LIMITED, Plaintiff-Appellee, v. HERITAGE PARK, INCORPORATED, Defendant-Appellant, and PAUL STEIN, Defendant, and JAMES O'BRIEN; DAVID KOPP; DAVID J. MISLIN; JOHN DOES, Third Party Defendants.
28	1996	93 F.3d 1537	Fed. C.	Court of Fed.C.	REVERSED AND REMANDED		JAMES M. ELLETT CONSTRUCTION COMPANY, INC., Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
29	1996	94 F.3d 1537	Fed. C.	Court of Fed.C.	REVERSED AND REMANDED		KRYGOSKI CONSTRUCTION COMPANY, INC., Plaintiff-Appellee, v. THE UNITED STATES, Defendant-Appellant.
30	1996	94 F.3d 548	9th C.	Washington.	AFFIRMED.		DEL HUR, INC., d/b/a/ ANGELES CONCRETE PRODUCTIONS, Plaintiff-Appellee, v. NATIONAL UNION FIRE INSURANCE COMPANY OF PITTSBURGH, PA., a Pennsylvania Corp. authorized to do business in the
31	1996	95 F.3d 153	2nd C.	N.Y.	Affirmed in part, vacated and remanded in part.		UNITED STATES OF AMERICA, for the use and benefit of EVERGREEN PIPELINE CONSTRUCTION CO., INC., Plaintiff, EVERGREEN PIPELINE CONSTRUCTION CO., INC., Plaintiff-Appellant/Cross-Appellee, v. MERRITT
32	1996	98 F.3d 1314	Fed. C.	Court of Fed.C.	AFFIRMED		OLYMPUS CORPORATION, Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
33	1996	99 F.3d 248	7th C.	Ill.	REVERSED AND REMANDED		ROBERTS & SCHAEFER COMPANY, a Delaware Corporation, Plaintiff-Appellant, v. MERIT CONTRACTING, INCORPORATED, a Pennsylvania Corporation, Defendant-Appellee.

Table A44 (L-8). Dispute cases list in 1997.

1997A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1997	108 F.3d 213	9th	Western District of Washington,. D.C.	AFFIRMED in apart, REVERSED in part and REMANDED		In re DALEY'S DUMP TRUCK SERVICES, INC., Debtor. WALTER AND SCI CONSTRUCTION (USA), INC., Appellee v. DALEY'S DUMP TRUCK SERVICES, INC., a Washington corporation, Appellant. DALEY'S DUMP TRUCK SERVICES,
2	1997	108 F.3d 67	4th	District of South Carolina, at Columbia	AFFIRMED AND REMANDED.		UNITED STATES OF AMERICA, Plaintiff-Appellee, v. FRED L. HATFIELD, SR., d/b/a HVAC Construction Company, Incorporated, Defendant-Appellant.
3	1997	108 F.3d 1186	10th	Eastern District of Oklahoma	Reversed and remanded.		UNIT DRILLING COMPANY, Plaintiff-Appellant, v. ENRON OIL & GAS COMPANY, Defendant-Appellee.
4	1997	111 F.3d 1376	8th	Western District of Missouri	affirm in part, reverse in part and remand the case		Walton General Contractors, Inc./Malco Steel, Inc., Appellant, v. Chicago Forming, Inc.; Peerless Insurance Company, Appellees. Chicago Forming, Inc., Third Party Plaintiff, v. United States
5	1997	111 F.3d 758	10th	Western District of Oklahoma	AFFIRMED IN PART and REVERSED IN PART. We reverse the district court's award		TOWERRIDGE, INC., sued as United States of America for the Benefit of Towerridge, Inc., Plaintiff-Appellee and Cross-Appellant, v. T.A.O., INC., and MID-CONTINENT CASUALTY CO., Defendants-Appellants and Cross-Appellees.
6	1997	112 F.3d 695	3rd	EASTERN DISTRICT OF PENNSYLVANIA	remanded for resolution of Defendant's motion for a new trial.	DISSENT	RHONE POULENC RORER PHARMACEUTICALS INC.; TURNER CONSTRUCTION CO., Appellants, v. NEWMAN GLASS WORKS; EMPLOYERS INSURANCE OF WAUSAU, Appellees, v. SPECTRUM GLASS PRODUCTS, INC.;
7	1997	117 F.3d 180	5th	Southern District of Texas	AFFIRMED in PART and REVERSED and REMANDED in PART		TRIAD ELECTRIC & CONTROLS, INC., Plaintiff/Counter-Defendant Appellant/Cross-Appellee, v. POWER SYSTEMS ENGINEERING, INC., ET AL., Defendants, POWER SYSTEMS ENGINEERING, INC.; CENTURY CONTRACTORS WEST,
8	1997	119 F.3d 548	7th	Northern District of Indiana	AFFIRMED.		SCHENKEL & SHULTZ, INC., Plaintiff-Appellant, v. HOMESTEAD INSURANCE COMPANY, Defendant-Appellee.
9	1997	121 F.3d 1357	9th	District of Oregon	REVERSED IN PART and AFFIRMED IN PART and REMANDED	DISSENT	BLUE FOX INC, a Washington Corporation, Plaintiff-Appellant, v. SMALL BUSINESS ADMINISTRATION; THE UNITED STATES ARMY, Defendants-Appellees.
10	1997	124 F.3d 394	2nd	Northern District of New York	AFFIRMED.		EFCO CORPORATION, Plaintiff-Appellant, v. U.W. MARX, INC., Defendant-Cross-Defendant-Cross-Claimant-Appellee, PATRIOT DOOR & WINDOW, INC., Defendant-Cross-Defendant-Appellee, JOSEPH FRANCESE, INC., Counter-Claimant-Cross-
11	1997	126 F.3d 886	7th	Northern District of Illinois,	REVERSED		PRISCO SERENA STURM ARCHITECTS, LTD., and SECURITY INSURANCE COMPANY OF HARTFORD, Plaintiffs-Appellees, v. LIBERTY MUTUAL INSURANCE CO., Defendant-Appellant.
12	1997	127 F.3d 1476	Fed. Cir.	Corps of Engineers Board of Contract Appeals	AFFIRMED		D.L. BRAUGHLER COMPANY, INC., Appellant, v. Togo D. West, SECRETARY OF THE ARMY, Appellee.
13	1997	129 F.3d.143	D.C. Cir.	the District of Columbia.	Affirmed, reversed and remanded		IDEAL ELECTRONIC SECURITY CO., INC., ET AL., APPELLANTS/CROSS-APPELLEES v. INTERNATIONAL FIDELITY INSURANCE COMPANY, APPELLEE/CROSS-APPELLANT
14	1997	130 F.3d 1469	Fed. Cir.	Armed Services Board of Contract Appeals.	AFFIRMED.		TRIAX PACIFIC, INC., Appellant, v. Togo D. West, Jr., SECRETARY OF THE ARMY, Appellee.
15	1997	131 F.3d 28	1st	DISTRICT OF MASSACHUSETTS	Affirmed		UNITED STATES OF AMERICA FOR THE USE AND, BENEFIT OF WATER WORKS SUPPLY CORPORATION, Plaintiff, Appellee, v. GEORGE HYMAN CONSTRUCTION COMPANY, NATIONAL UNION FIRE INSURANCE COMPANY
16	1997	132 F.3d 203	5th	Northern District of Texas	REVERSED and REMANDED.		STATE BANK & TRUST COMPANY, DALLAS, Plaintiff-Appellant, versus INSURANCE COMPANY OF THE WEST, Defendant-Appellee.
17	1997	132 F.3d 724	Fed. Cir.	Department of Transportation Board of Contract Appeals.	AFFIRMED-IN-PART, REVERSED-IN-PART, and REMANDED		T. BROWN CONSTRUCTORS, INC., Appellant, v. Federico Pena, SECRETARY OF TRANSPORTATION, Appellee

Table A45 (DV-1A). Dispute data for validation in 1993: Part – A.

		93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93
1993A		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Parties	Architect													1		1			1					1				1				
	Engineer	1	1		73				3	2			7		2		2		1	1		3			2		3			1	6
	Subcontractor		2									5		2	10		1		3		3		2			3		1	21	3		9
	Contracting Officer	1	2	3			24						2		2			2	1						17		25					
Work	**defect**				1	1	1		3	1	6							4	1					2			1					12
	deficiency							1														1								6	1
	repair		1	1					1			1									16		1				1				
	change	1		1	3	10	1		5	1		2	4			1	16	1	3	4		1		1	5		1		1			
	- change order					1			4								13			1					1							
	- directive												3						4						2							
	- purchase									9																						
	- replace	1		1		1			1						1			1	1	1		1		1							1
	add	2	4	15	6	12	14	5	25	5	1	5	2	1		10	9	11	3	19	5	4	4	5	8	4	4		3	1	8	5
	extra				3	5			4	1							3			2		2									9	
	delete																							1	4						1	
	scope					4		2				2				1				1		1									2	
	complete	2	1	18		2	1		3	6	1	3		1		1	4	8	1			17		5	2						2	
Cost	**cost**	22	16	23	3	6	7	6	21	4	11	2	22	2		1	5	3	3	17	7				12	2	3			6	2	3
	compensation		1			7			10	2	4	23	2			2	1			3	1				1		9				9	2
	expense					2			1	2		3					2			1	3	6	3				2	1				
	overhead			36					1		9								10	12												
	Eichleay			12							7									3												
	payment	1		5	6		42	1	1	11		5		3	4	2	10				5	8		1	5			4	14	1	11	4
	profit	5							1							3				3		8	1									
	increase	9	1	3	7		1		1	1			4	1	1					1			2			1	4					
	equitable	18		4					2		1		4						3	1		2			2							
	liquidated																															
	recover			7	12	7	1		9	9	7	1	1		4	1	4		1	12	8	8	4	1	1	1	4	2	5		9	5
	retainage					6			1	2				1	1																	
	loss				1	1						1		9			2			1		16	5	1								
	bond			5								3		8	18		1	3			6	12	3			13		4	19	4	9	6
	payment bond																															
	performance																															
	Surety					3						2		7	5		1				5	57		1		1		3	3	4	1	
	Miller Act											3			11		6				7	1						18	18			17
	default						33					1		1	1							11				1			5		1	
	lien				11							29																	1		37	
	quantum						3		1	10																					2	
Schedule	**schedule**			4						1			1	2	1									2	1						2	
	acceleration			3																											1	
	delay			45	2		2		42	2	13	1	4	1		1	9			9			4	1	2	2	35			3		
	extension			4	4	1		1	4		9	3	3		1	6			1	8		3	2		5	3	4			1	2	
	suspension			17																2												
	withhold																									1						
	progress			1			37			1												3										

Table A46 (DV-1B). Dispute data for validation in 1993: Part – B.

Project	Contract																														
Risk	**breach**				19	6			14	9			1	3	1	5	6					1	6	8		3		4	1		1	
	comply		3							6								2	1					1	1							1
	damage			3	20	11	3		52	10	1		1	18		9	6				9	3	12	10			6			10	1	4
	dispute		2	1	2	3	11		8		3	5	3	2		9	14	4				1	9	1	27	13	5	5	2	1	3	
	complaint	2			2		27		14			1			3	1						1		1		11		4			1	
	conflict						1			1	1						2		6		1								1			
	expert																8															
	CDA						13											4							5							
	duty		2	1		2	1			5		1	2		3		4	7		8				9		3				1		
	failure			1	3	3			5	10	1		2	2	6		5	1		2		2		1					1	1	1	1
	force majeure																															
	notice																															
	subsurface					7																										
	- differing																															
	termination					1	35		1			3		7		1		3							1							
	Contract																															
	ambiguity	2			3								6			13				20			1	1	1	1						
	clarify			2									1							10			1							1		
	error (-		1	2	1	3	1	9	3				2	3			1					1		3	4	1		2			3	
	interpret	9	7		2	1		1		3			10			2	1		3	17		2	15	2	4	4			1		1	1
	omission		2						1				1	1				1		1				11	1							
	plans	1		4	5	4		2	2				1			2		4	2				1		3					1	1	
	drawings								1				1						13	9												
	specification		2		9	5			16	2	6		1			1	1		24	5					2							2
	Liability					6								6	2	3	1	1					6	6	1	1	3	3	3		7	2
	misconduct					1		3																								
	misrepresent				6	14			1															1								
	mistake								13							1	1						1	16								
	negligent		1						1						3						2											
	warranty				1	12			13		4		2	1	1		1		1			1										1
	guarantee							1								3	1											2			6	
	fraud(ulent)				30	1	2		1							2	4	3		2			3								5	1
	faith - bad			1	3								1			4	11	4		1		1	2	6	1			4				
	faith - good																															
SUM		77	49	223	238	149	261	32	290	116	85	105	94	83	81	86	156	67	87	177	78	178	88	100	121	69	109	59	99	37	146	84
																								SUM	3624	AVG		117	SD		64.66	

Table A47 (LV-1A). Dispute cases list for validation in 1993: Part – A.

1993A		Citation No.	Appeal Court	Prior Court	Decision	Other Opinions	Parties
1	1993	11 F.3d 1032	Fed.C.	Court of Federal	AFFIRMED	CONCUR	FOLEY COMPANY, Plaintiff-Appellee, v. THE UNITED STATES, Defendant-Appellant.
2	1993	12 F.3d 1072	Fed.C.	Court of Federal	AFFIRMED	CONCUR	S.J. AMOROSO CONSTRUCTION CO., INC., Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
3	1993	12 F.3d 1053	Fed.C.	ASBCA	AFFIRMED.		INTERSTATE GENERAL GOVERNMENT CONTRACTORS, INC., Appellant, v. Togo West, SECRETARY OF THE ARMY, Appellee.
4	1993	13 F.3d 437	1st C.	Maine	Affirmed		COMBUSTION ENGINEERING, INC., Plaintiff, Appellant, v. MILLER HYDRO GROUP, ET AL., Defendants, Appellees. COMBUSTION ENGINEERING, INC., Plaintiff, Appellee, v. MILLER HYDRO GROUP, ET AL., Defendants, Appellants.
5	1993	1 F.3d 1005	10th C.	KANSAS	AFFIRMED		GREEN CONSTRUCTION COMPANY, an Iowa corporation, Plaintiff-Appellant and Cross-Appellee, v. THE KANSAS POWER & LIGHT COMPANY, Defendant-Counterclaimant Appellee and Cross-Appellant, v. SEABOARD SURETY COMPANY and GREEN HOLDINGS, INC.,
6	1993	2 F.3d 1564	Fed.C.	Court of Federal	REVERSED AND REMANDED.	DISSENT	THE SHARMAN COMPANY, INC., Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
7	1993	2 F.3d 716	7th C.	Ill.	AFFIRMED.		UNITED STATES OF AMERICA, Plaintiff-Appellee, v. ALEX JANOWS & COMPANY, and SHERWIN JANOWS, Defendants-Appellants.
8	1993	3 F.3d 192	7th C.	Ill.	AFFIRMED.		EDWARD E. GILLEN COMPANY, a Wisconsin corporation, Plaintiff-Appellant, v. CITY OF LAKE FOREST, Defendant-Appellee.
9	1993	5 F.3d 133	5th C.	Texas	Reversed, Rendered, and Affirmed		P & L CONTRACTORS, INC., Plaintiff-Counter-Defendant Appellee, v. AMERICAN NORIT COMPANY, INC., Defendant-Counterclaimant Appellant.
10	1993	5 F.3d 520	Fed.C.	ASBCA	AFFIRMED		DALY CONSTRUCTION, INC., Appellant, v. H. LAWRENCE GARRETT, III, SECRETARY OF THE NAVY, Appellee.
11	1993	6 F.3d 1573	Fed.C.	Court of Federal	AFFIRMED-IN-PART, REVERSED-IN-PART, and REMANDED	CONCUR, DISSENT	SKIP KIRCHDORFER, INC., Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
12	1993	6 F.3d 1539	Fed.C.	Court of Federal	AFFIRMED IN PART, VACATED IN PART AND REMANDED		C. SANCHEZ AND SON, INCORPORATED, Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
13	1993	8 F.3d 756	11th C.	Fl.	Affirmed in part, reversed in part, and remanded		UNITED ALUMA GLASS, Plaintiff-Counter-Defendant-Appellant, v.
14	1993	980 F.2d 1415	11th C.	Fl.	AFFIRMED		The HARDAWAY COMPANY, Plaintiff-Appellant, v. UNITED STATES ARMY CORPS OF ENGINEERS, Defendant-Appellee.
15	1993	984 F.2d 749	6th C.	Ohio.	REVERSED	DISSENT	CONSTRUCTION INTERIOR SYSTEMS, INC., Plaintiff-Appellee, v. MARRIOTT FAMILY RESTAURANTS, INC., Defendant-Appellant.

Table A48 (LV-1B). Dispute cases list for validation in 1993: Part – B.

16	1993	986 F.2d 1110	7th C.	Ill.	AFFIRMED.		UNITED STATES OF AMERICA, for the use and benefit of TREAT BROTHERS COMPANY, an Illinois Corporation, Plaintiff-Appellee, v. FIDELITY AND DEPOSIT COMPANY OF MARYLAND, a Maryland Corporation and BLINDERMAN CONSTRUCTION COMPANY, INCORPORATED, an
17	1993	987 F.2d 759	Fed.C.	ASBCA	REVERSED and REMANDED		FISCHBACH AND MOORE INTERNATIONAL CORP., Appellant, v. Warren M. Christopher, SECRETARY OF STATE, Appellee.
18	1993	987 F.2d 743	Fed.C.	Court of Federal	Reversed		BLAKE CONSTRUCTION COMPANY, INC., Plaintiff-Appellee, v. THE UNITED STATES, Defendant-Appellant.
19	1993	987 F.2d 1575	Fed.C.	ASBCA	AFFIRMED-IN-PART and REVERSED- and REMANDED-IN-PART		COMMUNITY HEATING & PLUMBING COMPANY, INC., Appellant, v. Admiral Frank B. Kelso, II, ACTING SECRETARY OF THE NAVY, Appellee.
20	1993	988 F.2d 88	10th C.	OKLAHOMA	Reversed and affirmed		UNITED STATES OF AMERICA, ex rel. RENT IT COMPANY, INC., Plaintiff-Appellant/Cross-Appellee, v. THE AETNA CASUALTY & SURETY COMPANY, Defendant-Appellee/Cross-Appellant.
21	1993	989 F.2d 1188	Fed.C.	Court of Federal	REVERSED and REMANDED		TRANSAMERICA INSURANCE COMPANY, Plaintiff-Appellant, v. THE UNITED STATES, Defendant-Appellee.
22	1993	989 F.2d 148	4th C.	S.C.	REVERSED AND REMANDED		SVERDRUP CORPORATION, Plaintiff-Appellant, v. WHC CONSTRUCTORS, INCORPORATED, Defendant-Appellee, and CENTURY III, INCORPORATED, Defendant.
23	1993	990 F.2d 195	5th C.	Texas	Affirmed		HARBOR INSURANCE CO., Plaintiff-Appellee, versus URBAN CONSTRUCTION CO. AND AUGUSTA COURT CO-OWNERS ASSOCIATION, INC., Defendants, URBAN CONSTRUCTION CO., Defendant-Appellant.
24	1993	991 F.2d 1579	Fed.C.	ASBCA	AFFIRMED		SANTA FE ENGINEERS, INC., Appellant, v. H. Lawrence Garrett, III, SECRETARY OF THE NAVY, Appellee.
25	1993	992 F.2d 386	Fed.C.	MASSACHUSET	Reversed and remanded		COMMERCIAL UNION INSURANCE COMPANY, Plaintiff, Appellant, v. GILBANE BUILDING COMPANY, Defendant, Appellee.
26	1993	994 F.2d 783-wit	Fed C.	Court of Federal	AFFIRMED	DISSENT	MELVIN WILNER, d/b/a WILNER CONSTRUCTION COMPANY, Plaintiff-Appellee, v. THE UNITED STATES, Defendant-Appellant.
27	1993	995 F.2d 656	6th C.	Ohio.	Affirmed		UNITED STATES OF AMERICA, for the use and benefit of SKIP KIRCHDORFER, INC., Plaintiff-Appellee, v. M.J. KELLEY CORPORATION, Defendant, RICHARD J. KELLEY and JOSEPH E. LOCONTI, Defendants-Appellants.
28	1993	995 F.2d 515	4th C.	VA	Affirmed		UNITED STATES OF AMERICA, for the use and benefit of Global Building Supply, Incorporated, Plaintiff-Appellant, v. WNH LIMITED PARTNERSHIP; THOMAS P. HARKINS, INCORPORATED; HARKINS BUILDERS, INCORPORATED; THE FEDERAL INSURANCE COMPANY, Defendants-
29	1993	996 F.2d 14	1st C.	RHODE ISLAND	Affirmed		WESTCOTT CONSTRUCTION CORP., Plaintiff, Appellant, v. FIREMEN'S FUND OF NEW JERSEY, Defendant, Appellee.
30	1993	998 F.2d 1092	1st C.	RHODE ISLAND	Affirmed.		COMMERCIAL ASSOCIATES, ET AL., Plaintiffs, Appellees, v. TILCON GAMMINO, INC., Defendant, Appellant.
31	1993	9 F.3d 996	1st C.	PUERTO RICO	Vacate		UNITED STRUCTURES OF AMERICA, INC. AND UNITED STATES OF AMERICA FOR THE USE OF UNITED STRUCTURES OF AMERICA, INC., Plaintiffs, Appellees, v. G.R.G. ENGINEERING, S.E. AND NEW HAMPSHIRE INSURANCE COMPANY, Defendants,

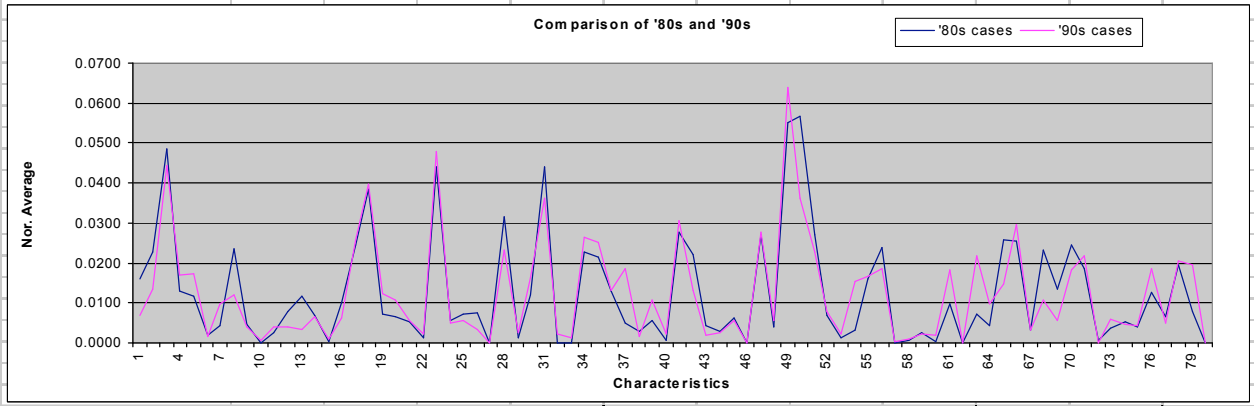
Table A49 (FA-1). Final analysis - Disputes characteristics.

1	Parties	Architect	26		equitable adjustment	51		complaint	76		warranty
2		Engineer	27		liquidated damage	52		conflict	77		guarantee
3		Subcontractor	28		recover	54		CDA		**A13**	**S-Warranty**
4		Contracting Officer	29		retainage	55		duty	78		fraud(ulent)
	A0	**S-Parties**	30		loss	56		failure	79		faith - bad
5	Work	defect		**A5**	**S-Adjustment**	58		notice requirement		**A14**	**S-Fraud**
6		deficiency	31		bond	61		termination		**SUM**	**Sub-Total-1**
7		repair	34		Surety		**A9**	**S-Condition**			
	A1	**S-Defect**	35		Miller Act	57		force majeure			
8		change	36		default	59		subsurface			
10		- directive	37		lien	60		- differing site condition			
11		- purchase order	38		quantum meruit		**A10**	**S-Subsurface**		Excluded	
12		- replace		**A6**	**S-Bond**	63		ambiguity	9		- change order
14		extra (work)	39	Schedule	schedule	64		clarify	13		**add**
15		delete	40		acceleration	65		error (- omission)	18		**cost**
	A2	**S-Change**	41		delay	66		interpret	25		increase
16		scope	43		suspension	67		omission	32		payment bond
17		complete	44		withhold	69		drawings	33		performance bond
	A3	**S-Scope**	45		progress	70		specification	42		extension
19	Cost	compensation		**A7**	**S-Schedule**		**A11**	**S-Defintion**	53		expert witness
20		expense	49		damage	71		Liability	68		**plans**
21		overhead	50		dispute	72		misconduct	46		**Contract condition**
22		Eichleay formula		**A8**	**S-Dispute**	73		misrepresent	62		**Contract definition**
23		payment				74		mistake	80		faith - good
24		profit	47	Project	breach	75		negligent			Sub-Ex-Total-2
	A4	**S-Cost**	48	Risk	comply		**A12**	**S-Liability**			Total

Table A50 (FA-2). Final analysis - Distributions of dispute characteristics.

Summary Table

	YR 1984	YR 1985	YR 1986	YR 1987	YR 1994	YR 1995	YR 1996	YR 1997	Sub-1980'	Sub-1990'	Total
Cases	25	31	36	42	22	27	33	17	134	99	233
Tatal Count	1804	3021	3196	4921	3206	2671	3912	2527	12942	12316	25258
Avg. per Case	72.16	97.45	88.78	117.17	145.73	98.93	118.55	148.65	96.58	124.40	108.40
St. Devi.	48.7739	79.4392	81.1123	89.5523	106.4094	91.4111	85.5304	109.8322			



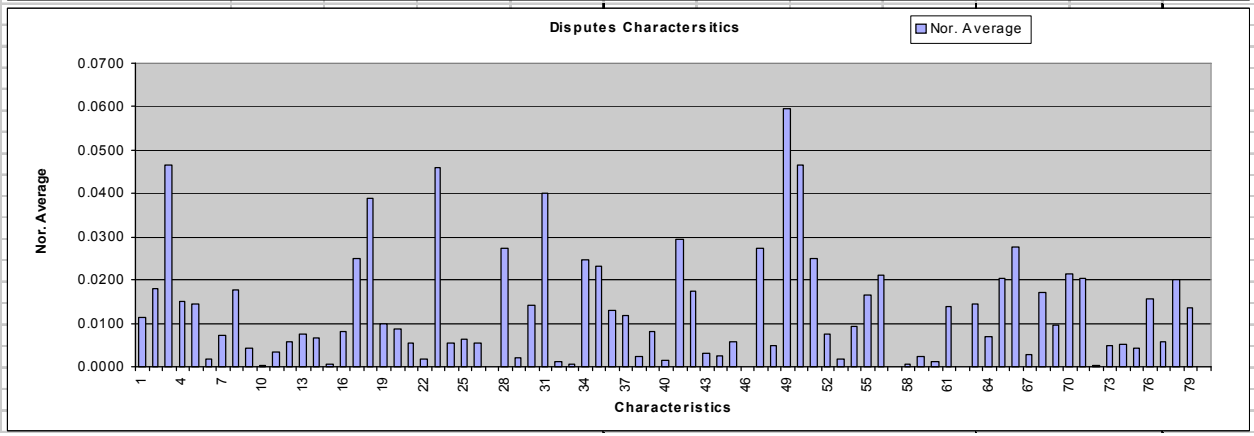


Table A51 (FA-3). Final analysis - Distributions of dispute characteristics

Normalized Value		Sub-1980'	Sub-1990'	Total
Cases		134	99	233
Tatal Count		12942	12316	25258
Avg. per Case		96.5821	124.4040	108.4034
St. Devi.				
		Avg. - 80	Avg. - 90	Avg.
	S-Parties	0.1018	0.0762	0.0909
A1	S-Defect	0.0179	0.0286	0.0224
A2	S-Change	0.0416	0.0304	0.0368
A3	S-Scope	0.0348	0.0322	0.0337
A4	S-Cost	0.0725	0.0862	0.0783
A5	S-Adjustment	0.0516	0.0446	0.0486
A6	S-Bond	0.1146	0.1197	0.1168
A7	S-Schedule	0.0457	0.0528	0.0487
A8	S-Dispute	0.1078	0.1029	0.1057
A9	S-Condition	0.1180	0.1395	0.1271
A10	S-Subsurface	0.0029	0.0043	0.0035
A11	S-Defintion	0.1031	0.0986	0.1012
A12	S-Liability	0.0332	0.0367	0.0347
A13	S-Warranty	0.0179	0.0233	0.0202
A14	S-Fraud	0.0278	0.0388	0.0325
	Sub-Excluded	0.1087	0.0854	0.0988
	Total	1	1	1

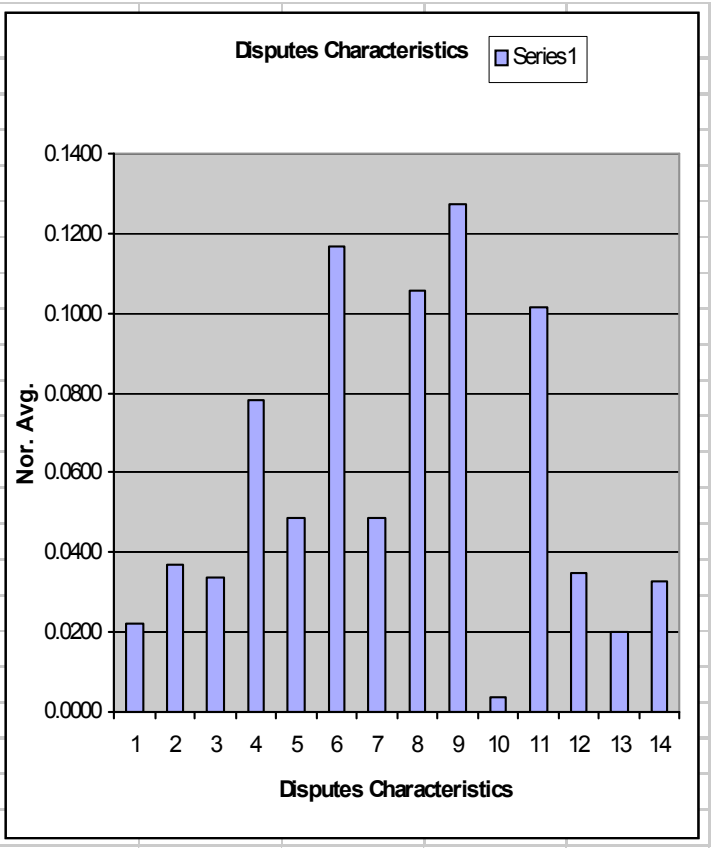


Table A52 (V-MW-1). Mann-Whitney test-1: 1980s and 1990s.

Mann-Whitney Test (Between 80s cases and 90s cases)

Ranks					Test Statistics	
					Grouping Variable: NUMBER	
A1	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6263.000
	1	134	114.24	15308.00	Wilcoxon W	15308.000
	2	99	120.74	11953.00	Z	-0.804
	Total	233			Asymp. Sig. (2-tailed)	0.421
A2	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	5609.000
	1	134	124.64	16702.00	Wilcoxon W	10559.000
	2	99	106.66	10559.00	Z	-2.066
	Total	233			Asymp. Sig. (2-tailed)	0.039
A3	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6510.500
	1	134	117.91	15800.50	Wilcoxon W	11460.500
	2	99	115.76	11460.50	Z	-0.243
	Total	233			Asymp. Sig. (2-tailed)	0.808
A4	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	5901.000
	1	134	111.54	14946.00	Wilcoxon W	14946.000
	2	99	124.39	12315.00	Z	-1.442
	Total	233			Asymp. Sig. (2-tailed)	0.149
A5	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6426.000
	1	134	118.54	15885.00	Wilcoxon W	11376.000
	2	99	114.91	11376.00	Z	-0.410
	Total	233			Asymp. Sig. (2-tailed)	0.682
A6	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6334.500
	1	134	114.77	15379.50	Wilcoxon W	15379.500
	2	99	120.02	11881.50	Z	-0.611
	Total	233			Asymp. Sig. (2-tailed)	0.541
A7	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6165.500
	1	134	113.51	15210.50	Wilcoxon W	15210.500
	2	99	121.72	12050.50	Z	-0.944
	Total	233			Asymp. Sig. (2-tailed)	0.345

Ranks					Test Statistics	
A8	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6157.500
	1	134	113.45	15202.50	Wilcoxon W	15202.500
	2	99	121.80	12058.50	Z	-0.936
	Total	233			Asymp. Sig. (2-tailed)	0.349
A9	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	5803.500
	1	134	110.81	14848.50	Wilcoxon W	14848.500
	2	99	125.38	12412.50	Z	-1.631
	Total	233			Asymp. Sig. (2-tailed)	0.103
A10	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6551.000
	1	134	116.39	15596.00	Wilcoxon W	15596.000
	2	99	117.83	11665.00	Z	-0.318
	Total	233			Asymp. Sig. (2-tailed)	0.751
A11	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6442.000
	1	134	115.57	15487.00	Wilcoxon W	15487.000
	2	99	118.93	11774.00	Z	-0.376
	Total	233			Asymp. Sig. (2-tailed)	0.707
A12	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6293.000
	1	134	114.46	15338.00	Wilcoxon W	15338.000
	2	99	120.43	11923.00	Z	-0.681
	Total	233			Asymp. Sig. (2-tailed)	0.496
A13	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	5751.000
	1	134	110.42	14796.00	Wilcoxon W	14796.000
	2	99	125.91	12465.00	Z	-1.948
	Total	233			Asymp. Sig. (2-tailed)	0.051
A14	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	6296.500
	1	134	114.49	15341.50	Wilcoxon W	15341.500
	2	99	120.40	11919.50	Z	-0.718
	Total	233			Asymp. Sig. (2-tailed)	0.473

Table A53 (V-MW-2). Mann-Whitney test-2: Between 1980s & 1990s, and 1993 cases.

Mann-Whitney Test (Between 80s and 90s cases and 1993 cases)

Ranks — Grouping Variable: NUMBER

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3170.000
A1	1	233	130.61	30431.00	Wilcoxon W	30431.000
	2	31	146.74	4549.00	Z	-1.205
	Total	264			Asymp. Sig. (2-tailed)	0.228

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3565.000
A2	1	233	132.30	30826.00	Wilcoxon W	30826.000
	2	31	134.00	4154.00	Z	-0.119
	Total	264			Asymp. Sig. (2-tailed)	0.905

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	2909.500
A3	1	233	135.51	31574.50	Wilcoxon W	3405.500
	2	31	109.85	3405.50	Z	-1.773
	Total	264			Asymp. Sig. (2-tailed)	0.076

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3052.000
A4	1	233	130.10	30313.00	Wilcoxon W	30313.000
	2	31	150.55	4667.00	Z	-1.403
	Total	264			Asymp. Sig. (2-tailed)	0.161

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3019.500
A5	1	233	129.96	30280.50	Wilcoxon W	30280.500
	2	31	151.60	4699.50	Z	-1.490
	Total	264			Asymp. Sig. (2-tailed)	0.136

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3247.500
A6	1	233	130.94	30508.50	Wilcoxon W	30508.500
	2	31	144.24	4471.50	Z	-0.945
	Total	264			Asymp. Sig. (2-tailed)	0.345

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3469.000
A7	1	233	131.89	30730.00	Wilcoxon W	30730.000
	2	31	137.10	4250.00	Z	-0.366
	Total	264			Asymp. Sig. (2-tailed)	0.714

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3439.000
A8	1	233	133.24	31045.00	Wilcoxon W	3935.000
	2	31	126.94	3935.00	Z	-0.432
	Total	264			Asymp. Sig. (2-tailed)	0.665

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	2972.000
A9	1	233	135.24	31512.00	Wilcoxon W	3468.000
	2	31	111.87	3468.00	Z	-1.601
	Total	264			Asymp. Sig. (2-tailed)	0.109

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3392.000
A10	1	233	133.44	31092.00	Wilcoxon W	3888.000
	2	31	125.42	3888.00	Z	-1.124
	Total	264			Asymp. Sig. (2-tailed)	0.261

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3588.000
A11	1	233	132.60	30896.00	Wilcoxon W	4084.000
	2	31	131.74	4084.00	Z	-0.059
	Total	264			Asymp. Sig. (2-tailed)	0.953

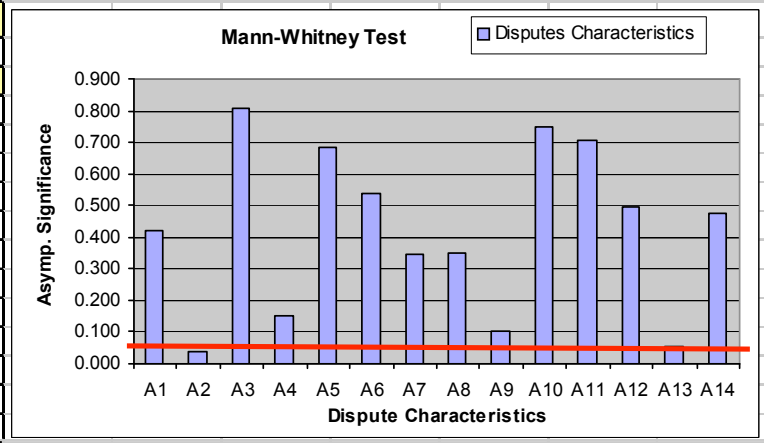
	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3593.500
A12	1	233	132.58	30890.50	Wilcoxon W	4089.500
	2	31	131.92	4089.50	Z	-0.046
	Total	264			Asymp. Sig. (2-tailed)	0.963

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3399.000
A13	1	233	131.59	30660.00	Wilcoxon W	30660.000
	2	31	139.35	4320.00	Z	-0.594
	Total	264			Asymp. Sig. (2-tailed)	0.552

	NUMBER	N	Mean Rank	Sum of Ranks	Mann-Whitney U	3447.000
A14	1	233	133.21	31037.00	Wilcoxon W	3943.000
	2	31	127.19	3943.00	Z	-0.447
	Total	264			Asymp. Sig. (2-tailed)	0.655

Table A54 (V-MW-3). Mann-Whitney test-3: Summary of test 1 and 2.

Mann-Whitney Test	(Between 80s cases and 90s cases)
Asymptotic. Sig. (2-tailed)	
A1	0.421
A2	0.039
A3	0.808
A4	0.149
A5	0.682
A6	0.541
A7	0.345
A8	0.349
A9	0.103
A10	0.751
A11	0.707
A12	0.496
A13	0.051
A14	0.473



Mann-Whitney Test	(Between 80s and 90s cases and 1993 cases)
Asymptotic. Sig. (2-tailed)	
A1	0.228
A2	0.905
A3	0.076
A4	0.161
A5	0.136
A6	0.345
A7	0.714
A8	0.665
A9	0.109
A10	0.261
A11	0.953
A12	0.963
A13	0.552
A14	0.655

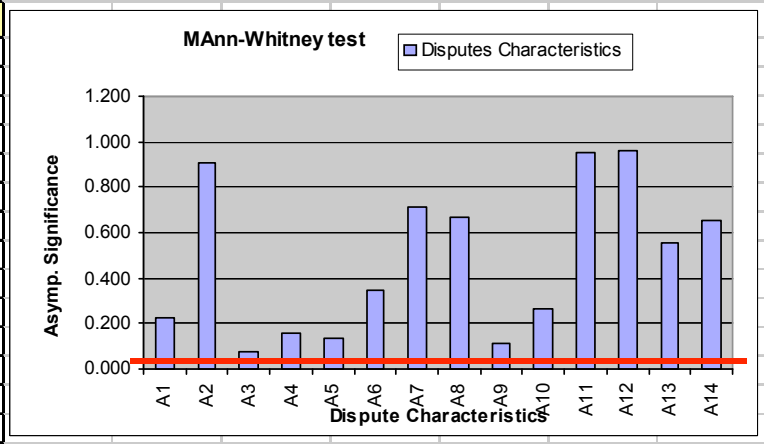
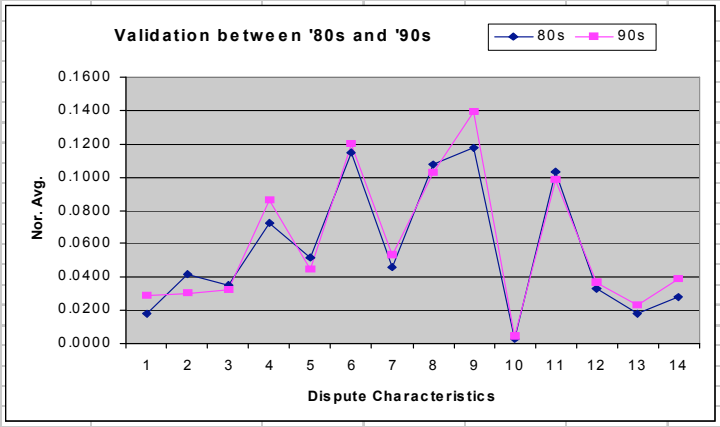


Table A55 (V-1). Summary of normalized value.

Normalized Value		YR 1984	YR 1985	YR 1986	YR 1987	YR 1994	YR 1995	YR 1996	YR 1997	Sub-1980'	Sub-1990'	Total	1993
Cases		25	31	36	42	22	27	33	17	134	99	233	
Tatal Count		1804	3021	3196	4921	3206	2671	3912	2527	12942	12316	25258	
Avg. per Case		72.1600	97.4516	88.7778	117.1667	145.7273	98.9259	118.5455	148.6471	96.5821	124.4040	108.4034	
St. Devi.		48.7739	79.4392	81.1123	89.5523	106.4094	91.4111	85.5304	109.8322				
										Avg. - 80	Avg. - 90	Avg.	
	S-Parties	0.0980	0.0988	0.0750	0.1294	0.0678	0.0602	0.0655	0.1331	0.1018	0.0762	0.0909	0.0682
A1	S-Defect	0.0184	0.0196	0.0254	0.0099	0.0391	0.0216	0.0297	0.0241	0.0179	0.0286	0.0224	0.0229
A2	S-Change	0.0436	0.0375	0.0334	0.0504	0.0234	0.0143	0.0507	0.0256	0.0416	0.0304	0.0368	0.0305
A3	S-Scope	0.0313	0.0318	0.0409	0.0340	0.0276	0.0241	0.0391	0.0377	0.0348	0.0322	0.0337	0.0241
A4	S-Cost	0.0610	0.0644	0.0710	0.0867	0.0928	0.0515	0.1162	0.0741	0.0725	0.0862	0.0783	0.0884
A5	S-Adjustment	0.0602	0.0502	0.0531	0.0463	0.0418	0.0346	0.0461	0.0609	0.0516	0.0446	0.0486	0.0564
A6	S-Bond	0.0665	0.0865	0.1485	0.1349	0.0955	0.1358	0.1110	0.1425	0.1146	0.1197	0.1168	0.1312
A7	S-Schedule	0.0763	0.0423	0.0238	0.0488	0.0824	0.0244	0.0587	0.0482	0.0457	0.0528	0.0487	0.0526
A8	S-Dispute	0.1471	0.1110	0.1074	0.0823	0.1003	0.1082	0.1117	0.0810	0.1078	0.1029	0.1057	0.0917
A9	S-Condition	0.0964	0.1769	0.0925	0.1091	0.1498	0.1821	0.1327	0.0719	0.1180	0.1395	0.1271	0.0929
A10	S-Subsurface	0.0052	0.0004	0.0011	0.0049	0.0076	0.0031	0.0039	0.0026	0.0029	0.0043	0.0035	0.0015
A11	S-Defintion	0.1119	0.0955	0.1195	0.0896	0.1113	0.1077	0.0711	0.1209	0.1031	0.0986	0.1012	0.0976
A12	S-Liability	0.0203	0.0353	0.0401	0.0334	0.0365	0.0325	0.0361	0.0446	0.0332	0.0367	0.0347	0.0348
A13	S-Warranty	0.0273	0.0268	0.0148	0.0084	0.0166	0.0351	0.0156	0.0279	0.0179	0.0233	0.0202	0.0131
A14	S-Fraud	0.0283	0.0280	0.0221	0.0325	0.0337	0.0646	0.0195	0.0419	0.0278	0.0388	0.0325	0.0227
	Sub-Excluded	0.1081	0.0950	0.1318	0.0995	0.0735	0.1002	0.0926	0.0631	0.1087	0.0854	0.0988	0.1716
	Total	1	1	1	1	1	1	1	1	1	1	1	1



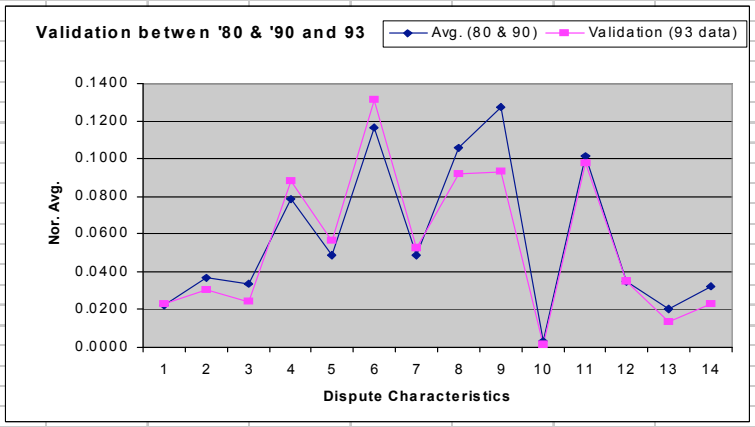


Table A56 (V-TT-1). T-test between 1980s and 1990s.

t-Test: Two-Sample Assuming Unequal Variances

A1	S-Defect		A2	S-Change		A3	S-Scope		A4	S-Cost	
	80s	*90s*		*80s*	*90s*		*80s*	*90s*		*80s*	*90s*
Mean	0.01789	0.02862	Mean	0.04159	0.03040	Mean	0.03484	0.03222	Mean	0.07253	0.08615
Variance	0.00187	0.00378	Variance	0.00358	0.00352	Variance	0.00150	0.00108	Variance	0.00615	0.00749
Observations	134	99	Observations	134	99	Observations	134	99	Observations	134	99
Hypothesized Mean Differe	0		Hypothesized Mean D	0		Hypothesized Mean D	0		Hypothesized Mean D	0	
df	166		df	212		df	227		df	199	
t Stat	-1.48569		t Stat	1.41745		t Stat	0.55761		t Stat	-1.23608	
P(T<=t) one-tail	0.06963		P(T<=t) one-tail	0.07891		P(T<=t) one-tail	0.28883		P(T<=t) one-tail	0.10894	
t Critical one-tail	1.65408		t Critical one-tail	1.65207		t Critical one-tail	1.65159		t Critical one-tail	1.65255	
P(T<=t) two-tail	0.13926		P(T<=t) two-tail	0.15782		P(T<=t) two-tail	0.57766		P(T<=t) two-tail	0.21789	
t Critical two-tail	1.97436		t Critical two-tail	1.97122		t Critical two-tail	1.97047		t Critical two-tail	1.97196	

A5	S-Adjustment		A6	S-Bond		A7	S-Schedule		A8	S-Dispute	
	80s	*90s*		*80s*	*90s*		*80s*	*90s*		*80s*	*90s*
Mean	0.05161	0.04456	Mean	0.11458	0.11970	Mean	0.04569	0.05279	Mean	0.10777	0.10292
Variance	0.00409	0.00264	Variance	0.03317	0.02756	Variance	0.00495	0.00668	Variance	0.01357	0.00784
Observations	134	99	Observations	134	99	Observations	134	99	Observations	134	99
Hypothesized Mean Differe	0		Hypothesized Mean D	0		Hypothesized Mean D	0		Hypothesized Mean D	0	
df	229		df	221		df	192		df	231	
t Stat	0.93208		t Stat	-0.22317		t Stat	-0.69523		t Stat	0.36147	
P(T<=t) one-tail	0.17614		P(T<=t) one-tail	0.41180		P(T<=t) one-tail	0.24388		P(T<=t) one-tail	0.35904	
t Critical one-tail	1.65154		t Critical one-tail	1.65178		t Critical one-tail	1.65283		t Critical one-tail	1.65148	
P(T<=t) two-tail	0.35228		P(T<=t) two-tail	0.82361		P(T<=t) two-tail	0.48775		P(T<=t) two-tail	0.71808	
t Critical two-tail	1.97037		t Critical two-tail	1.97076		t Critical two-tail	1.97239		t Critical two-tail	1.97029	

A9	S-Condition		A10	S-Subsurface		A11	S-Defintion		A12	S-Liability	
	80s	*90s*		*80s*	*90s*		*80s*	*90s*		*80s*	*90s*
Mean	0.11796	0.13952	Mean	0.00288	0.00428	Mean	0.10314	0.09855	Mean	0.03319	0.03668
Variance	0.01315	0.01333	Variance	0.00014	0.00030	Variance	0.01904	0.01722	Variance	0.00228	0.00215
Observations	134	99	Observations	134	99	Observations	134	99	Observations	134	99
Hypothesized Mean Differe	0		Hypothesized Mean D	0		Hypothesized Mean D	0		Hypothesized Mean D	0	
df	211		df	161		df	217		df	215	
t Stat	-1.41275		t Stat	-0.69317		t Stat	0.25802		t Stat	-0.56047	
P(T<=t) one-tail	0.07960		P(T<=t) one-tail	0.24460		P(T<=t) one-tail	0.39832		P(T<=t) one-tail	0.28787	
t Critical one-tail	1.65211		t Critical one-tail	1.65437		t Critical one-tail	1.65191		t Critical one-tail	1.65197	
P(T<=t) two-tail	0.15920		P(T<=t) two-tail	0.48920		P(T<=t) two-tail	0.79664		P(T<=t) two-tail	0.57574	
t Critical two-tail	1.97127		t Critical two-tail	1.97481		t Critical two-tail	1.97096		t Critical two-tail	1.97106	

A13	S-Warranty		A14	S-Fraud	
	80s	*90s*		*80s*	*90s*
Mean	0.01789	0.02325	Mean	0.02784	0.03880
Variance	0.00221	0.00272	Variance	0.00516	0.00493
Observations	134	99	Observations	134	99
Hypothesized Mean Differe	0		Hypothesized Mean D	0	
df	199		df	214	
t Stat	-0.80850		t Stat	-1.16590	
P(T<=t) one-tail	0.20988		P(T<=t) one-tail	0.12248	
t Critical one-tail	1.65255		t Critical one-tail	1.65201	
P(T<=t) two-tail	0.41977		P(T<=t) two-tail	0.24495	
t Critical two-tail	1.97196		t Critical two-tail	1.97111	

Table A57 (V-TT-2). T-test between 1980s, 1990s, and 1993.

t-Test: Two-Sample Assuming Unequal Variances

A1	S-Defect		A2	S-Change		A3	S-Scope		A4	S-Cost	
	80s & 90s	*1993*		*80s & 90s*	*1993*		*80s & 90s*	*1993*		*80s & 90s*	*1993*
Mean	0.02245	0.02286	Mean	0.03684	0.03046	Mean	0.03373	0.02412	Mean	0.07832	0.08836
Variance	0.00270	0.00210	Variance	0.00357	0.00137	Variance	0.00132	0.00099	Variance	0.00673	0.00518
Observations	233	31	Observations	233	31	Observations	233	31	Observations	233	31
Hypothesized Mean Differe	0		Hypothesized Mean D	0		Hypothesized Mean D	0		Hypothesized Mean D	0	
df	41		df	54		df	41		df	41	
t Stat	-0.04654		t Stat	0.82695		t Stat	1.56420		t Stat	-0.71779	
P(T<=t) one-tail	0.48155		P(T<=t) one-tail	0.20595		P(T<=t) one-tail	0.06273		P(T<=t) one-tail	0.23848	
t Critical one-tail	1.68288		t Critical one-tail	1.67357		t Critical one-tail	1.68288		t Critical one-tail	1.68288	
P(T<=t) two-tail	0.96310		P(T<=t) two-tail	0.41190		P(T<=t) two-tail	0.12546		P(T<=t) two-tail	0.47696	
t Critical two-tail	2.01954		t Critical two-tail	2.00488		t Critical two-tail	2.01954		t Critical two-tail	2.01954	

A5	S-Adjustment		A6	S-Bond		A7	S-Schedule		A8	S-Dispute	
	80s & 90s	*1993*		*80s & 90s*	*1993*		*80s & 90s*	*1993*		*80s & 90s*	*1993*
Mean	0.04861	0.05638	Mean	0.11676	0.13121	Mean	0.04871	0.05258	Mean	0.10571	0.09173
Variance	0.00347	0.00258	Variance	0.03066	0.02662	Variance	0.00567	0.00694	Variance	0.01110	0.00724
Observations	233	31	Observations	233	31	Observations	233	31	Observations	233	31
Hypothesized Mean Differe	0		Hypothesized Mean D	0		Hypothesized Mean D	0		Hypothesized Mean D	0	
df	42		df	40		df	37		df	43	
t Stat	-0.78469		t Stat	-0.45912		t Stat	-0.24568		t Stat	0.83404	
P(T<=t) one-tail	0.21852		P(T<=t) one-tail	0.32432		P(T<=t) one-tail	0.40364		P(T<=t) one-tail	0.20443	
t Critical one-tail	1.68195		t Critical one-tail	1.68385		t Critical one-tail	1.68709		t Critical one-tail	1.68107	
P(T<=t) two-tail	0.43704		P(T<=t) two-tail	0.64864		P(T<=t) two-tail	0.80729		P(T<=t) two-tail	0.40887	
t Critical two-tail	2.01808		t Critical two-tail	2.02107		t Critical two-tail	2.02619		t Critical two-tail	2.01669	

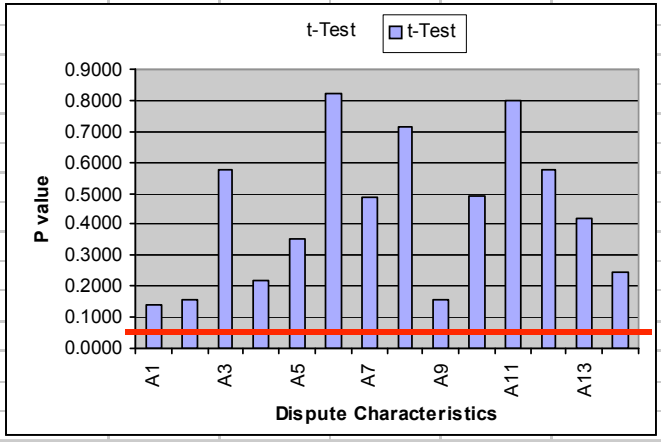
A9	S-Condition		A10	S-Subsurface		A11	S-Defintion		A12	S-Liability	
	80s & 90s	*1993*		*80s & 90s*	*1993*		*80s & 90s*	*1993*		*80s & 90s*	*1993*
Mean	0.12712	0.09291	Mean	0.00348	0.00152	Mean	0.10119	0.09755	Mean	0.03467	0.03480
Variance	0.01328	0.00699	Variance	0.00021	0.00007	Variance	0.01819	0.01390	Variance	0.00222	0.00246
Observations	233	31	Observations	233	31	Observations	233	31	Observations	233	31
Hypothesized Mean Differe	0		Hypothesized Mean D	0		Hypothesized Mean D	0		Hypothesized Mean D	0	
df	47		df	56		df	41		df	38	
t Stat	2.03466		t Stat	1.10012		t Stat	0.15849		t Stat	-0.01300	
P(T<=t) one-tail	0.02377		P(T<=t) one-tail	0.13799		P(T<=t) one-tail	0.43743		P(T<=t) one-tail	0.49485	
t Critical one-tail	1.67793		t Critical one-tail	1.67252		t Critical one-tail	1.68288		t Critical one-tail	1.68595	
P(T<=t) two-tail	0.04755		P(T<=t) two-tail	0.27599		P(T<=t) two-tail	0.87485		P(T<=t) two-tail	0.98970	
t Critical two-tail	2.01174		t Critical two-tail	2.00324		t Critical two-tail	2.01954		t Critical two-tail	2.02439	

A13	S-Warranty		A14	S-Fraud	
	80s & 90s	*1993*		*80s & 90s*	*1993*
Mean	0.02017	0.01307	Mean	0.03250	0.02270
Variance	0.00242	0.00039	Variance	0.00507	0.00139
Observations	233	31	Observations	233	31
Hypothesized Mean Differe	0		Hypothesized Mean D	0	
df	92		df	64	
t Stat	1.48125		t Stat	1.20162	
P(T<=t) one-tail	0.07098		P(T<=t) one-tail	0.11697	
t Critical one-tail	1.66159		t Critical one-tail	1.66901	
P(T<=t) two-tail	0.14196		P(T<=t) two-tail	0.23394	
t Critical two-tail	1.98609		t Critical two-tail	1.99773	

Table A58 (V-TT-3). Summary of t-test.

t-Test: Two-Sample Assuming Unequal Variances (Between 80s and 90s)

P(T<=t) two-tail	
A1	0.1393
A2	0.1578
A3	0.5777
A4	0.2179
A5	0.3523
A6	0.8236
A7	0.4878
A8	0.7181
A9	0.1592
A10	0.4892
A11	0.7966
A12	0.5757
A13	0.4198
A14	0.2450



t-Test: Two-Sample Assuming Unequal Vari.(Between 80s & 90s and 1993)

P(T<=t) two-tail	
A1	0.9631
A2	0.4119
A3	0.1255
A4	0.4770
A5	0.4370
A6	0.6486
A7	0.8073
A8	0.4089
A9	0.0475
A10	0.2760
A11	0.8749
A12	0.9897
A13	0.1420
A14	0.2339

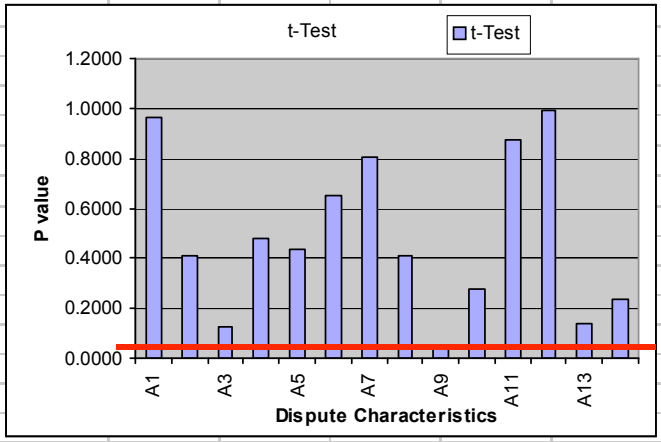


Table A59 (S-1). Summary of dispute cases – By year.

Year	Total Cases		Affirmed Cases		Other Opinions		Public		Civil	Arch
	Numbers	%	Numbers	%	Numbers	%	Private			
1984	25	10.7%	17	68.0%	4	16.0%	21	84.0%	12	9
							4	16.0%	0	4
1985	31	13.3%	13	41.9%	4	12.9%	21	67.7%	12	9
							10	32.3%	4	6
1986	36	15.5%	19	52.8%	3	8.3%	29	80.6%	20	9
							7	19.4%	0	7
1987	42	18.0%	15	35.7%	1	2.4%	33	78.6%	15	18
							9	21.4%	2	7
Sub-Total	134	57.5%	64	47.8%	12	9.0%	104	77.6%	65	69
							30	22.4%	48.5%	51.5%
1994	22	9.4%	9	40.9%	4	18.2%	15	68.2%	10	5
							7	31.8%	2	5
1995	27	11.6%	15	55.6%	3	11.1%	21	77.8%	11	10
							6	22.2%	3	3
1996	33	14.2%	18	54.5%	1	3.0%	27	81.8%	16	11
							6	18.2%	1	5
1997	17	7.3%	5	29.4%	2	11.8%	12	70.6%	8	4
							5	29.4%	2	3
Sub-Total	99	42.5%	47	47.5%	10	10.1%	75	75.8%	53	46
							24	24.2%	53.5%	46.5%
Total	233	100.0%	111	47.6%	22	9.4%	179	76.8%	118	115
							54	23.2%	50.6%	49.4%

Table A60 (S-2). Summary of dispute cases – By appellate court.

Appellate Court	Total Cases		Affirmed Cases		Public		Civil	Arch
	Numbers	%	Numbers	%	Private			
1st C.	6	2.6%	4	66.7%	4	66.7%	3	1
					2	33.3%	0	2
2nd C.	17	7.3%	8	47.1%	13	76.5%	5	8
					4	23.5%	2	2
3rd C.	9	3.9%	3	33.3%	5	55.6%	2	3
					4	44.4%	0	4
4th C.	29	12.4%	13	44.8%	22	75.9%	13	9
					7	24.1%	1	6
5th C.	31	13.3%	9	29.0%	22	71.0%	14	8
					9	29.0%	5	4
6th C.	10	4.3%	5	50.0%	8	80.0%	5	3
					2	20.0%	0	2
7th C.	16	6.9%	7	43.8%	10	62.5%	7	3
					6	37.5%	2	4
8th C.	14	6.0%	9	64.3%	10	71.4%	5	5
					4	28.6%	0	4
9th C.	21	9.0%	15	71.4%	18	85.7%	14	4
					3	14.3%	1	2
10th C.	12	5.2%	3	25.0%	9	75.0%	8	1
					3	25.0%	2	1
11th C.	20	8.6%	7	35.0%	10	50.0%	5	5
					10	50.0%	1	9
D.C. C.	4	1.7%	1	25.0%	4	100.0%	3	1
					0	0.0%	0	0
Fed. C.	44	18.9%	27	61.4%	44	100.0%	19	25
					0	0.0%	0	0
Total	233	100.0%	111	47.6%	179	76.8%	117	116
					54	23.2%	50.2%	49.8%

APPENDIX B

1993 - 1F.3d.1005

GREEN CONSTRUCTION COMPANY, an Iowa corporation, Plaintiff-Appellant and Cross-Appellee, v. THE KANSAS POWER & LIGHT COMPANY, Defendant-Counterclaimant Appellee and Cross-Appellant, v. SEABOARD SURETY COMPANY and GREEN HOLDINGS, INC., Counterclaim-Defendants Appellees.

No. 91-3150, 91-3151

UNITED STATES COURT OF APPEALS FOR THE TENTH CIRCUIT

1 F.3d 1005; 1993 U.S. App. LEXIS 18357; 26 Fed. R. Serv. 3d (Callaghan) 1459

July 21, 1993, Filed

PRIOR HISTORY: [**1] APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF KANSAS D.C. No. 87-2070-S. D.C. Judge DALE E. SAFFELS

COUNSEL: John P. Ahlers, Barokas & Martin, Seattle, Washington (Kevin E. Glynn, Niewald, Waldeck & Brown, Kansas City, Missouri and Gilbert G. Lundstrom, Woods & Aitken, Lincoln, Nebraska, with him on the brief) for Plaintiff-Appellant.

Jeffrey S. Southard, The Kansas Power & Light Company, Topeka, Kansas (J. Nick Badgerow, Spencer, Fane, Britt & Browne, Overland Park, Kansas, with him on the brief) for Defendant-Appellee.

JUDGES: Before KELLY and SETH, Circuit Judges, and KANE, District Judge. *

* The Honorable John L. Kane, Jr., Senior United States District Judge for the District of Colorado, sitting by designation.

OPINIONBY: KELLY

OPINION:
[*1007] KELLY, Circuit Judge.

This appeal arises out of a contract dispute over the construction of a dam by Plaintiff-appellant Green Construction for Defendant-appellee Kansas Power and Light (KPL). Green Construction appeals the district court's order limiting its recovery to contract damages and disallowing additional expenses and prejudgment interest. KPL cross-appeals the district court's orders denying KPL's motions for realignment of the parties, bifurcation of the trial, post-trial [**2] juror interviews and judgment notwithstanding the verdict or a new trial. KPL also appeals the admission of evidence of insurance and the testimony of multiple expert witnesses. Our jurisdiction arises under 28 U.S.C. 1291 and we affirm.

Background

The best laid plans . . .

In 1984, KPL solicited bids for the construction of an earthen dam to create a reservoir at a power plant in Kansas. The dam was to be built out of the clay soil found at the project site. KPL provided bidders with a Geotechnical Data Report on the subsurface conditions at the site, but instructed the bidders to make their own investigation as there would be no future adjustment in price for unforeseen conditions.

Green was the lowest bidder, but did not conduct an investigation.

[*1008] The contract required Green to construct the dam with a soil moisture content that would yield the greatest strength. The soil moisture range was to be +3% to -2% from "optimum." The soil in the borrow area (located behind the dam site) contained more moisture than indicated in the Geotechnical Report, however. Green began construction in the spring of 1985 and finished in June 1986. Within [**3] a few weeks, the dam developed cracks which Green attempted, unsuccessfully, to fix. KPL refused to accept the dam and eventually replaced the dam at its own cost. KPL withheld $ 420,000, or 5% of the contract price, which would have been due to Green upon acceptance.

Green initiated litigation to collect the 5% retainage as well as extra costs incurred during construction, based on theories of implied warranty, constructive change and misrepresentation. Green argued that the dam failed due to KPL's design. KPL counterclaimed alleging defective construction and breach of contract. The district court granted summary judgment for KPL on Green's claims for additional compensation, with the exception of the compensation based on misrepresentation, which it ruled would be available only as a set-off against any damages awarded to KPL. A jury trial resulted in a verdict for Green on its retainage claim and denying recovery to KPL. Both sides appeal, raising numerous issues.

Discussion

I. Green's Claim for Additional Compensation

Green Construction appeals the district court's partial summary judgment on its claim for expenses in excess of the contract price. The district court [**4] eliminated Green's theories of implied warranty and constructive change, and limited any recovery based on misrepresentation to a set-off against damages that might be awarded to KPL.

We review summary judgment de novo and apply the same legal standard used by the district court under Fed. R. Civ. P. 56(c). Applied Genetics Int'l, Inc. v. First Affiliated Sec., Inc., 912 F.2d 1238, 1241 (10th Cir. 1990). Summary judgment is appropriate if "there is no genuine issue as to any material fact and . . . the moving party is entitled to a judgment as a matter of law." Fed. R. Civ. P. 56(c). We view the evidence and draw any inferences in a light most favorable to the party opposing summary judgment, but that party must identify sufficient evidence which would require submission of the case to a jury. Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 249-52, 91 L. Ed. 2d 202, 106 S. Ct. 2505 (1986); Hall v. Bellmon, 935 F.2d 1106, 1111 (10th Cir. 1991). Kansas law governs in this diversity action, and in the absence of state cases on point we will look to other state courts as well as federal decisions. Armijo v. Ex Cam, Inc., 843 F.2d 406, 407 (10th Cir. 1988). [**5] We review de novo the district court's application of Kansas law. Salve Regina College v. Russell, 499 U.S. 225, 113 L. Ed. 2d 190, 111 S. Ct. 1217 (1991).

A. Implied Warranty

Green contends that the information provided to bidders regarding subsurface conditions created an implied warranty of these conditions. The district court found no implied warranty as a matter of law because the construction contract expressly instructed bidders to conduct their own investigation of the site, placed the risk of excessively moist soil on the contractor, and stated that the "logs of test borings may not be indicative of all subsurface conditions that may be encountered." n1

- - - - - - - - - - - - - - - - - -Footnotes- - - - - - - - - - - - - - - - - -

n1 The relevant contract clauses are as follows:

A.7 LOCAL CONDITIONS. Each bidder shall visit the site of the work and thoroughly inform himself relative to construction hazards and procedure, labor, and all other conditions and factors, local and

otherwise, which would affect the prosecution and completion of the work and the cost thereof . . . .

It must be understood and agreed that all such factors have been properly investigated and considered in the preparation of every proposal submitted, as there will be no subsequent financial adjustment, to any contract awarded thereunder, which is based on the lack of such prior information or its effect on the cost of the work.

A.8 SUBSURFACE CONDITIONS. The determination of the character of subsurface materials . . . shall be each bidder's responsibility. Borings, field testing, and laboratory tests have been performed for the project design. This information has been bound separately and is issued with these specifications. Rock cores from this site are available for inspection upon request at the Jeffrey Energy Center. Logs of test borings may not be indicative of all subsurface conditions that may be encountered.

Aplt. App. at 28.

- - - - - - - - - - - - - - - - -End Footnotes- - - - - - - - - - - - - - - - - [**6]

[*1009] Green argues that: (1) the project owner impliedly warrants the accuracy and suitability of its plans and specifications; (2) additional compensation was waived only as to local conditions, as addressed in Section A.7 of the contract, and not as to subsurface conditions, addressed in Section A.8; (3) boilerplate disclaimers do not abrogate an implied warranty; and (4) KPL cannot disclaim the accuracy of the tests where the data constitutes a positive misrepresentation.

Generally, absent fraud, the party who agrees to complete construction for a fixed cost must absorb any losses resulting from unforeseen conditions. Reece Const. Co. v. State Highway Com'n, 6 Kan. App. 2d 188, 627 P.2d 361, 364 (Kan. App. 1981). When a contract contains a site inspection clause, it places a duty on the contractor to exercise professional skill in inspecting the site and estimating the cost of work. Pinkerton and Laws Co. v. Roadway Express, Inc., 650 F. Supp. 1138, 1146 (N.D. Ga. 1986). Thus, Green is not entitled to additional compensation merely because the project was more expensive due to unexpected soil moisture. See United States v. Spearin, 248 U.S. 132, 63 L. Ed. 166, 39 S. Ct. 59 (1918). [**7] Green may still recover, though, if KPL impliedly warranted the plans and specifications, and then breached that warranty. Id. at 136; Trustees of Indiana Univ. v. Aetna Cas. & Sur. Co., 920 F.2d 429, 436 (7th Cir. 1990). An implied warranty will only be found where the owner made unequivocal affirmative statements which were false or misleading. Christie v. United States, 237 U.S. 234, 59 L. Ed. 933, 35 S. Ct. 565 (1915). Such a warranty is not avoided by standard clauses disclaiming responsibility for the accuracy of data. Hollerbach v. United States, 233 U.S. 165, 58 L. Ed. 898, 34 S. Ct. 553 (1914).

However, where a contractor has a duty to make an independent inspection, reliance on the owner's specifications may very well be unreasonable. Brant Constr. Co. v. Metropolitan Water Reclam. Dist., 967 F.2d 244, 248 (7th Cir. 1992). An owner does not create an implied warranty by providing some soil information but instructing the contractor that the information may not be complete and that an independent site and soil investigation is required. See, McDevitt & Street Co. v. Marriott Corp., 713 F. Supp. 906, 914 (E.D. Va. 1989) [**8] aff'd in relevant part, 911 F.2d 723 (4th Cir. 1990); Pinkerton, 650 F. Supp. at 1146; Anderson v. Golden, 569 F. Supp. 122, 142-43 (S.D. Ga. 1982). This contract, like those in McDevitt, Pinkerton and Anderson, squarely placed the risk of uncertainty as to site and soil conditions on the contractor. There was no implied warranty.

B. Constructive Change

Green's next theory is that the extra work caused by the wet soil amounted to a material change in the scope of the project, entitling Green to additional compensation. Again, we disagree.

When Green encountered wet soil in the designated borrow area, Green opted to obtain soil from another location rather than process (dry out) the soil from the borrow area. KPL consented to the change. Green relies on the "changes" clause, section D.27 of the contract, and on KPL's assent to the change, in support of this theory of recovery. Section D.27 provides in part:

The COMPANY, without invalidating the Contract, may order any extra work or make any changes by altering, adding to or reducing the work, provided the Contract price [**9] be adjusted as provided herein and evidenced by written agreement . . . .

Aplt. App. at 58. The district court found that section D.27 applies only to changes in the scope of work caused by amendments to the project design, and not to difficulties in performance due to unforeseen conditions.

Generally, a contractor may recover for additional work necessitated by a material change in specifications. 13 Am. Jur. 2d Building and Construction Contracts 19 [*1010] (1964 & Supp. 1993). However, there can be no recovery for extra work if the work is covered by the terms of the contract. Id. "The extra work doctrine" allows additional compensation only "for work that was not within the scope of the contract, such that the parties could not have established a contract price of their own." Brant Constr., 967 F.2d at 248. Here, Green is not entitled to additional compensation merely because the work it had contracted for was made more expensive by wet soil. See Pinkerton, 650 F. Supp. 1138, 1146 (citing Spearin, 248 U.S. 132). The fact that KPL assented to the change in the source of soil does not amount [**10] to a change in the scope of the project.

C. Misrepresentation

Even where no implied warranty exists, an owner may be liable for unknowingly (or "innocently") misrepresenting material facts about site conditions. The district court ruled that an innocent misrepresentation claim may be maintained only for equitable relief or as a defense to breach of contract. The court therefore limited Green's use of the claim to that of a defense in the event of an award to KPL. Green argues that money damages are available for innocent misrepresentation and that the jury should have been so instructed.

The Restatement (Second) of Contracts 164 (1981) provides that where one party makes a material misrepresentation, which the recipient justifiably relies on, the contract is voidable by the recipient. Innocent misrepresentation claims are usually limited to equitable relief. See id.; 17 C.J.S. Contracts 147, 152. Kansas law recognizes the equitable theory of innocent misrepresentation as grounds for rescission of a contract. Topinka v. American Eagle Fire Ins. Co., 167 Kan. 181, 205 P.2d 991, 993-94 (Kan. 1949). Green relies on Nichols v. Nold, 174 Kan. 613, 258 P.2d 317 (Kan. 1953) [**11] for the proposition that money damages are available for innocent misrepresentation. However, Nichols was a product liability action concerning the theory of implied warranty, not innocent misrepresentation. We agree with the district
court that innocent misrepresentation in Kansas is limited to equitable relief, and the court did not err in refusing to instruct the jury on an affirmative claim for damages.

II. Green's Claim for Prejudgment Interest

Finally, Green contends that the court erred in denying its Rule 59(e) motion for prejudgment interest on the damage award. We review the district court's order for an abuse of discretion. Oklahoma Radio Assocs. v. F.D.I.C., 987 F.2d 685, 697 (10th Cir. 1993); U.S. Indus. Inc. v. Touche Ross & Co., 854 F.2d 1223, 1255 (10th Cir. 1988).

In Kansas, prejudgment interest is allowed on liquidated claims. Kan. Stat. Ann. 16-201 (1980); Plains

Resources, Inc. v. Gable, 235 Kan. 580, 682 P.2d 653 (Kan. 1984); Royal College Shop, Inc. v. Northern Ins. Co., 895 F.2d 670, 673 (10th Cir. 1990). "A claim becomes liquidated when both [**12] the amount due and the date on which it is due are fixed and certain, or when the same become definitely ascertainable by mathematical computation." Plains Resources, 682 P.2d at 657. It is irrelevant that the underlying liability is disputed, so long as the amount of damages is certain. Royal College, 895 F.2d at 674 (citing Smart v. Hardware Dealers Mut. Fire Ins. Co., 181 F. Supp. 575 (D. Kan. 1960)). The district court ruled that damages were not liquidated because the amount was disputed throughout trial and required a jury determination, so it could not be simply ascertained by a mathematical computation. Green prayed for $ 422,010.56 on its retainage claim at trial. KPL counterclaimed for breach of contract, demanding $ 12.9 million. KPL alternatively argued that any award to Green for retainage should be reduced pursuant to a "change order." The jury awarded $ 222,312.56 to Green. This is not a case where the parties stipulated to the damages or even generally agreed on the damages. See Royal College Shop, 895 F.2d at 674; Crawford v. Prudential Ins. Co., 245 Kan. 724, 783 P.2d 900, 909 (Kan. 1989). [**13] The district court did not abuse its discretion in denying prejudgment interest.

[*1011] **III. KPL's Motions**

KPL appeals numerous unfavorable rulings on its motions, some of which merit our attention, while others border on frivolous.

Some of KPL's arguments remind us that "too often, attorneys forget that the potential for success on appeal begins at the pretrial preparation stage [and] continues during the trial . . . . More often than one would expect, cases are lost on appeal due to a failure of counsel at the trial level to make a proper record, or to raise arguments or objections . . . ." The Honorable Lawrence W. Pierce, Appellate Advocacy: Some Reflections from the Bench, 61 Fordham L. Rev. 829, 834 (1993). This admonition should be heeded by all who would litigate.

A. Motion for Realignment of the Parties

KPL moved for a realignment of the parties sixteen months prior to trial, arguing before the magistrate that KPL was the "real" plaintiff and that Green had simply won the race to the courthouse. KPL relies on the disparity in the size of the damage claims; it sought $ 12.9 million, while Green was asking for a mere $ 422,000. KPL also [**14] contends that it was prejudiced by its defendant status at trial. This argument is meritless. First, KPL fails to direct us to any authority supporting this position. Second, we have previously held that the denial of a request for realignment, where the request is made in order to proceed first and last at trial, is not reversible error. Commercial Iron & Metal Co. v. Bache Halsey Stuart, Inc., 581 F.2d 246, 250 (10th Cir. 1978); cert. denied, 440 U.S. 914, 59 L. Ed. 2d 463, 99 S. Ct. 1229 (1979). Finally, KPL failed to object to the magistrate's ruling within 10 days as required by Fed. R. Civ. P. 72(a). A party may not wait to see whether the verdict is favorable before deciding to object; failure to raise the issue below results in a waiver. Moore v. United States, 950 F.2d 656, 659 (10th Cir. 1991); Polson v. Davis, 895 F.2d 705, 711 (10th Cir. 1990).

B. Motion for Bifurcation and Objection to Jury Trial

KPL moved to strike Green Construction's request for a jury trial as untimely, arguing that the right was waived under Fed. R. Civ. P. 38(b) & (d) and that the nature of the case [**15] was too technical for a jury. Alternatively, KPL moved to bifurcate the claims against Green Holdings in order to simplify the trial. Both motions were denied. We review the district court's denial for abuse of discretion. Eastridge Dev. Co. v. Halpert Assocs., 853 F.2d 772, 781 (10th Cir. 1988); Paramount Pictures Corp. v. Thompson Theatres, Inc., 621 F.2d 1088, 1090 (10th Cir. 1980).

Green requested a jury trial, but not within the ten days as provided by Rule 38(b). The district court granted Green's request. See Fed. R. Civ. P. 39(b); Jolivet v. Deland, 966 F.2d 573, 577 (10th Cir. 1992). We have previously held that a jury trial should be granted in the absence of "'strong and compelling reasons to the contrary.'" AMF Tuboscope, Inc. v. Cunningham, 352 F.2d 150, 155 (10th Cir. 1965) (quoting Swofford v. B & W, Inc., 336 F.2d 406, 409 (5th Cir. 1964) cert. denied, 379 U.S. 962, 13 L. Ed. 2d 557, 85 S. Ct. 653 (1965)). KPL's reasoning for striking the jury trial was that the subject matter would be too confusing for [**16] a jury. However, juries are commonly called upon to decide complex cases. We fail to see how the complexity of the subject was particularly prejudicial to KPL and we find no abuse of discretion.

In the absence of a bench trial, KPL moved to bifurcate its alter ego claims against Green Holdings, in order to simplify the trial for the jury. KPL proposed trying the liability case with Green Construction first and, if KPL prevailed, holding a second trial against Green Holdings as the alter ego of Green Construction. The district courts have "'broad discretion in deciding whether to sever issues for trial and the exercise of that discretion will be set aside only if clearly abused.'" Eastridge Dev. Co., 853 F.2d at 781 (quoting Easton v. City of Boulder, 776 F.2d 1441, 1447 (10th Cir. 1985) cert. denied, 479 U.S. 816, 93 L. Ed. 2d 28, 107 S. Ct. 71 (1986)). KPL fails to show that it suffered prejudice from this ruling and we find no abuse of discretion.

C. Motion for Post-trial Juror Interviews

KPL moved for an order allowing post-trial communication with the jury in order to [*1012] determine whether the jurors were influenced [**17] by outside factors. KPL's basis for the motion was that the husband of the jury foreperson was present during the entire trial and spoke to attorneys for both KPL and Green, but most often to those representing Green. He also chatted with corporate representatives of both parties who were observing the trial, and he regularly lunched with the jurors. KPL does not know the subject of the discussions involving Green, but claims that the juror's husband attempted to discuss specifics of the trial with KPL's attorneys on two occasions. Aplee. Supp. App. at 635-37. KPL's attorneys claim that they advised Green's attorneys that these communications appeared improper. KPL's attorneys neither expressed that concern to the judge nor formally objected. KPL now asserts that it was not fully aware of the extent of the relationship until the juror's husband sat at Green's counsel's table while awaiting the jury's deliberations. Green's attorneys submitted affidavits indicating that neither the trial nor the deliberations were discussed with the juror's husband. Aplee. Supp. App. at 660-66.

District of Kansas Local Rule 123 allows juror interviews if granted by court order, for good cause. District [**18] courts have "wide discretion" to restrict attorney-juror contact in order to shield jurors from post-trial "fishing expeditions" by losing attorneys. Journal Publishing Co. v. Mechem, 801 F.2d 1233, 1236 (10th Cir. 1986). The district court must balance the losing party's right to an impartial jury against the risks of juror harassment and jury tampering. See Tanner v. United States, 483 U.S. 107, 126-27, 97 L. Ed. 2d 90, 107 S. Ct. 2739 (1987); Delvaux v. Ford Motor Co., 764 F.2d 469, 471-72 (7th Cir. 1985). We will uphold the denial of a motion where the allegation of misconduct is unsubstantiated. Journal Publishing, 801 F.2d at 1236; see also Tanner, 483 U.S. 107 at 126 at 126-27, 97 L. Ed. 2d 90, 107 S. Ct. 2739 . As KPL admitted, it is unaware of the content of the conversations between Green's attorneys and the juror's husband. The jury was admonished daily not to discuss the case with others and we will assume, absent more than speculation by the losing party, that the jury followed these instructions. See United States v. Armendariz, 922 F.2d 602, 606 (10th Cir. 1990), [**19] cert. denied, 112 S. Ct. 87 (1991). We find no abuse of discretion.

Furthermore, KPL failed to object to the perceived impropriety during the trial. We reiterate that "'a party may not sit idly by, watching error be committed, and then raise the claimed error on appeal without having accorded the trial court the opportunity'" to respond. Chevron, U.S.A., Inc. v. Hand, 763 F.2d 1184, 1186 (10th Cir. 1985) (quoting Gundy v. United States, 728 F.2d 484, 488 (10th Cir. 1984)).

D. Motions for Directed Verdict, J.N.O.V. or New Trial

We first note that it is difficult to address KPL's arguments here because KPL, as cross-appellant, failed to include in its appendix all of the district court's orders from which it appeals and also makes inaccurate references to its own appendix (e.g., Aplee. Reply Brief at 8). See 10th Cir. R. 28.2(c), 30.1.1, 30.1.2, 30.2; Fed. R. App. P. 30(a).

KPL's problems do not end there. KPL also failed to move for directed verdicts on several issues: Green's claim for retainage, KPL's breach of contract claim against Green, and KPL's alter ego claim against Green [**20] Holdings. KPL now attempts to appeal the denial of its motion for judgment n.o.v. or new trial on those issues. It has long been the rule that failure to move for a directed verdict precludes later appellate review of the sufficiency of the evidence. Comcoa, Inc. v. NEC Telephones, Inc., 931 F.2d 655, 663 n.11 (10th Cir. 1991). According to Fed. R. Civ. P. 50(a), specific grounds are required for a motion for directed verdict. At the close of evidence, KPL moved as follows: "At this time, the defendant . . . moves for a directed verdict at the close of all the evidence, particularly on the claims of the plaintiff on the issue of misrepresentation." Aplee. Supp. App. at 1226. Although we interpret Rule 50's specificity requirement liberally, KPL's motion was clearly insufficient as to the above issues. As such, KPL has failed to preserve its sufficiency of the evidence argument as to the breach of contract, retainage [*1013] and alter ego claims. See Comcoa, Inc., 931 F.2d at 663 n.11; Dow Chemical Corp. v. Weevil-Cide Co., 897 F.2d 481, 486 (10th Cir. 1990); Anderson v. Phillips Petroleum Co., 861 F.2d 631, 634 (10th Cir. 1988). [**21] Furthermore, even had the error been properly preserved, we find the evidence sufficient to support the jury's findings.

KPL did move for a directed verdict on Seaboard Surety's defense of no termination of contract. The jury did not reach the issue of Seaboard's liability because it found no liability on the part of Green. Green's liability was a prerequisite to Seaboard's liability. Because we do not disturb the jury's finding on Green's liability, this issue is moot.

IV. KPL's Evidentiary Objections

KPL appeals two adverse evidentiary rulings by the district court; rulings which allowed the admission of evidence of insurance and the admission of multiple expert witnesses. "A trial court necessarily possesses considerable discretion in determining the conduct of a trial" and its evidentiary rulings "will not be disturbed absent a manifest injustice to the parties." Thweatt v. Ontko, 814 F.2d 1466, 1470 (10th Cir. 1987).

A. Evidence of Insurance

Prior to trial, KPL filed a motion in limine to exclude evidence of insurance. That motion was denied. KPL failed to renew that objection during trial, except to object to the admission of the policy [**22] itself, based on improper foundation. Aplee. Supp. App. at 993. Green argues that KPL waived the objection by failing to preserve it for appeal. We have recently set forth a three-part test to determine whether it is necessary for the objecting party to renew the objection at trial when a motion in limine has been denied. United States v. Mejia-Alarcon, 995 F.2d 982 (10th Cir. 1993). First, we ask whether the matter was adequately presented to the district court when it considered the motion. Id. at * 11. We believe that it was. Second, we determine whether the issue is of a type that can be finally decided prior to trial. Id. We find that it was not. KPL argues that evidence of insurance was highly prejudicial, relying on the general rule excluding evidence of insurance in tort cases. Here, however, the surety company was a party to this contract case and the existence of the policy had relevance as a material term of the contract. The district court did not wish to exclude evidence relevant to the contract prior to having the benefit of hearing related evidence at trial. This was not purely an issue of law which could be definitively [**23] decided pretrial. See Id. at * 11-13.

The third requirement is that the district court's ruling be definitive. Id. at * 13. We find that it was not. The district court indicated that the ruling would be subject to reconsideration at trial, informing KPL's counsel that "because the court has ruled does not prevent you from submitting them [the objections] again during the trial if the circumstances are such that you believe the Court should take another look at them." Aplee. Supp. App. at 39.

Based on the above, we find that KPL's objection was of the type that must be renewed, and thus KPL has waived the objection. See McEwen v. City of Norman, 926 F.2d 1539 (10th Cir. 1991). As for the objection to foundation, we find that the district court was within its discretion in overruling it.

B. Cumulative Expert Testimony

Finally, KPL appeals the number of expert witnesses which were allowed to testify. n2 We will not disturb an evidentiary ruling unless a substantial right of a party has been affected. Fed. R. Evid. 103(a). In technical cases such as this, it is particularly [*1014] appropriate that we accord deference to the ruling of the trial judge, [**24] who is most familiar with the issues and evidence. C.A. Assocs. v. Dow Chem. Co., 918 F.2d 1485, 1489 (10th Cir. 1990). Green Construction, Green Holdings and KPL presented numerous expert witnesses. KPL contends that both it and the jury were overwhelmed by Green's cumulative experts. It is certainly within the district court's discretion to limit the number of experts, provided the witnesses are not excluded arbitrarily, or on the basis of mere numbers. See Fed. R. Civ. P. 16(c)(4); Coal Resources, Inc. v. Gulf & W. Ind., 865 F.2d 761, 769 (6th Cir. 1989); Aetna Cas. & Sur. Co. v. Guynes, 713 F.2d 1187, 1193 (5th Cir. 1983); MCI Communications v. American Tel. and Tel. Co., 708 F.2d 1081, 1171 (7th Cir.), cert. denied, 464 U.S. 891, 78 L. Ed. 2d 226, 104 S. Ct. 234 (1983). By the time KPL objected (two days prior to the end of the six week trial), practically all of the expert testimony had been presented. We find no abuse of discretion in admitting the final expert, who was offered to tie the evidence together.

- - - - - - - - - - - - - - - - - -Footnotes- - - - - - - - - - - - - - - - - -

n2 KPL filed a motion in limine with the magistrate prior to the depositions of the experts, requesting a limit
on the number of experts which Green could present. However, KPL withdrew that motion before the magistrate could rule on it. Aplee. Supp. App. at 600. KPL then filed a motion to strike two particular experts that Green had added close to the time of trial. KPL argued that the last minute listing of the experts was prejudicial and that their testimony was cumulative. Aplee. Supp. App. at 620. The court denied KPL's motion. Aplee. Supp. App. at 733. KPL renewed the objection during trial, albeit during the testimony of a different expert than those listed in its motion. Aplee. Supp. App. at 1010.

- - - - - - - - - - - - - - - - - -End Footnotes- - - - - - - - - - - - - - - - - [**25]

For the foregoing reasons, the district court's judgment is

AFFIRMED.

BIBLIOGRAPHY

AAA. (1994). ADR: A practical guide to resolve construction disputes. American Arbitration Association, New York, N.Y.

AAA. (1996). AAA annual report 1996. American Arbitration Association, New York, N.Y.

Abdel-Razek, R.H. (1997). "How construction managers would like their performance to be evaluated," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.123, No.3, p.208-213.

Abdou, O.A. (1996). "Managing construction risk," Journal of Architectural Engineering. ASCE, New York, N.Y., Vol.2, No.1.

AGC. (1991). Partnering: concept for success. AGC publication No. 2900, The Associated of General Contractors of America.

AGC. (1995). Partnering: changing attitudes in construction. AGC Pub. No.2902, The Associated General Contractors of America.

AGC. (1997). Standard form of agreement and general conditions between owner and contractor (where the contract price is a lump sum). AGC document No. 200, The Associated General Contractors of America.

Ahmed, Syed; Kangari, Roozbeh. (1995). "Analysis of client-satisfaction factors in construction industry," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 11, No. 2, p.36-44.

AIA. (1997). General conditions of the contract for construction. Document A201-1997, The American Institute of Architects, Washington D.C.

AIA. (1998). "Contract management in change related clauses," The Architect's Handbook of Professional Practice (12th Ed.). The American Institute of Architects, Washington D.C.

Alarcon, L.F.; Ashley, D.B. (1996). "Modeling project performance for decision making," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 122, No. 3, p.265-273.

Allen, Richard K. (1993). Dispute avoidance and resolution for consulting engineers. ASCE Press, New York, N.Y.

The American Heritage College Dictionary (AHCD). (1993). 3rd Ed. Houghton Mifflin Company, Boston, MA.

Arditi, David; Tokdemir, Onur Behzat. (1999). "Comparison of case-based reasoning and artificial neural networks," Journal of Computing in Civil Engineering. ASCE, New York, N.Y., Vol. 13, No. 3, p.162-169.

ASCE. (1991). Avoiding and resolving disputes during construction: successful practices and guideline, The technical committee on contracting practices of the underground technical research council of ASCE. ASCE Press, New York, N.Y.

AskSam User's Guide. (1995). Seaside Software Inc. Perry, FL.

Babbie, Barl. (1995). The practice of social research (7th Ed.). Wadsworth Publishing Company, Belmont, CA.

Battelle, Anthony E. (1995). "The growing impact of ADR on the construction industry: real time dispute processing," The construction lawyer. American Bar Association Press, New York, N.Y., p.13-18.

Benoma, Thomas, V. (1989). Learning with Case. Harvard Business School Case 9-589-080. Harvard Business School Publishing, Boston, MA.

Bohn, Roger E. (1994). " Measuring and managing technical knowledge," Sloan Management Review. M.I.T. Boston, MA., Vol. 36, No.1.

Bing, Li; Tiong Robert L.K. (1999). "Risk management model for international construction joint venture," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 125, No.5, p.377-384.

Bishop, D.F.L. (1992). "Planning for disputes education construction management," Building Research and Information. E. & F.N. Spon, London, UK. Vol.20, No.6, p.360-363.

Bruggermann, Bernhard M; Holz, K. Peter; Molkenthin, Frank. (2000) "Semantic documentation in engineering - content retrieval by arbitrary information," Proceedings of the Eighth International Conference on Computing in Civil and Building Engineering. (ICCCBE-VIII). ASCE, Reston, VA. p. 828-835.

Buchheit, R.B.; Garrett, J.H.Jr., et. al. (2000). "A knowledge discovery case study for the intelligent workplace," Proceedings of the Eighth International Conference on Computing in Civil and Building Engineering. (ICCCBE-VIII). ASCE, Reston, VA. p.914-921.

Carney, Thomas F. (1972). Content analysis. University of Manitoba Press, Winnipeg, Canada.

Carr, R.I. (1997). "Engineering and construction management: leadership and opportunity," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.123, No.3, p.292-296.

CERF (1993), Construction industry research prospectuses for the 21st century, Civil Engineering Research Foundation. Washington D.C.

Chau, Kwok-wing. (1992). "Resolving construction disputes by mediation: Hong Kong experience," Journal of Management in Civil Engineering. ASCE, New York, N.Y., Vol.8, No.4, p.384-393.

Chua, D.K.H. (1997). "Model for construction budget performance-Neural network approach," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 123, No.3, p.214-222.

Chua, D.K.H. et.al. (1999). "Critical success factors for different project objectives," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 125, No.3, p.142-150.

Chinowsky, Paul S.; Meredith, James E. (2000a). Strategic Corporate Management for Engineering. Oxford University Press, New York, N.Y.

Chinowsky, Paul S.; Meredith, James E. (2000b). "Strategic management in construction," Journal of Construction Engineering and Management. ASCE, Reston, VA., Vol.126, No.1, p.1-9.

CII. (1992). Construction changes and change order: their magnitude and impact. Source Document 66, Construction Industry Institute, Austin, Texas.

Clough, Richard H.; Sears, Glenn A. (1994). Construction Contracting (6th Ed.), John Wiley & Sons Inc., New York, N.Y.

Conley, Michael A.; Gregory, Rita A. (1999). "Partnering on small construction projects," Journal of Construction Engineering and Management. ASCE, Reston VA., Vol.125, No. 5, p.320-324.

Contract Dispute Act. (1987). 41 U.S.C. United States.

Construction Claims Monthly. (1996-2000). Business Publishers, Inc. Silver Spring, MD.

Cook, E.; Lynn, Hancher; Donn E. (1990). "Partnering: contracting for the future," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.6, No.4, p.431-446.

Costantino, Cathy A. (1990). "Designing conflict management systems: a guide to creating productive and healthy organizations," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 116, No.4, p.595-608.

Cox, Robert K. (1997). "Managing change orders and claims," Journal of Management in Engineering. ASCE, New York, N.Y., p.24-29.

CPR. (1994). Construction industry ADR, Center for Public Resources - Institute for Dispute Resolution.

Cramer, Duncan. (1994). Introducing statistics for social research - step by step calculations and computer techniques using SPSS. Routledge, New York, N.Y.

Crane, Travis G.; Sanders, Steve R. (1997). "Partnering process model," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.13, No.3, p.57-63.

Crowley, Larry G.; Karim, Md. Ariful. (1995). "Conceptual model of partnering," Journal of Management in Engineering. ASCE, New York, N.Y., p.33-39.

Crowell, Eldon H.; Pou, Charles. (1990). "Study: appealing government contract decisions: reducing the cost and delay of procurement litigation with alternative dispute resolution techniques," Maryland Law Review. 49 Md. L. Rev. 183, School of Law, University of Maryland, MD.

Davenport, Thomas H.; Prusak, Laurence. (1998). Working Knowledge. Harvard Business School Press, Boston, MA.

Davis, Duane. (1996). Business research for decision making (4th Ed.). Warsworth Publishing Co., Belmont, CA.

Dauer, Edward A. (1994). Manual of dispute resolution: ADR law and practice, Shepard's / Mcgraw-Hill, Inc. Colorado Springs, CO.

DBIA, (1998). Standard form of general conditions of contract between owner and design-builder. Design-Build Institute of America, Washington, D.C.

Diekmann, J. (1984). "Claims analysis and computer reasoning," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.110, No.4, p.391-408.

Diekmann, James E.; Nelson, Mark C. (1985) "Construction Claims: frequency and severity," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.111, No.1, p.74-81.

Diekmann, James E.; Gjertsen, Knut. (1992a). "Site event advisor: expert system for contract claims," Journal of Computing in Civil Engineering. ASCE, New York, N.Y., Vol.6, No.4, p.472-479.

Diekmann, James E.; Kim, Moonja P. (1992b). "Superchange: expert system for analysis of change claims," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.118, No.2, p.399-411.

Diekmann, James; Girard, Matthew; Abdul-Hadi, Nader. (1994). DPI - Dispute Potential Index: A study into the predictability of contract disputes. Source document 101, Construction Industry Institute, Austin, Texas.

Diekmann, James; Girard, Matthew J. (1995). "Are contract disputes predictable?" Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.121, No.4, p.355-363.

Doctoroff, Susan. (1998). "Reengineering negotiations," Sloan Management Review. Sloan Business School, M.I.T. Boston, MA. p. 63-71.

Drucker, Peter. (1988). "The coming of the new organization," Harvard Business Review, Harvard Business School, Boston, MA. Vol. 66, No.2. p.45-53.

EJCDC. (1996). Standard general conditions of the construction contract. Engineers Joint Contract Documents Committee. No.1910-8-1996

Ellison, S.D. (1995). "Beyond ADR: working toward synergistic strategic partnership," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.11, No.6, p.44-54.

Federal Acquisition Regulation. (FAR), 48 C.F.R. United States.

Federal Transit Administration. (1996). "Procurement/contracts/disputes/claims," Project and construction management guidelines 1996 updates. Federal Transit Administration, U.S. Department of Transportation, Washington D.C.

Fellows, Richard; Liu, Anita. (1997). Research Methods for Constriction. Blackwell Science Ltd. Malden, MA.

Fisher, Roger; Ury, William. (1991). Getting to Yes - Negotiation agreement without giving in. Penguin Books, New York, N.Y.

Frano, Andrew. (1996). "Guarding against litigation," Journal of Management in Engineering, ASCE, New York, N.Y., p.28-32.

Friedman, George H. (1995). "Major changes coming to AAA construction arbitration," The Construction Lawyer. American Bar Association Press, New York, N.Y., p.25-29.

Gaede, A.H. Jr. (1993). "Preventing and managing claims," The Dispute Avoidance and Resolution Task Force (DART). American Arbitration Association, New York, N.Y.

GAO. (1990). Case study evaluations. Program Evaluation and Methodology Division, United States General Accounting Office. Washington D.C.

GAO. (1992). Quantitative data analysis: an introduction. Program Evaluation and Methodology Division, United States General Accounting Office. Washington D.C.

GAO. (1996). Content Analysis: A methodology for structuring and analyzing written material. Program Evaluation and Methodology Division, United States General Accounting Office. Washington D.C.

Garsden, B.R. (1995) "Post construction evaluation'" Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 121, No.1, p.37-42.

Garvin, David A. (1993). "Building a learning organization," Harvard Business Review, Harvard Business School, Boston, MA., Vol. 71, No.4, p.78-91.

Goodman, Robin E.; Chinowsky, Paul S. (1997). "Preparing construction professional for executive decision making," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 13, No. 6, p.55-61.

Goodman, Robin E.; Chinowsky, Paul S. (2000). "Taxonomy of knowledge requirements for construction executives," Journal of Management in Engineering. ASCE, Reston, VA., Vol. 16, No. 1, p.80-89.

Gordon, Christopher M. (1994). "Choosing appropriate construction contracting method," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 120, No.1, p.196-210.

Groton, James P. (1991). Preventing and resolving construction disputes, CPR Legal Program Construction Disputes Committee. Center for Public Resources (CPR)- Institute for Dispute Resolution.

Groton, James P. (1993a). The quite revolution in construction dispute resolution. The Dispute Avoidance and Resolution Task Force (DART). American Arbitration Association, New York, N.Y.

Groton, James P., (1993b). Dispute review boards–backdoor partnering. The Dispute Avoidance and Resolution Task Force (DART). American Arbitration Association, New York, N.Y.

Hair, Joseph F. Jr.; Anderson, Rolph E.; Tatham, Ronald L.; Black, William C. (1998). Multivariate data analysis (5th Ed.). Prentice Hall, Upper Saddle River, N.J.

Hartman, Francis; Snelgrove, Patrick. (1996). "Risk allocation in lump-sum contracts - concept of latent disputes," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.122, No.3, p.291-296.

Healey, Joseph F. (1999). Statistics: a tool for social research. Wadsworth Publishing Company, Belmont, CA.

Henderson, T. (1991). "Analysis of construction disputes and strategies for cost minimization," Civil Engineer. ASCE, Vol. 33, No.11, p.17-21.

Hinze, Jimmie; Couey, James. (1989). "Weather in construction contracts," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.115, No. 2, p.270-283.

Ibbs, C. William; Ashley, David B. (1987). "Impact of various construction contract clauses," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 113, No.3, p.501-521.

Ibbs, C. William. (1997). "Quantitative impacts of project change: size issues," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 123, No.3, p.308-311.

Jahren, Charles T.; Dammeier, Bruce F. (1990). "Investigation into construction disputes," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 6, No. 1, p.39-46

Jeljeli, M.N.; Russell, Jeffrey S. (1995). "Coping with uncertainty in environmental construction: decision-analysis approach," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 121, No. 4, p.370-380.

Jaselskis, Edwards J.; Ashley, David B. (1991). "Optimal allocation of project management resources for achieving success," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 117, No. 2, p.321-340.

Jergeas, George F.; Hartmann, Francis T. (1994). "Contractors' construction-claims avoidance," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.120, No.3, p.553-560.

Kabanoff, Boris; Waldersee, Robert; Chohen, Marcus. (1995). "Espoused values and organizational change themes," Academy of Management Journal. Vol. 38, No. 4, p.1075-1104

Kangari, Roozbeh. (1988). "Business failure in construction industry," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.114, No. 2, p.172-190.

Kangari, Roozbeh. (1995a). "Risk management perceptions and trends of US construction," Journal of Construction Engineering and Management, ASCE, New York, N.Y., Vol.121, No. 4, p.422-429.

Kangari, Roozbeh. (1995b). "Construction documentation in arbitration," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.121, No.2, p.201-208.

Kraiem, Zaki M.; Diekmann, James E. (1988). "Representing construction contract legal knowledge," Journal of Computing in Civil Engineering. ASCE, New York, N.Y., Vol. 2, No.2, p.202-211.

Krippendorff, Klaus. (1980). Content analysis - an introduction to its methodology. Sage Publications, Berverly Hills, CA.

Kuprenas, J.A.; Songer, A.D. (1997). "Construction change order impact assessment using influence diagrams," Proceedings of Conference on Computing in Civil Engineering. ASCE, New York, N.Y., p.441-448.

Laborde, Maria; Sanvido, Victor. (1994). "Introducing new process technologies into construction companies," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.120, No.3, p.488-508.

Lamari, Maria R. (1994). The role of alternative dispute resolution in government construction contract disputes, 23 Hofstra Law Review 205. Hofstra Law Review.

Lavenue, Lionel M. (1998). "Area summary: survey of government contract cases in the united states court of appeals for the federal circuit: 1997 in review," 47 Am. U. L. Rev. 1393. The American University Law Review, The American University.

Larson, Erik. (1995) "Project partnering: results of study of 280 construction projects," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 11, No.2, p.30-35.

Larwood, Laurie; Falbe, Cecili M.; Kriger, Mark P. et. al. (1995). "Structure and meaning of organizational vision," Academy of Management Journal. Vol.38, No.3, p. 740-769.

Levin, Paul. (1998). Construction contract claims, changes & dispute resolution (2nd Ed.). ASCE press, Reston, VA.

Lexis-Nexis Academic Universe (2000). Legal research database. Reed Elsevier Inc.

Lunch, Milton F. (1990). "The liability crisis," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 6, No.2, p.197-202.

Macomber, John D. (1989). "You can manage construction risks," Harvard Business Review. Harvard Business School. Boston, MA. Vol. 67, No. 2. p. 155-165.

Malhotra, Naresh K. (1999). Marketing Research - An Applied Orientation (3rd Ed.). Prentice Hall Inc., Upper Saddle Rriver, N.J.

McLeod, Raymond. Jr. (1998). Management Information System. Prentice Hall Inc., Upper Saddle Rriver, N.J.

Miles, R. S. (1996). "Twenty-first century partnering and the role of ADR," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.12, No.3.

Minato, Takayuki; Ashley, David B. (1998). "Data-driven analysis of 'corporate risk' using historical cost-control data," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 124, No. 1, p.42-47.

Mohsini, R.A. (1992). "Determinant of performance in the traditional building process," Construction Management and Economics, Vol.10, No.4, p.343-359.

Molenaar, Keith; Songer, Anthony D. (1997). "Automated prediction tool for design-build projects," Proceedings of Construction Congress V. ASCE, New York, N.Y., p.582-589.

Molenaar, Keith; Songer, Anthony D. (1998). "Model for public sector design-build project selection," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 124, No. 6, p.467-479.

Molenaar, Keith; Songer, Anthony D; Barash, Mouji. (1999). "Public-sector design-build evolution and performance," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 15, No. 2, p.54-62.

Nonaka, Ikujiro, (1991). "The knowledge creating company," Harvard Business Review. Harvard Business School, Vol. 69, No. 5, p.96-104.

O'Connor, James T. (1987). "Constructability concepts for engineering and procurement," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.113, No. 2, p.235-248

Pearce, Annie R. (1999). Increasing the sustainability of the built environment: a metric and process for prioritizing improvement opportunities. Ph.D. Dissertation, School of Civil and Environmental engineering, Georgia Institute of Technology, Atlanta, GA.

Pena-mora, Feniosky. (1996). "Theoretical foundations for computer-supported negotiation," Proceedings of Conference on Computing in Civil Engineering. ASCE, New York, N.Y., p.186-192.

Pena-mora, Feniosky; Wang, Chun-Yi. (1998). "Computer supported collaborative negotiation methodology," Journal of Computing in Civil Engineering. ASCE, New York, N.Y., Vol. 12, No. 2, p.64-81.

Phillips, Babara A. (1997). "Alternative dispute resolution symposium issues: Mediation: Did we get it wrong?" 33 Willamette Law Review 649. Willamette Law Review.

Pinto, Jeffrey K. (1998). Project Management Handbook, The Project Management Institute. Jossey-Bass Publishers, San Francisco, CA.

Pocock, J.B.; Hyun, Chang-Taek; Liu, L.Y.; Kim, M.K. (1996). "Relationship between project interaction and performance indicators," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.122, No.2, p.165-176.

Pocock, J.B.; Liu, L.Y.; Kim, M.K. (1997a). "Impact of management approach on project interaction and performance," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.123, No.4, p.411-418.

Pocock, J.B.; Liu, L.Y.; Tang, W.H. (1997b). "Prediction of project performance based on degree of interaction," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 13, No.2, p.63-76.

Pollalis, Spiro (Ed.). (1996). "Alternative dispute resolution (ADR) in contract management," Uncertainty and Risk in International Construction Markets. Graduate School of Design, Harvard University, Cambridge, MA.

Rahayu, Harkunti. (1996). "A New model of risk allocation for construction contracts based on fair liabilities between parties," Proceedings of Conference on Computing in Civil Engineering. ASCE, New York, N.Y., p.35-41.

Revay, S.G. (1993). "Can construction claims be avoided?" Building Research and Information. E. & F.N. Spon, London, U.K. Vol.21, No.1, p.56-58.

Roberts, Carl W. (Ed.). (1997). Text Analysis for the social sciences. Lawrence Erlabaum Associates Publishers, Mahwah, N.J.

Ross, D.L. (1997). 'Emerging trends in correctional civil liability cases: content analysis of federal court decisions," Journal of Criminal Justice. Vol. 25, No. 6, p. 501-515.

Russell, Jeffrey S. (1990). "Surety industry: overview," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.6, No. 3, p. 323-341.

Russell, Jeffrey S. (1991). "Construction contract bonds," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.7, No.3, p.299-313.

Russell, Jeffrey S. (1991). "Contractor failure: analysis," Journal of Performance of Constructed Facilities. ASCE, New York, N.Y., Vol.5, No.3, p.163-180.

Russell, Jeffrey S., Jaselskis, Edward J. (1992). "Predicting construction contractor failure prior to contract award," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.118, No.4, p.791-811.

Russell, Jeffrey S; Zhai, Huaming. (1996). "Predicting contractor failure using stochastic dynamics of economic and financial variables," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 122, No. 2, p.183-191.

Russell, Jeffrey S., Jaselskis, Edward J. (1997). "Continuous assessment of project performance," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.123, No.1, p.64-71.

Sanvido, V.; Grobler, F.; Parfitt, K. (1992). "Critical success factors for construction projects," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 118, No.1, p.94-111.

Scott, Stephen. (1997). "Delay Claims in U.K. Contracts," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.123, No.3, p.238-244.

Scherer, Raimar J.; Reul, Savine. (2000). "Retrieval of project knowledge from heterogeneous AEC documents," Proceedings of the Eighth International Conference on Computing in Civil and Building Engineering. (ICCCBE-VIII). ASCE, Reston, VA., p. 812-819.

Seale, Clive (Ed.). (1998). Researching society and culture. Sage Publications, Thousand Oak, CA.

Semple, Cheryl; Hartman, Francis T.; Jergeas, George. (1994). "Construction claims and disputes: causes and cost/time overruns," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.120, No.4, p.785-795.

Singh, Amarjit.; Vlatas, Demetres A. (1991). "Using conflict management for better decision making," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.7, No.1, p.70-82.

Singh, Amarjit.; Johnson, Holly M. (1998). "Conflict management diagnosis at project management organizations," Journal of Management in Engineering. ASCE, New York, N.Y., p.48-63.

Singleton, Royce A. Jr.; Straits, Bruce C.; Straits, Margaret Millers. (1993). Approaches to social research. Oxford University Press, New York, N.Y.

Smith, Currie & Hancock. (1997). Sweeney, Neal J.; Kelleher Thomas J. Jr.; Beck, Philip E.; Hafer, Randall F. (Ed.). Smith, Currie & Hancock's Common sense construction law. John Wiley & Sons, Inc., New York, N.Y.

Smith, Robert J. (1997). "Dispute review boards: resolving construction disputes in real time," ADR Current. American Arbitration Association, New York, N.Y., p.6-9.

Soibelman, Lucio; Kim, Hyunjoo. (2000). "Generating construction knowledge with knowledge discovery in database," Proceedings of the Eighth International Conference on Computing in Civil and Building Engineering. (ICCCBE-VIII). ASCE, Reston, VA. p. 906-913.

SPSS (1998). SPSS Base 8.0-Applications Guide. SPSS, Inc., Chicago, Il.

Stipanowich, Thomas J.; Henderson, Douglas A. (1992). "Settling construction disputes by mediation, mini-trial and other processes - The ABA forum survey," The Construction Lawyer. American Bar Association Press, New York, N.Y., p.6-10.

Stipanowich, Thomas J.; Henderson, Douglas A. (1993a). "Mediation and mini-trial of construction disputes," Building Research and Information. E. & F.N. Spon, London, Vol.21, No.3, p.162-166.

Stipanowich, Thomas J. (1993b). The quite revolution continues: mediation and other emerging approaches to construction conflicts, The Dispute Avoidance and Resolution Task Force (DART). American Arbitration Association, New York, N.Y.

Stipanowich, Thomas J. (1995a). "Dispute avoidance and resolution: The construction industry as the cutting edge of evolution", The Construction Lawyer. American Bar Association Press, New York, N.Y., p.3-4.

Stipanowich, Thomas J.; O'Neal, Leslie King. (1995b). "Charting the course: The 1994 construction industry survey on dispute avoidance & resolution - part I," The Construction Lawyer. American Bar Association Press, New York, N.Y., p.5-11.

Stipanowich, Thomas J. (1996). "Charting the course: The 1994 construction industry survey on dispute avoidance & resolution - part II," The Construction Lawyer. American Bar Association Press, New York, N.Y., p.8-19.

Stipanowich, Thomas J. (1998a). "Reconstructing construction law: Reality and reform in a transactional system," 1998 Wisconsin Law Review 463, Wisconsin Law Review. University of Wisconsin, MN.

Stipanowich, Thomas J. (1998b). "The multi-door contract and other possibilities," 13 Ohio St. J. on Disp. Resol. 303, Ohio State Journal on Dispute Resolution. Ohio State University, Ohio.

Sweet, Justin. (1994). Legal aspects of architecture, engineering and the construction process. (5th Ed.). West Publishing Company, St. Paul, MN.

Tatum, C.B. (1987). "Improving constructability during conceptual planning," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 113, No.2, p.191-207.

Tatum, C.B. (1988). "Classification system for construction technology," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 114, No.3, p.344-363.

Tatum, C.B. (1993). Structure and characteristics of knowledge from construction experience. Technical report No. 81. Center for Integrated Facility Engineering (CIFE), Stanford University, Palo Alto, CA.

Thomas, H. Randolph. (1990). "Resolving disputes over contract notice requirements," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.116, No.4, p.738-755.

Thomas, H. Randolph; Smith, Gary R. (1991). "Legal aspects of oral change orders," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 117, No.1, p.148-162.

Thomas, H. Randolph; Smith, Gary R. (1992). "Resolving contract disputes based on misrepresentations," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.118, No.3, p.472-491.

Thomas, H. Randolph; Smith, Gary R. et. al.(1994). "Interpretation of construction contracts," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 120, No.2, p.321-336.

Thomas, H. Randolph; Smith, Gary R.; Cumming Daniel J. (1995). "Have I reached substantial completion?" Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.121, No.1, p.121-129.

Thomson, Dean B. (1996). "The forum's survey on the current and proposed AIA A201 dispute resolution provisions," The Construction Lawyer. American Bar Association Press, New York, N.Y., p.3-6.

Thompson, Paul; Crane, Travis; Sanders Steve. (1996). The partnering process - Its benefits, implementation and measurement. Research report 102-11. Construction Industry Institute (CII), Austin, Texas.

Tiong, Robert L.K.; Yeo, Khim-Teck. (1992a). "Critical success factors in winning BOT contracts," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.118, No.2, p.217-228.

Tiong, Robert L.K. (1992b). "Strategies in risk management of on-demand guarantees," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.118, No.2, p.229-243.

Treacy, T.B. (1995). "Use of alternative dispute resolution (ADR) in the construction industry," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.11 No.1.

Vanegas, Jorge. (2000). "A conceptual framework for research," Ph. D. seminar material. Georgia Inst. of Technology, Atlanta, GA.

Vanegas, Jorge A.; Nguyen, Tuan H. (1997). "Global system of acquisition and dissemination of lessons learned," Proceeding of Construction Congress V. ASCE, New York, N.Y., p. 494-501.

Vidogah, William.; Ndekugri, Issaka. (1997). "Improving management of claims: contractor's perspective," Journal of Management in Engineering. ASCE, New York, N.Y., p.37-44.

Vorster, M.C. (1993). Dispute prevention and resolution. Source Document-95. Construction Industry Institute (CII), Austin, Texas.

Wall, Colin J. (1993). "The disputes resolution advisor in the construction industry," Building Research and Information. E. & F.N. Spon, London, Vol.21, No.2, p.122-127.

Wang, Shouqing; Tiong, Robert L.K. et. al. (1999). "Political risks: analysis of key contract clauses in China's BOT project, " Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol. 125, No.3, p.190-197.

Wartel, Sidney J. (1989). "Negotiation and drafting the civil engineering contract," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 5, No.3, p.272-279.

Watts, V. M., Scrivener, J.C., (1993). "Review of Australian building disputes settled by litigation," Building Research and Information. E. & F.N. Spon, London, U.K. Vol. 21, No.1, p.59-63.

Weber, Robert Philip. (1990). Basic Content Analysis (2nd Ed.). Sage Publications, Newbury Park, CA.

Weston, David C.; Gibson, Edward Jr. (1993). "Partnering-project performance in US Army Corps of Engineers," Journal of Management in Engineering. ASCE, New York, N.Y., Vol.9, No.4, p.410-425.

Whitman, Douglas; Gergacz, John Williams. (1997). Legal Studies in Business. West publishing Company, St. Paul, MN.

Wilson, Roger; Songer, A.; Diekmann, J. (1995). "Partnering: more than a workshop - a catalyst for change," Journal of Management in Engineering. ASCE, New York, N.Y., Vol. 11, No.5, p.40-45.

Yin, Robert K. (1993). Applications of case study research. Sage Publications, Newbury Park, CA.

Yin, Robert K. (1994). Case study research: design and methods (2nd Ed.). Sage Publications, Thousand Oaks, CA.

Zack, James G. Jr. (1993). "Claimsmanship current perspective," Journal of Construction Engineering and Management. ASCE, New York, N.Y., Vol.119, No.3, p.480-497.

Zack, James G. Jr. (1998). "Resolution of disputes – The next generation," Proceedings of the 29th PMI Annual Conference. Project Management Institute, Newtown Square, PA.

Zack, Michael H. (1999). "Managing codified knowledge,: Sloan Management Review, M.I.T., Boston, MA., Vol. 40, No.4.

VITA

Kyoo-Chul (KC) Shin has been an architect and project manager in Hyundai Engineering and Construction Co., Ltd. in Seoul Korea for more than one and half decades. In 1996, he was awarded the company's scholarship for Ph. D. research which ignited his long desire of further study and research, filling the gaps in his intellectual curiosity. He is a diligent in his duties including international and domestic project assignments, various positions in the head office, and voluntary activities. He participated in various projects in south east Asia for about six years which covered a broad spectrum of project life cycle. He was a lead design architect for a commercial project in Korea which has a worth of about US 100 million dollars within a two-year span. He was one of the founders and continues as an active member of the Construction Management Research committee in the company since 1990 which eventually helped set company policy in a better direction. His extra activities include serving as a lecturer in the company's educational institute, and as a member of various internal committees and task forces. He even appears as a model in the company's marketing brochure and was a leading anchorman in the company's anniversary festival with more than 2,500 patrons.

He received his master's degree in architectural engineering from Yonsei University, Korea and his bachelor's degree in architectural engineering from Inha University, Korea. He is a registered architect, a qualified first class level engineer in architecture, urban planning and fire safety engineering in Korea.

He lives in the metro Seoul area with his family, wife, and two daughters. He can be reached by e-mail at 'kcshin@yahoo.com' about the research and dissertation.