UNIVERSITY OF ALBERTA

AN INTEGRATED REPOSITORY SYSTEM FOR COLLECTING, CLASSIFYING AND ANALYZING CANADIAN CONSTRUCTION CLAIMS

BY

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TO DAD

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TABLE OF CONTENTS

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LIST OF TABLES

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LIST OF FIGURES

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I am indebted to all the wonderful people who have impacted my life and helped me in my work. What a priceless gift to have such teachers who show the way. Among them, I am so grateful to....

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These teachers, and many more have I had, and from them have I learned. I know that any good thing that may proceed from me has to some degree been passed on from them, for they have taught it to me, and I have merely passed it on.

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ABBREVIATIONS

ANN: Artificial Neural Networks

AI: Artificial Intelligence

CBR: Case Based Reasoning

CCDC 2 (1994): Canadian Construction Document Committee – Standard Stipulated price Contract – 1994

CCDC 3 (1994): Canadian Construction Document Committee – Standard Cost plus Contract – 1994

CCDC 3 (1994): Canadian Construction Document Committee – Standard Unit Price Contract – 1994

CCDC 2 (1982): Canadian Construction Document Committee – Standard Stipulated price Contract – 1982

CCDC 3 (1982): Canadian Construction Document Committee – Standard Cost plus Contract – 1982

CCDC 4 (1982): Canadian Construction Document Committee – Standard Unit Price Contract – 1982

ERD: Entity relationship Diagram

KBES: Knowledge Based Expert System

MS Access: Microsoft Access 2000

NeuroShell: NeuroShell2 release 4.0

VBA: Visual Basic for Application 6.0 in Microsoft Access

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1 INTRODUCTION

1.1 Motivation

The construction industry accounts for over 12% of Canada's gross domestic product with an estimated output of over $1.23 trillion in 2003 (Canadian Construction Association, 2004), and in 1999, it employed 4.5% of the working population (McCabe and Pilateris, 2003). A healthy economy leads to an increase in competition, a rise in project complexity, an escalation in project cost, and a decrease in the quality of contract documents (Zack, 1993). In addition, complex construction processes, documents, and contract conditions have a tendency of escalating the occurrence of disputes, conflicting interpretations, and adversarial attitudes between parties (Abdel-Malak et al., 2002). As a result of the previous issues, more construction projects are involved in disputes now than at any other time in history (Popescu-Kohler, 1998).

Resolution methodologies such as litigation, arbitration, and other forms of alternative dispute resolution (ADR) are commonly used in the conflict-prone construction industry (Abdel-Malak et al., 2002). Both the public and private sector have been looking to the judicial system as a major means for dispute resolution. The cost of litigation has been increasing at a rate of 10% per year in the United States and $5 billion of its $60 billion lawsuit industry is spent on construction related issues each year (Michel, 1998). It is not uncommon for the litigation process to take several years (Jervis, 1988). The prolonged

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and detailed factual discovery process of litigation makes it the least desirable option to parties under contract (Levin, 1988).

Avoiding construction claims before they occur compels the two-pronged approach to contract dispute prevention and resolution: 'Start right and stay right' (Diekman and Girard, 1995). Practitioners should draw on previous cases and avoid the process of litigation whenever it is feasible to do so. The current Canadian construction industry is lacking in a collection and classification methodology that can conveniently inform practitioners of relevant Canadian claim decisions from the past; Kirsh and Roth (1997) and Sandori and Pigott (2000) are among the few who have attempted to present manual repositories of Canadian construction court cases in case summaries. Two advantages could result from standardizing and automating the manual repository process: 1) practitioners can use the automated Canadian construction claim databank to add or review cases and 2) the construction claim environment can be analyzed through the information collected by the automated databank.

1.2 Research Objectives

The main objectives of this research are:

- Develop a methodology to collect and classify Canadian construction claims.
- Develop an automated databank for Canadian construction claims.
- Develop and implement a methodology in a 'statistical module' to analyze and benchmark the Canadian construction claims.

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- Develop and implement a methodology in a 'classification module' to analyze the causes of construction claims in the Canadian Construction Documents Committee (CCDC) contract document.
- Implement an Artificial Neural Network (ANN) in a 'prediction module' to assist in the prediction of the outcome of litigation cases.
- Develop and implement a prototype in a computer-integrated system that integrates the automated databank and the three developed modules.

1.3 Research Methodology

To achieve its objectives, this research follows the methodology illustrated in Figure 1.1. After the collection of 567 litigation cases, a classification methodology was proposed to categorize the collected cases. The repository of cases was further divided into 'limited cases' and 'detailed cases' based on the amount of information each case provides. A 'statistical module', a 'classification module' and a 'prediction module' were also proposed to analyze the 'detailed cases' collected. Henceforth a computer-integrated application called Canadian Construction Claim Tracker (CCCT) has been developed to integrate the repository of cases and the three proposed analysis modules. Different versions of the conceptual model of CCCT were proposed before the final model was adopted and implemented. The repository was implemented in an MS Access database, the 'statistical module' and the 'classification module' were implemented in MS Access statistical modules and the 'prediction module' was implemented in NeuroShell and MS Excel.

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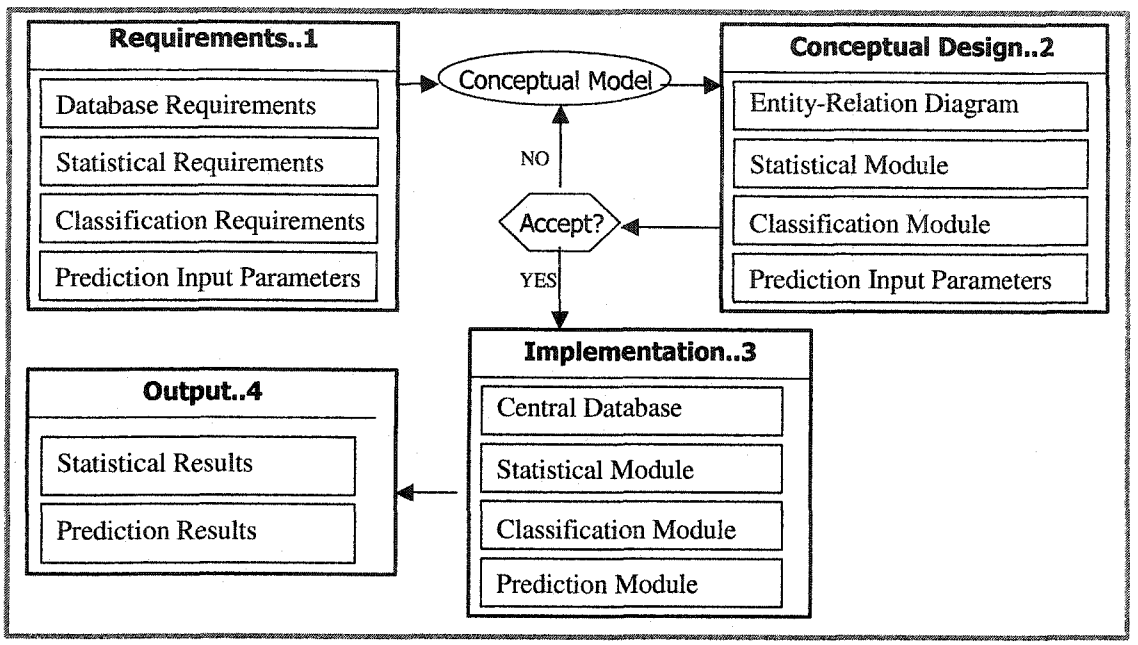

Figure 1.1: Research Methodology

1.4 Thesis Organization

The report is organized into 6 chapters: ***Chapter 1*** introduces the research motivation and defines the research objectives. ***Chapter 2*** provides a literature review of the construction claims domain and explains the unique characteristics of the Canadian legal system. ***Chapter 3*** explains the proposed methodology for collecting, classifying and analyzing Canadian construction claims including the system main components, the 'statistical module', the 'classification module' and the 'prediction module'. ***Chapter 4*** describes the implementation of the proposed methodology in a computer-integrated application called the Canadian Construction Claim Tracker (CCCT). ***Chapter 5*** discusses the 'statistical module' analysis and results. ***Chapter 6*** summarizes the research findings and proposes recommendations for future research.

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2 LITERATURE REVIEW

2.1 Introduction

Construction claims often arise from the poor resolution of disputes during the course of construction projects. The continuous escalation in claims and disputes proves that inadequate solutions have been offered by past construction claims research. Efforts have been geared towards reducing the incidence of claims; nevertheless, contractual difficulties continue to rise and are now considered to be an essential aspect of the modern contract system. This chapter presents an overview on different issues related to construction claims. The first part presents the current construction claim environment and the second part investigates the causalities of construction claims. In a later section, the construction claim process is summarized and contract construction claims are explored.

2.2 State of the Art Literature

2.2.1 Construction Claims Environment

A claim is defined as 'a request supported by full details and particulars, for something that one party believes it is entitled to (usually time or money or both), by virtue of a term or terms in a valid contract with another party but for which there is as yet no agreement' (Worby et al, 1985). According to Kululanga et al. (2001), a construction claim arises when a party to a construction contract believes that in some way, by act or omission, the other party has not fulfilled its part of the bargain. Therefore, a construction claim is 'an

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assertion of, and a demand for, compensation by way of evidence produced and arguments advanced by a party in support of its case' (Worby et al, 1985). Disputes are becoming an irrevocable feature of the construction industry and nearly every party in the construction industry is involved in a dispute nowadays (Adrian, 1988). Construction claims represent a substantial amount of the total contract awarded values (Gharehbaghi and McManus, 2003a) and the impact of litigations constituted as much as 20% of the cost of construction in the 1980's (Popescu, 1999). Semple et al. (1993) elaborated more on construction contract claims in their survey of construction projects in Canada and point out that more than one-half of claims constituted an additional cost of at least 30% of the original contract value and that approximately one-third of the claims amounted to at least 60% of the original contract value. Today's construction industry has become a very complex, high risk, and multiparty business; thus, there has been a continuous increase in conflicts between members. Unfortunately, despite constant research attempts to uncover the reasons behind construction claims, the fundamental causes and costs associated with these disputes are not well understood (Semple et al., 1993).

2.2.2 Construction Claims Causes

There are many causal agents for disputes; some examples include miscommunication, inadequate plans and specifications, rigid contracts, changes in site conditions, non-payment, catch-up profits, limitations on manpower, tools and equipment, improper supervision, notice requirements, constructive changes not recognized as such by the owner, delays, and acceleration orders (Adrian, 1988). Disputes have also been traced to the following sources: contract documents due to errors, defects and omissions, poor cost

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estimates in the initial stages, altered conditions, and stakeholders involved in a project (Kululanga et al., 2001). The grounds for construction claims are very complex and can be analyzed from social, industrial and project perspectives. Socially, the construction industry is under increasing pressure from society to be more competitive in terms of cost, time, quality and environment. As a result, the risk level within the industry has increased over the years. Industrial factors include the wide range of participants, the increasing size of projects, enhanced competitive tendering, increased technological complexity, greater uncertainty in construction environments, unbalanced risk allocations and complex interdependent relationships. Finally, the direct causes of claims relating to the project factors include unforeseeable site conditions, unrealistic planning, changes made by the client, acceleration, unfulfilled duties by project participants and force majeure (Ren et al., 2001).

Several keen insights concerning the nature of contract disputes originated from the data analysis of a project developed by Diekman and Girard (1995). Findings of the survey revealed that the caliber of people on the project could affect the project dispute performance more than any other type of project variable. People either greatly help or hinder the process of dispute resolution. Of all project participants, the contractor has the greatest impact on the disputes climate of a project. Project variables do not affect project disputes to a large extent. Generally speaking, complex projects do not have a significant impact on disputes performance. In essence, people settle disagreements on projects issues. The impact of process falls between the project and the individuals involved. Preconstruction planning and contractual relationships are the factors that have the greatest impact on a project (Diekman and Girard, 1995).

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2.2.3 Construction Claim Process

The construction claim process is an attempt by researchers to model the different stages of a construction claim. The model developed by Kululanga et al. (2001) is presented in this section as a typical construction claim process. The process is based on the following steps: claim identification, claim notification, claim examination, claim documentation, claim presentation, claim negotiation and claim quantification. Other processes have been reported in the literature but they contain similar classification as the process described above.

Claim Identification: An event which causes, or is likely to cause, the contractor to incur loss or expense for which he would otherwise not be reimbursed under the contract (Vidogah and Ndekugri, 1998a). Construction claim identification involves timely and accurate detection of a construction claim. This is the first and critically important ingredient in the claim process. Thus, an awareness of job factors that may give rise to construction claims is a skill that has to be acquired. Identification of the causes of claims, and proper documentation have been recognized as the two most essential and difficult factors in the justification of a claim (Ren et al, 2001). Although time consuming and rarely directly rewarded, documentation and claims management are also important for the justification of claims.

Claim Notification: This involves alerting the other party of a potential problem in a non-adversarial way. The initial letter of a claim notice to the other party is ideally short, clear, simple, conciliatory, and cooperative. Project participants prefer to settle claims through negotiation. However, claims negotiation is inefficient due to the diversity of

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intellectual backgrounds, complex interactions and inadequate negotiation knowledge of project participants (Ren et al., 2003).

Claim Examination: This involves establishing the legal and factual grounds on which the claim is to be based and should also involve the estimation of the potential recovery. The primary sources for claim examination include items such as project files, video footages, and memos. This task involves project managers as well as other staff such as quantity surveyors, site planning managers and external claim consultants (Bustos, 2003). According to Vidoga and Ndekugri (1997), claim preparation and examination is the most important aspect of the claim process.

Claim Documentation: This is the collection of the hard facts that give the actual history of a construction claim. A well-prepared defendant quickly demolishes evidence and claim costs that are not supported by accurate records. Document-based evidence plays an important role in establishing the facts, providing the evidence (Batikha, 1994) and finding contract-borne evidence (Bustos, 2003). Examples of documents that are reviewed for claims analysis include project contract, project addendum, project plans and specifications, daily progress reports, change orders requests, proposals and approvals, as-planned and as-built schedules, bid estimates and schedules of values, project cost reports, as-built drawings and substantial performance (Bustos, 2003).

Claim Presentation: The contractor draws up the formal claims documents with supporting information for presentation to the contract administrator. A claim presentation is logically built up, well organized, and factually convincing. A claim is written in a format that emphasizes the fact that a contract requirement was breached.

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The contractor has to demonstrate the harm or damage resulting from the owner's act. The consultant or expert plays an important role in almost every aspect of the claim presentations; it ranges from the development of a claim strategy to the actual presentation of a case. The right to present an opinion as to the merits of the claim on trial is reserved for the expert.

Claim Negotiation: A structured and proper negotiation preparation includes: 1) ascertaining that all information is current and complete; 2) minimizing the scope of negotiation beforehand so that insignificant points should not precipitate a violent argument and disrupt progress; 3) knowing one's weakness and try to utilize weak points by conceding them in return for concessions from the other party; 4) foreseeing problems; and 5) anticipating the opposition's next move (Kululanga et al., 2001).

Claim Quantification: The contractor establishes his/her entitlement to reimbursement by showing that he/she is entitled to damages under the provisions of the contract. The contractor quantifies the claims and assembles supporting documentation for submission to the contract administrator (Vidogah and Ndekugri, 1998). The claim quantification includes both the direct costs and delays caused by unanticipated events and the cumulative impacts that may result from them. Arguments concerning the rates of compensation, the quantity of the impacts, and the compensation for cumulative claim events are often generated. The loss of productivity, the level of disruption and the indirect costs of a project resulting from claims are not easy to quantify, even with the best information available (Ren et al., 2001).

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2.2.4 Construction Contract Claims

Construction contract claims indicate several problem areas in the construction process; if industry practitioners monitor these areas during all stages of the construction process, the possibility of claims occurrence can decrease. Steps are taken to clarify any issues or conflicts that may arise in these common problem areas. The most common factors contributing to construction contract claims in the Canadian industry are the increase in scope of work, weather, restricted access and project acceleration (Semple et al., 1993). According to the same study, the categories that experienced the largest number of claims are site overhead, loss of productivity, loss of revenue and financial costs. The authors go further by stating that special considerations should be given to contract clauses dealing with changes, disputes, site characteristics and delay. In a later study, the same authors uncover the causes and the cost/time overruns of construction claims and disputes in Canada (Semple et al, 1994). Their research extracts the following seven attributes: the type of contract the claim originated from, the method of payment in the contract, the industry or sector the contract originated from, the original contract duration, the delays encountered during the course of the project, the original value of the work, and the amount of compensation requested in the claim. While analyzing general construction claims and claims that involve contract disputes, it is essential to choose a specific standard construction contract and analyze the claims based on this standard. Cultural issues have a great impact on the contractual arrangements, conflict causation, and selection of dispute resolution mechanisms (Chan and Tse, 1991). Therefore, it is important to compare cases within the same context or even within the same dispute resolution mechanism.

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2.3 Canadian Legal System

2.3.1 Background

Canada's present legal system was derived from various European systems brought to Canada in the 17th and 18th Centuries by explorers and colonists. The legal system of the common-law provinces of Canada is based upon the English common-law system. After the defeat of the French in Quebec in 1759, the country fell almost exclusively under English law; the exception being Quebec, where the civil law dominated and is still the current practice. The civil law is based on the French Napoleon code and is defined as a set of rules, many of which are broadly defined so as to deal with any dispute that may arise. The common law, which developed in Great Britain, is referred to as judge-made law because it is a system of rule based on precedent. The common law cannot be found in any 'code' or 'legislation' because it exists in past decisions and is therefore adaptable to changing circumstances (Supreme Court of Canada, 2004).

2.3.2 Canadian Court System

There are 4 levels of courts in the Canadian judicial system: provincial, provincial superior, provincial court of appeal and the Supreme Court of Canada. The four levels of court are illustrated in Figure 2.1; on the first court level, the provincial court handles the great majority of cases that come into the system. Each province and territory has a provincial court that hears cases involving either federal or provincial laws. Provincial courts deal with most criminal offences, family law matters, young offenders, traffic violations, provincial regulatory offences, and claims involving money up to a certain amount (set by the province). The second level contains both the provincial superior court

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and the trial division of the federal court; provincial superior court deals with more serious crimes and take appeals from provincial court judgments while the federal court (trial division) conducts hearings across the country of cases involved in federal-provincial disputes, copyrights, citizenship appeals and cases involving departments of the Government of Canada (Canada Justice, 2004). On a higher level, the provincial court of appeal hears appeals from decisions made by the superior courts and provincial courts. As shown in Figure 2.1, there are three appeal courts with the power to refer to the Supreme Court of Canada; these are the court martial appeal court, the provincial court of appeal and the federal court of appeal. The court martial appeal court hears appeals deriving from military courts. The federal court of appeal receives appeals from either the trial division of the federal court or the tax division of Canada (Courts of Alberta, 2004). Provincial administrative tribunals and federal administrative tribunals were not included in the figure in the interest of simplicity. Factual distinctions between cases may also provide the basis for flexibility. A court may see fit to dismiss the application of a precedent based on the facts of the case before the court, provided the end result is justified. However, departures from established precedents are often very slow to evolve. This slow evolution is a characteristic of the legal system that may, at times, be criticized; nevertheless, the theory of precedent is the basis of predictability in the legal system.

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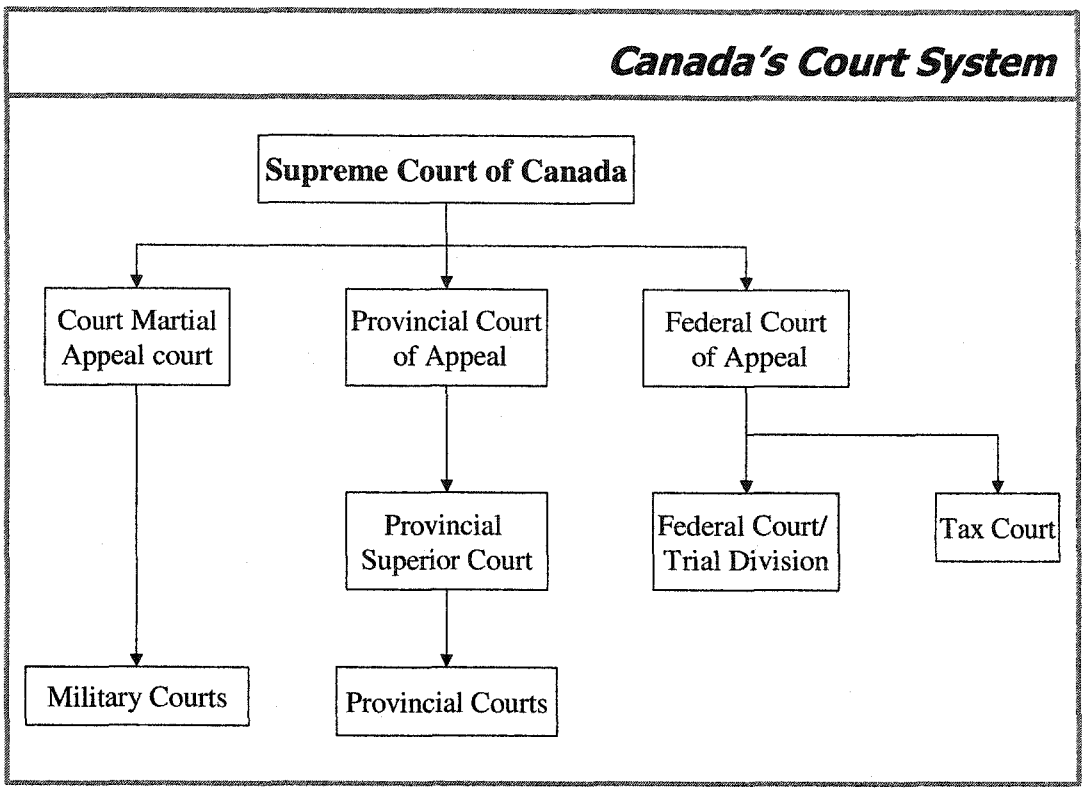

Figure 2.1: Canada's Court System (Courtesy Canada Justice, 2004)

2.3.3 Provincial and Federal Courts

The constitutional authority of the judicial system in Canada is divided between the federal and provincial governments. Federal courts include the federal court of Canada, which has jurisdictions over federal matters such as patents, trademarks and copyright, and the Supreme Court of Canada, Canada's final appeal court. The federal government has the exclusive authority to appoint and pay the judges of the superior courts in the provinces. Parliament also has the authority to establish a general court of appeal and courts for the better administration of the laws of Canada; it has used this authority to create the Supreme Court of Canada, the Federal Court and the Tax Court. In addition,

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Parliament has, as part of its criminal-law power, exclusive authority over procedure in courts of criminal jurisdiction. Federal authority for criminal law and procedure ensures fair and consistent treatment of criminal behavior across the country.

At the apex of the pyramidal legal structure sits the Supreme Court, Canada's highest court. It is the final general court of appeal, the last judicial resort for all litigations. In addition to being Canada's final court of appeal, the Supreme Court of Canada has jurisdiction over disputes in all areas of law. It is comprised of a chief justice and eight judges with minimum of 3 judges coming from Quebec (Supreme Court of Canada, 2004).

Each province and territory has a provincial court, and these courts hear cases involving either federal or provincial laws. The court system within each of the common law provinces is generally the same. Provincial courts deal with most criminal offences, family law matters (except divorce), young offenders (from 12 to 17 years old), traffic violations, provincial regulatory offences, and claims involving money up to a certain amount (set by the province in question). Provinces have explicit jurisdiction over the administration of justice within said provinces; this includes the constitution, organization and maintenance of both civil and criminal provincial courts. The Supreme Court of Canada stands at the apex of the Canadian legal system as shown in Figure 2.1 (Canada Justice, 2004).

In deciding cases, courts apply legal principles established in previous court decisions, which involved similar or analogous fact situations; this is called the theory of precedents (Marston, 1981). The most persuasive precedent is usually the decision most recently made by the highest court. Decisions of the Supreme court of Canada rank highest,

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followed by decisions made by the court of appeal of the province in which a case is commenced. Precedents from other common law jurisdictions may also be followed (Canada Justice, 2004).

2.3.4 Alternative Dispute Resolutions

There are four main disadvantages of litigation, which makes the process undesirable: 1) litigation commands a higher level of expertise and consultant participation than perhaps any other category of dispute resolution (Noce, 1989); 2) depending on the jurisdiction, a complex construction dispute may take anywhere from two to six years before it reaches trial; 3) the prolonged and detailed factual discovery process makes litigation very expensive; and 4) the relationships between members of the construction industry are intricately balanced and constantly changing. A company's biggest rival in one project can suddenly become its closest partner in another. It is important for members to maintain respectful relationships with their peers because their livelihood could depend on it. As a result, alternative dispute resolutions (ADR) should be employed whenever it is practical to do so.

The consultant or expert plays an important role in almost every aspect of claim presentation, ranging from the development of claim strategy to the actual presentation of the case (Arditi and Tokdemir, 1999b). The avoidance of litigation not only saves money and time, it also allows private disputes between parties to remain private. Once a claim has been filed, information concerning the case becomes public knowledge and parties may be subjected to unwanted opinions and scrutiny (Harmon, 2003a), (Harmon, 2003b). Solutions provided by the court often come in the form of cash rewards (Harmon, 2003a);

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however, the money may not be enough to recover total cost of the process. Litigation does not provide the opportunity for open discussions, nor does it adequately address the needs of each party. Litigation is, in fact, an expensive and time-consuming process that is not suitable for every type of conflict (Semple et. al., 1993). For disputes resolvable outside of the courtroom, the extensive amount of resources required for preparing documents, collecting evidence, attending meetings, discussing strategies, and attending pretrial motions can be conveniently avoided (Harmon, 2003a; Patterson, 1997). Alternative Dispute Resolution (ADR) is a set of techniques that aims to resolve conflicts quickly and inexpensively by introducing communication into the strategy. Methodologies used in ADR include arbitration, mediation, third-party neutrals, and minitrials (Harmon, 2003a). Arbitration is the only binding form of ADR; the rulings of arbitrators are enforceable. Mediation, third-party neutrals, and minitrials are non-binding ADR methodologies that rely mainly upon mutual respect, understanding, and cooperation. While ADR is effective for cases that can be presented in less than five days of hearing (Patterson, 1997), complex cases that involve multiple parties and events are better resolved through the structured and vigorous process of litigation (Harmon, 2003a; Patterson, 1997). The latter authors believe that the process of litigation is not suitable for resolving disputes within the construction industry because it has a tendency to increase hostility between parties.

2.4 Canadian Construction Contracts

Where parties submit competing bids, the acceptance of any of these bids results in a contract. Under common law, parties have the right to choose their contract terms and

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conditions; thus there is no prescribed format for construction contracts. There are, however, certain types of contractual arrangements and contract format that are being used in the industry. Some of these formats have been reduced to standard forms that are widely accepted (Marston, 1981).

The advantages of a common form were recognized by the industry and, as a consequence, a number of associations formed a joint committee for the purpose of determining the appropriate contents of standard forms of construction contracts and developed the Canadian Construction Contract Documents, the discussion of which follows (Kirsh and Roth, 1997).

2.4.1 Canadian Construction Contract Documents (CCDC)

The construction industry realized long ago the benefits of having a standard form of contract. The Canadian Construction Documents Committee (CCDC, 2004) is a national joint committee responsible for the development, production and review of standard Canadian construction contracts, forms and guides. Formed in 1974, the CCDC includes one owner representative from each of the public and private sectors, as well as appointed volunteer members of the following five national organizations (CCDC, 2004): the Association of Consulting Engineers of Canada, the Canadian Construction Association, the Canadian Council of Professional Engineers, the Construction Specifications Canada, and the Royal Architectural Institute of Canada. CCDC documents such as contract forms, standard forms, guides, and bulletins are intended for use by all construction industry participants including owners, design professionals, construction managers, legal professionals, contractors and subcontractors. These constituent associations endorsed

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each type of contract for use by those contracting for construction projects. The net result is what is referred to as Canadian Construction Documents Committee contracts or more commonly referred to as CCDC contracts.

2.4.2 CCDC Contracts

The committee has issued three standard construction contract forms embracing the following three distinct contracting methods: CCDC 2, CCDC 3 and CCDC 4.

- **CCDC 2 (Standard Stipulated Price Contract)**: This form assumes a lump sum or fixed price which includes the agreement, definitions, and general conditions for a construction project agreed upon by an owner and a contractor; it is based on work for a single, pre-determined fixed price or lump sum, regardless of the Contractor's actual costs. This type of contract requires that a complete set of drawings and specifications be prepared prior to soliciting bids from contractors. As a consequence, CCDC 2 places the majority of the risks regarding the performance of the work on the contractor. CCDC 2 is likely the owner-contractor contract most commonly used throughout the Canadian construction industry. With the exemption of its provisions related to payment and contract price, its general conditions are virtually identical to the other forms of standard construction contract endorsed by the Canadian Construction Documents Committee (i.e. cost plus contracts (CCDC3) and unit price contracts (CCDC4) (Construction law department, Cassels, Brock & Blackwell, 1989).

- **CCDC 3 (Standard Cost Plus Contract)**: The cost plus method of contracting is implemented in the CCDC 3 form, which is used in more urgent circumstances or

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situations where the true nature of the work is unknown or unclear at the outset of the project.

- **CCDC 4 (Standard Unit Price Contract)**: This document is similar to CCDC 2; the main difference appears with respect to the treatment of such items as contract price, method of payment, and variations in scope (CCDC, 2004).

All three standard CCDC contract forms assume a tri-partite relationship regarding the subject matter of the contract; the owner engages the consultant under a separate agreement to provide professional design services and to administer the contract between the owner and the contractor (Kirsh and Roth, 1997). In 1989, the CCDC conducted an intensive review of the 1982 version of the CCDC-2 contract. The revised version was published in 1994. It contains a number of substantial amendments and additions, including a new approach to dispute resolution. CCDC 2-1994 has been adopted as a basis for classifying the collected Canadian construction claims in this research.

2.5 The Tendering Process in Canada

Where contractors submit competing bids in the project tendering process, the acceptance of any of these bids constitutes a contract. The selection depends on the particular terms the owner has outlined in the tendering documentation (Marston, 1981). The main revolution in the law of bidding in Canada occurred in 1981 with the Ron Engineering case, which established a basic framework for determining the contractual relationships that arise in the course of a tendering process (Sandori and Pigott, 2000). Appendix D elaborates on the cases relevant to the tendering process by presenting ten construction claims related to the revolution in the law of bidding. Although it is difficult to reconcile

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any construction claim that occurs in the tendering phase, most of these claims consider Ron Engineering's 'Contract A/Contract B' theory in their analysis.

2.5.1 Ron Engineering Case

In order for a legally binding contract to exist between two parties, the first party must make an offer, and the second party must accept that offer. In the context of tendering, this gives rise to difficult questions: when is the offer made, and when is the contract formed. In the Ron Engineering case, shortly after tenders were opened, the low bidder determined that a serious error in the tender calculation was made and immediately notified the owner, requesting to be allowed to withdraw the tender and have the tender deposit returned (Hot calls in Construction, 2001). The owner rejected this request and the contractor refused to sign the construction contract and perform the work, requiring the owner to contract with the second lowest bid. The contractor commenced an action to have the tender deposit returned, and the court was required to decide whether a contract had arisen between the owner and the contractor, and if so, when that contract arose (Hot calls in Construction, 2001). The bidders' freedom to withdraw their bids up to the moment the owner accepted one of them occasionally created problems. If the lower bidder thought that the bid was too low, he would simply withdraw without suffering any legal sanctions. The construction industry had been unable to find a solid answer to this dilemma until the Supreme Court of Canada finally resolved the problem in 1981 in the Ron Engineering case involving a mistaken bid. The industry has had to live with this solution and since then, Ron Engineering has been essential to competitive bidding. (Sandori, P. and Pigott, W., 2000).

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2.5.2 'Contract A/Contract B' Analysis

The court held that an owner's call for tenders gives rise to a two-step process, resulting in two separate contracts:

- **Contract A**: The court held that the call for tenders constitutes an offer which, when responded to by a bidder through the submission of a bid in compliance with the call for tenders, gives rise to an initial tender contract which automatically comes into existence. The court referred to this initial tender contract between the owner and each conforming bidder as Contract A. The terms of Contract A are the terms of the initial call for tenders. Contract A ordinarily is specified to be irrevocable for a stipulated period of time in which the owner may elect to accept or reject any of the tenders.

- **Contract B**: The second contract formed is the construction contract that the court refers to as Contract B. Contract B comes into existence between the owner and the successful bidder once an owner accepts one of the tenders. Until such time, or until the stipulated period of irrevocability expires, the parties' actions are governed by the terms of Contract A. The terms of contract B are set out in the tender documents.

In the Ron Engineering case, the contractor maintained that a mistake was made in the calculation of the tender price, which was not discovered until the tenders were opened. After a failed request to withdraw the tender, the contractor refused to execute the construction contract. The failure to conform to Contract A's terms resulted in the retention of the contractor's tender deposit by the owner and the awarding of the contract to the second lowest bidder.

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The Supreme Court of Canada found that the contractor was in breach of Contract A, rejecting the contractor's argument that the tender had contained a mistake in the calculation of price and could not, therefore, be accepted by the owner. The court justified its ruling on the grounds that to permit the contractor to come forward after tenders had been opened and allege that the low price had been improperly calculated, would threaten the integrity of the bidding system.

2.5.3 Use of Privilege Clauses in Tender Documents

An owner is not without means, however, to include stipulations in the tender documents, expressly prescribing the ground rules upon which conduct will be measured in determining whether his/her actions are fair under the circumstances. Typically, owners include in instructions to bidders the so called 'privilege clause', which reserves for the owner the right to exercise discretion in choosing the successful bidder, even though that bidder may not be the lowest. The use of owner privilege clauses has, however, given rise to a point of contention concerning what limits, if any, ought to be imposed on the discretion that a privilege clause affords to an owner.

2.6 Computer Integrated Claim Management Systems

2.6.1 Background

Compared to other management functions of construction organizations, claims management has benefited much less from information technology. Problems with claims management are most profound in the areas of claims justification, quantification and most acute with respect to the retrieval of supporting information and the adequacy of information. Spreadsheets, databases and project management packages are used

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frequently, while expert systems have been proposed to ease justification. Newer technologies, such as electronic document management systems and imaging systems did not, as yet, enjoy widespread use in industry (Vidogah and Ndekugri, 1998).

The development of modern information technologies, such as MS Word, MS Excel spreadsheets, MS Access, MS project, Primavera, intranet, extranet, electronic data interchange (EDI) and expert systems, and their application in general project management provide an opportunity to enhance claim management by improving record keeping and presentation, easing the analysis of the impact of delays and changes and by improving communication and decision support on a legal aspect of a given claim (Ren et al., 2001).

2.6.2 Categories of Computer Integrated Claim Management Systems

A number of systems have been reported in the construction literature. These systems have been classified into the following four categories:

- **Systems for Resolving Contractual Disputes**: This category comprises the systems that attempt to resolve claims containing construction law issues; Diekmann and Girard (1984) presented the first attempt at developing a construction contract legal analysis computer system, called 'Differing Site Conditions Analysis Systems'. The system of Alshawi and Hope (1992) obtains details such as contract completion date, previous time extensions, site possession by the contractor and any notices of delay served by the contractor pursuant to a required extension of time. As well as advising on the applicability of a time extension, the system encompasses features such as advice on the appropriate action to be taken by parties in related areas of contract law,

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such as completion situations, liability for liquidated damages, freezing of fluctuations and potential for loss and expense (Vidogah and Ndekugri, 1998a). The computer systems related to this category have been accepted by legal professionals following the development of an expert system for claim identification and evaluation by the 'Watt, Tiedler, Killian and Hoffar' law firm in Virginia (Lester, 1987).

- **Systems for Analyzing Construction Claims:** Systems for analyzing claims related to change, time and cost fall into this category. Kim et al. (1989) developed a module called the claims guidance system (CGS) used for analyzing 'differing site conditions' (DSC) claims. The system also included a selection of appropriate cases and a sample consultation. AlKass and Harris (1987) developed a prototype that integrates scheduling functions with standard applications, such as databases and spreadsheets, with an expert system to analyze the impact of delays on the contractor's progress. The system provides guidance on record keeping and the preparation of cost estimates required for the presentation of a case. SuperChange is another system that analyzes claims arising under the changes clause as found in the US Federal Acquisition Regulations. Riad et al. (1994) used a Knowledge based expert system (KBES) to analyze disputes that arise due to different types of delays, to manage time-based claims.

- **Systems to Predict the Outcome of Construction Claims:** Arditi et al. (1998), (1999a), and (1999b) reported two techniques to predict the outcome of construction claims utilizing ANNs (Arditi et al. 1998) and case based reasoning (Arditi and Tokdemir, 1999a), (Arditi and Tokdemir, 1999b).

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Artificial Neural Networks: ANN is defined as a type of information processing system whose architecture is inspired by the structure of biological systems (Stergiou and Siganos, 2003). The artificial neuron is an approximately simulated model of a biological neuron. These artificial neurons are used to develop an artificial neural net with many interconnections between different neurons (Arditi and Tokdemir, 1998). Such a network has been found to be capable of carrying out parallel computations for different tasks, such as pattern recognition, linear optimization, speech recognition, and prediction (Mukherjee and Deshpande, 1995), and can therefore transform sporadic input information into meaningful output results (Stergiou and Siganos, 2003). Arditi and Tokdemir (1999b) suggested the ANN supervised learning algorithm "back-propagation" to predict the outcome winner of a litigated claim from the Illinois circuit courts.

Case Based Reasoning: CBR is a problem-solving paradigm that, in many respects, is fundamentally different from other major artificial intelligence (AI) approaches such as expert systems and neural networks. Instead of relying solely on the general knowledge of a problem domain, or on making associations according to generalized relationships between problem descriptors and conclusions, CBR is able to utilize the specific knowledge of previously experienced concrete cases. CBR reflects the essence of how human reasoning works. People reason from their own past experiences or they make use of the experiences of others in order to obtain relevant information. An individual's knowledge is the collection of experiences that he/she has either lived through or heard about. A previous experience that has been learned and is may be reused in

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the solving of future problems is referred to as a past case, previous case, or past experience. Correspondingly, a new or unfamiliar situation is the description of a new problem to be solved. It is, in effect, a cyclic process of retrieving, reusing, revising, and retaining information (Tojo and Nitta, 1997).

- **Systems to Provide Guidance to Parties Under the Contract:** These systems have been designed to provide support to the contractors, owners or their representatives. However, the only recorded attempt of a computer-integrated model using the Canadian Construction Document Contracts (CCDC) is the use of a hypertext information system for contract claim analysis (Bubbers and Christian, 1992). Bubbers and Christian (1992) suggested a new approach using a hypertext information system to assist in settling construction contract claims. This new approach uses a hypertext information system by providing a precise hypertext guide to the contract wording. Key words are linked to the relevant sections of various reference texts and descriptions of cases in which similar issues were dealt with. Users are presented with the information they need to reach an informed decision (Bubbers and Christian, 1992). Their system does not make any decision on behalf of the parties; it only provides suggestions relating to the contract document. The system provides a hypertext guide to the contract wording, which is in turn linked to the relevant sections of various reference texts and descriptions of cases in which similar issues were handled. Careful structuring and linking of the data contained in the system are necessary to enable users to focus quickly on only relevant material. In this way, the system presents users with the information they need in order for them to reach an informed decision on the validity of a claim. Clause GC 4 from the

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Canadian Construction Documents Committee (CCDC) Stipulated Price Contract (1982), which deals specifically with delays, has been selected. It is hoped that the system could inform users of the contract provisions as it guided them toward an answer to their problems. Even though the attempt was successful, the developed model was still found to be lacking in that it only addresses one section of the CCDC contract document, and cannot guide users through all the contract provisions. This last category is lucubrated in the next section due to its relevance to the developed prototype in this research.

2.6.3 Deficiencies in the Current Computer Supported Applications

The concept of construction claims is not new, but what has been deficient so far is the methodology that would help construction managers in assessing the effectiveness of their construction claim process (Kululanga et. al., 2001). According to Ren et al. (2001), the major deficiencies of current claim management practices are a lack of awareness and proper interpretation of contract terms and provisions, inadequate information and documentation, the shortage of effective claims management tools and inefficient claims negotiation.

Prediction models also incur deficiencies; previous research in this area concentrated on the use of expert systems to predict the outcome of a claim, but encountered limited success. The outcome of construction litigation is normally affected by a large number of complex and interrelated factors; these factors include social, psychological, regional cultural, religious, political and temporal issues. Given the existing technology, an intelligent system cannot simultaneously consider all these factors (Arditi and Tokdemir,

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1999a). Accordingly, the prediction of construction litigation outcomes may never reach 100% accuracy. Another drawback of the prediction model is that predictions are specific to a particular set of claims; the prediction rate of 67% for the ANN system is specific to the circuit courts in Illinois.

2.7 Closing

The system proposed in this research falls under the 'System to Provide Guidance to the Parties Under the Contract' category. The literature review presented in this chapter did not report any systems for collecting, classifying and analyzing Canadian construction claims. This thesis proposes two main contributions: a methodology to develop a repository for Canadian construction claims and a methodology to analyze the collected claims through what have been called 'analysis modules' which are the 'statistical module', the 'classification module' and the 'prediction module'. These two methodologies have been implemented in a computer-integrated system called 'Canadian construction claim tracker (CCCT)'. The methodology utilized in the design of CCCT is presented in Chapter 3, its implementation is presented in Chapter 4, and the statistical results of the 'statistical module' are presented in Chapter 5.

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3 PROPOSED METHODOLOGY

3.1 Introduction

This chapter sheds the light on the proposed methodology for classifying and analyzing Canadian construction claims. The classification methodology developed for the construction claims is introduced first. The main system components are then discussed, including the central database and the three modules. The 'statistical module' proposes a methodology for analyzing Canadian construction claims using a set of collected statistical information, the 'classification module' proposes a methodology for relating the causes of claims to the contract document, and the 'prediction module' discusses the applicability of the ANN in predicting the Canadian court decisions based on the collected cases. The final section of the chapter summarizes the mechanism of the proposed methodology in a prototype system. The proposed methodology has been incorporated into an integrated computer system called the "Canadian Construction Claims Tracker". Note however that any reference to the prototype system in this chapter refers to its conceptual design; implementation of the system is described in the next chapter.

3.2 Claim Classification Methodology

In order to classify Canadian construction claims, a standard classification system is used. The best method developed thus far for claim classification involves the use of a standard

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Canadian construction document. As introduced in Chapter 2, the Canadian construction contract document (CCDC) is widely used as a standard Canadian construction contract. CCDC 2 -1994 is selected as the basis for the classification of the 567 cases developed in this research due to the industry's familiarity and recognition of its standards; in fact, CCDC sells approximately 50,000 copies of its documents annually (CCDC, 2004). As illustrated in Figure 3.1, the 12 categories of the classification methodology correspond to the stipulated price contract CCDC 2 -1994 general conditions. However, after thorough investigation of the 567 collected cases, it has been observed that the causes of claims under each category have various origins; for example, some of the cases that belong to the 'general provisions' category are related to 'breach of contract' issues, while other cases are related to 'misrepresentation of construction clauses' issues and others are related to 'renegotiation of contract documents' issues. To further classify the cases, subcategories have been developed to represent more specific issues that may occur. The 32 subcategories were developed based on their frequency of occurrence within the construction industry. The cases have been sorted based on the 12 categories and 32 subcategories illustrated in Figure 3.1.

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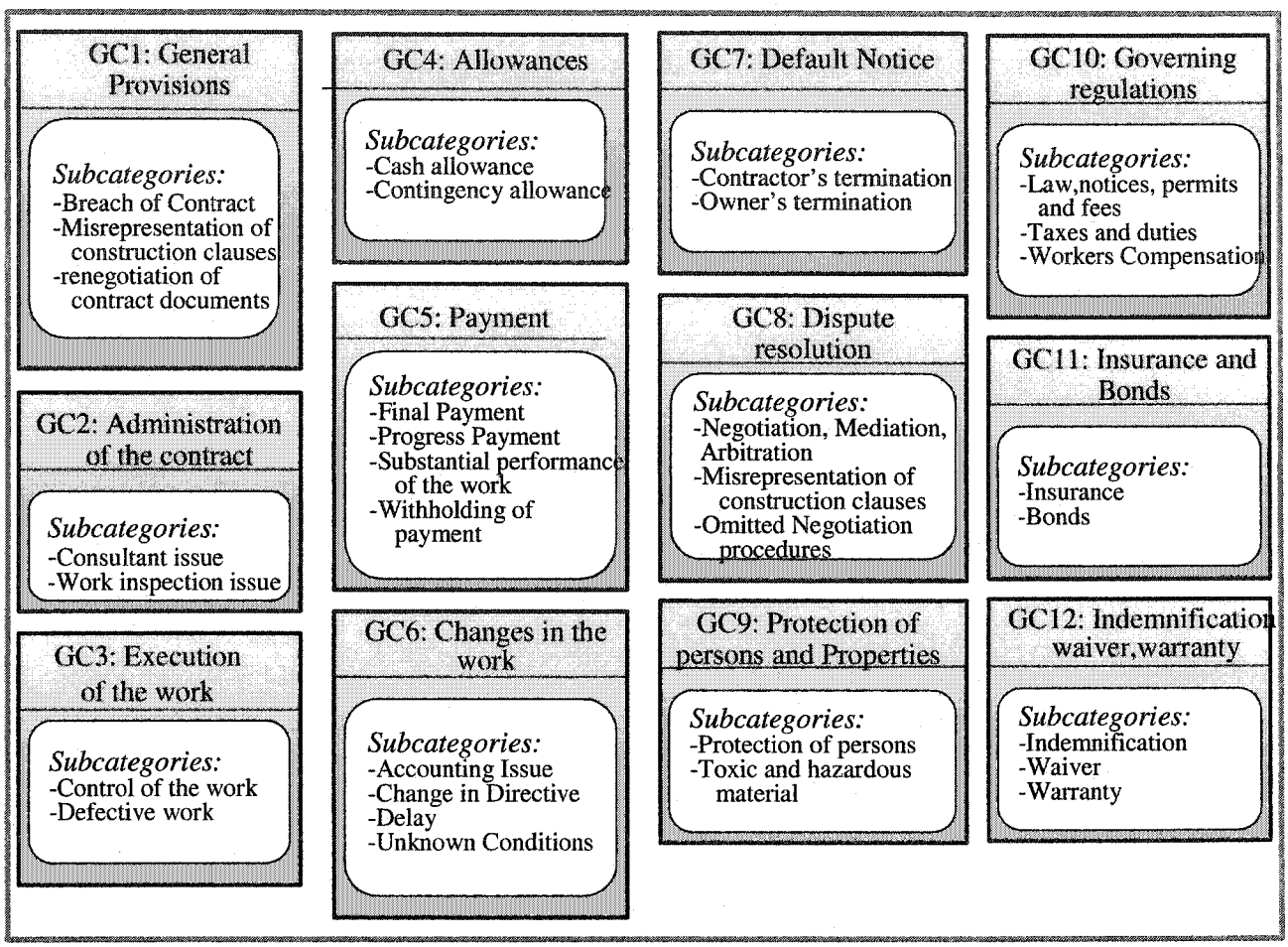

Figure 3.1:Classification Methodology

Two main objectives of this research include: 1) the development of an automated databank for Canadian construction claims; and 2) the analysis of Canadian construction claims. Therefore, any case that meets the minimum required criteria for information is included in the databank. The second objective of this research requires claims with detailed information. In order to differentiate claims with varying levels of available information, the 'limited cases' group, which contains a limited amount of information, and the 'detailed cases' group, which contain a detailed amount of information, were

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formed. The information required form the 'limited cases' group and the 'detailed cases' group are listed in Table 3.1. 567 construction cases have been collected for the purpose of this research: 460 'limited cases' and 107 'detailed cases' as illustrated in Table 3.2.

Table 3.1: Information of Limited vs. Detailed Cases

Limited claim information	Detailed claim information
Claim Information	**Claim Information**
Claim name	*Claim name*
Claim Source	*Claim Source*
Occurrence year	*Occurrence year*
CCDC category	*CCDC category*
CCDC Subcategory	*CCDC Subcategory*
Parties Information	**Parties Information**
Plaintiff limited attributes	*Plaintiff detailed attributes*
Defendant limited attributes	*Defendant detailed attributes*
	Owner attributes
	Contractor attributes
	Project Information
	Contract attributes
	Project attributes
	Prediction input Information
	Prediction input attributes

Table 3.2: Percentage of Limited vs. Detailed Cases

	Limited cases	Detailed cases
Number of cases	460	107
% of total cases	81.1	18.9

The claims have been gathered from the various sources listed in Table 3.3. The detailed claims have been extracted from the provincial and Supreme Courts of Canada records because they provide official detailed judicial information that can extend to up to 20 pages of court briefings each. The repository developed in this research includes only litigation claims because of the lack of available relevant information about other resolution procedures, such as arbitration, mediation and negotiation.

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Table 3.3: Sources of Collected Cases

Source Name	Source Type
The annotated Construction Contract by Harvey Kirsh	Book
Bidding and tendering: What is the law by Paul Sandori	Book
Construction law letter	Journal
Institute 2001	Conference
Legal education society of Alberta	Conference
Canadian Legal institute of Canada	Web site
Alberta provincial and supreme courts	Web site
British Columbia provincial and supreme courts	Web site
Saskatchewan provincial and supreme courts	Web site
Manitoba provincial and supreme courts	Web site
Ontario provincial and supreme courts	Web site

3.3 System Main Components

The proposed methodology has been implemented in a computer-integrated system called 'the Canadian Construction Claims Tracker (CCCT). CCTC consists of four main components: the central database, the 'statistical module', the 'classification module' and the 'prediction module' as illustrated in Figure 3.2.

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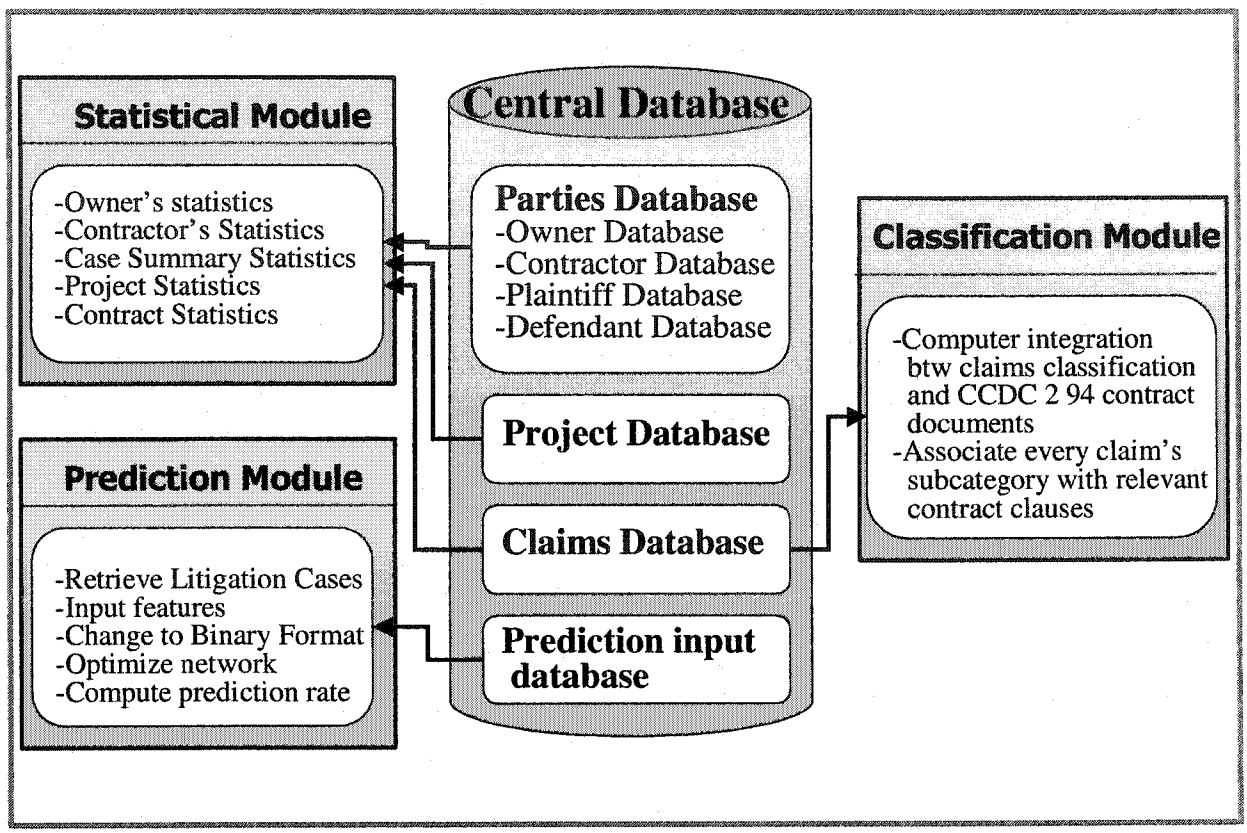

Figure 3.2: Canadian Construction Claim Tracker (CCCT) Main Components

3.4 System Central Database

The central database of the system is divided into four sub-databases: the 'claims database', the 'parties database', the 'project database' and the 'prediction input database'. Each database not only functions as a storage unit but also provides information to the three modules for analysis. Information from the 'claims database' is analyzed in the 'classification module' whereas information from the 'prediction input database' is analyzed in the 'prediction module'. As illustrated in Figures 3.3 and 3.4, the 'statistical module' gathers its information from the 'claims database', the 'project database' and the 'parties database'.

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3.4.1 Claims Database

The claims database is an essential part of the system. Its functionality is illustrated in Figure 3.3. The cases collected are first classified into categories and subcategories. The main categories and subcategories of the proposed system provides framework for the claim classification structure.

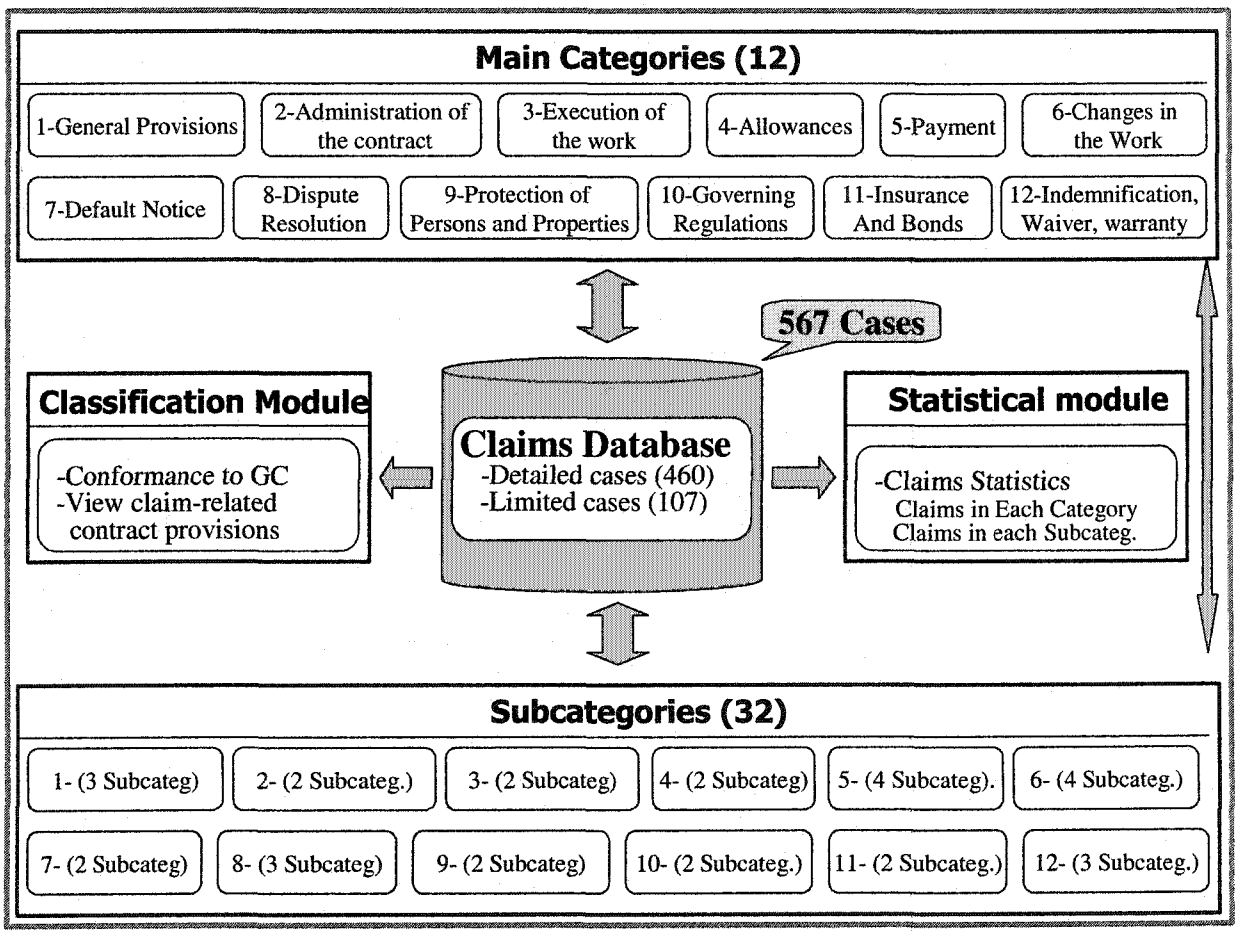

Figure 3.3:Data Flow of the Claims Database

Information within the 'claims database' is separated into detailed and limited categories. The information stored in the 'claims database' under the detailed format is analyzed in

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the 'statistical module' and the 'prediction module' as shown in Figure 3.3. The 'claims database' contributes to the 'statistical module' by providing claims statistics. In addition, the 'claims database' contributes to the 'classification module' by associating every case with relevant contract provisions; based on the categories-subcategories selection, every subcategory is linked with related CCDC contract provisions. The 'classification module' section gives examples of the applicability of the claim-contract relations.

3.4.2 Parties, Project and Prediction Input Databases

The 'parties database', 'project database' and 'prediction input database' have been combined because they perform similar functions illustrated in Figure 3.4.

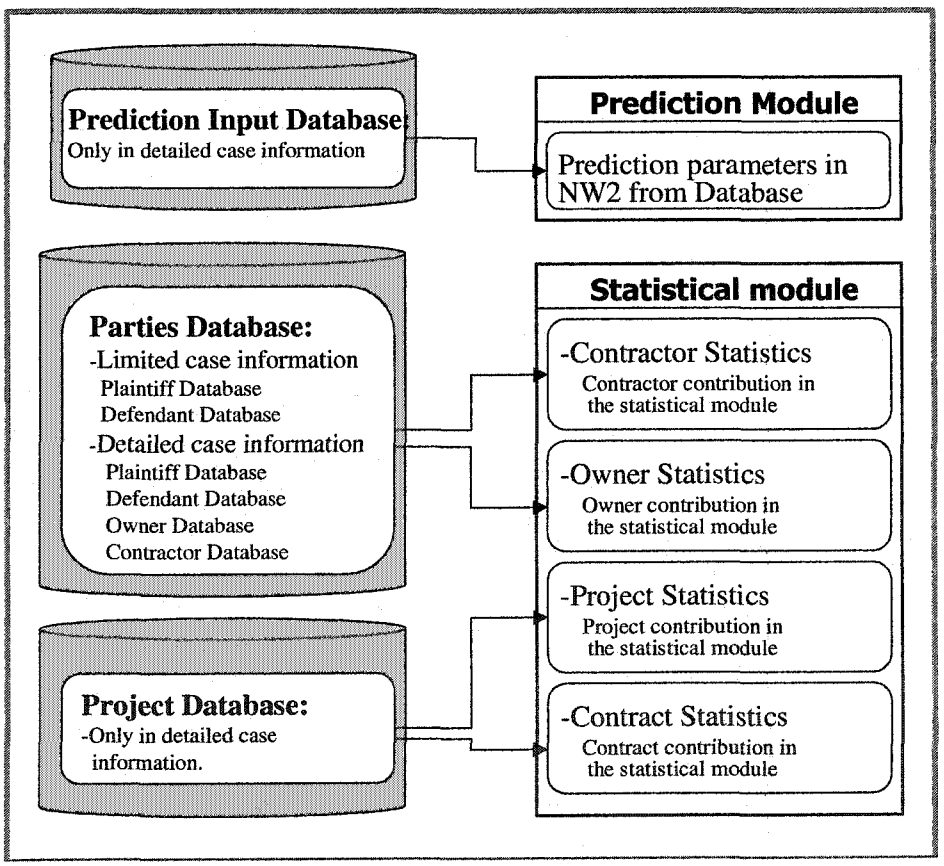

Figure 3.4: Data Flow of the Parties, Project and Prediction Input Database

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- **Parties Database:** The 'parties database' consists of four sub-databases, which include the 'plaintiff database', 'defendant database', 'owner database' and 'contractor database' as illustrated in Figure 3.4. Information about the plaintiff/defendant and owner/contractor has been collected in separate databases as each set of information serves a different purpose; information about the defendant/plaintiff is collected because it is essential information about a case, whereas information about the contractor/owner is collected for statistical purpose. Vidogah (1997) describes the impact of the contractor and owner's organization structure and management on claim occurrence and proves that the statistical information presented in Table 3.4 influences claim occurrence. The information shown in Table 3.4 has been incorporated in the statistical module developed in this research and the validity of these findings with respect to Canadian construction claims is discussed in the next chapter.

Table 3.4: Contractor and Owner Statistical Findings (Vidogah, 2002)

Owner Statistical findings
Owner's interpersonal skills
Owner's responsibility structure
Contractual parties with owner's upper management
Owner's organization based on past projects
Contractor Statistical findings
Competence level
Interpersonal skills
Previous Experience on similar projects
Responsibility structure of the project individuals
Successful organization based on past projects

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- **Project Database**: As illustrated in Figure 3.4, the 'project database' provides project and contract related statistical information to the 'statistical module'. The project information is applied to the 107 detailed cases.

- **Prediction Input Database:** The purpose of this database is to house prediction input information used by the 'prediction module' in order to predict the outcome of the litigation process. The prediction information is applied to the 107 detailed claims.

3.4.3 Conceptual Design of the Central Database

The database design first requires the collection and analysis of data. During this stage, construction professionals and legal professionals were interviewed and asked to give their opinions on the information provided in the proposed databases. Furthermore, the proposed system was presented to a panel of professionals including lawyers, claim consultants and academics during a presentation given at the University of Alberta in Edmonton, Canada on February 12th, 2004. The original conceptual design was subjected to many corrections and improvements and, as a result, the database conceptual design was altered many times. The final result of this process is a concisely written set of user requirements presented in terms of related data organized on the three previously described levels: claim information, project information and parties information.

Once all the requirements were collected and analyzed, the next step was to create a conceptual schema for the database, using a high-level conceptual data model. Because the conceptual design does not include any implementation details, it was easy to communicate the proposed system to the panel in the presentation in a non-technical

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manner. The Entity-Relationship (E-R) presented in Figure 3.5 describes data as entities, attributes and relationships.

- **Entities and attributes:** An entity type is represented in the E-R diagram as a rectangular box enclosing the entity type name. Attribute names are enclosed in ovals and attached to their entity type by straight lines. An entity type describes the schema of a set of entities that share the same structure. An important constraint on the entities of an entity type is the uniqueness constraint on attributes. An entity type usually has an attribute whose values are distinct for each individual entity. Such an attribute is called a key attribute and its value can be used to identify each entity uniquely (Watson, 2002). Considering the 'claim entity' in Figure 3.5 as an example, the key attribute is 'case Id'. Some entity types have more than one key attribute. Each simple attribute of an entity type is associated with a value set or domain, specifying the set of values that may be assigned to that attribute for each individual entity.

- **Relationships, roles and constraints:** Two main types of relationship constraints are distinguished: cardinality ratio and participation. The cardinality ratio specifies the number of relationship instances that an entity can participate in. The participation constraint specifies whether the existence of an entity depends on its being related to another entity via the relationship type. There are two types of participation constraints: total and partial. Total participation is displayed as a double line connecting the participating entity type to the relationship, whereas a single line represents partial participation. The selected E-R notation for specifying structural

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constraints involves associating a pair of integer numbers (Min, Max) with the quantity of relationships in which an entity participates. The numbers specify that the entity must participate in at least Min and at most Max relationship instances. In this method, Min=0 implies partial participation, whereas Min > 0 implies total participation. In the E-R diagram presented in Figure 3.5, a category participates with the entity subcategory with a minimum of two and a maximum of five instances, because every category has at least two subcategories and at most five subcategories. Weak entity types, such as the 'prediction input entity', may not have key attributes of their own. Entities belonging to a weak entity type are identified by being related to specific entities from another entity type, such as 'claim entity' in combination with 'Case ID'. The 'claim entity' is referred to as the identifying owner. A weak entity type normally has a partial key, which is the set of attributes that can uniquely identify weak entities related to the same owner entity. In E-R diagrams, a weak entity type and its identifying relationship are distinguished by double lines surrounding their boxes.

- **E-R Diagram:** The E-R diagram is shown in Figure 3.5. All the entities attributes have not been included in the E-R diagram for purposes of clarity. The full list of attributes for every entity is shown in Figure 3.6.

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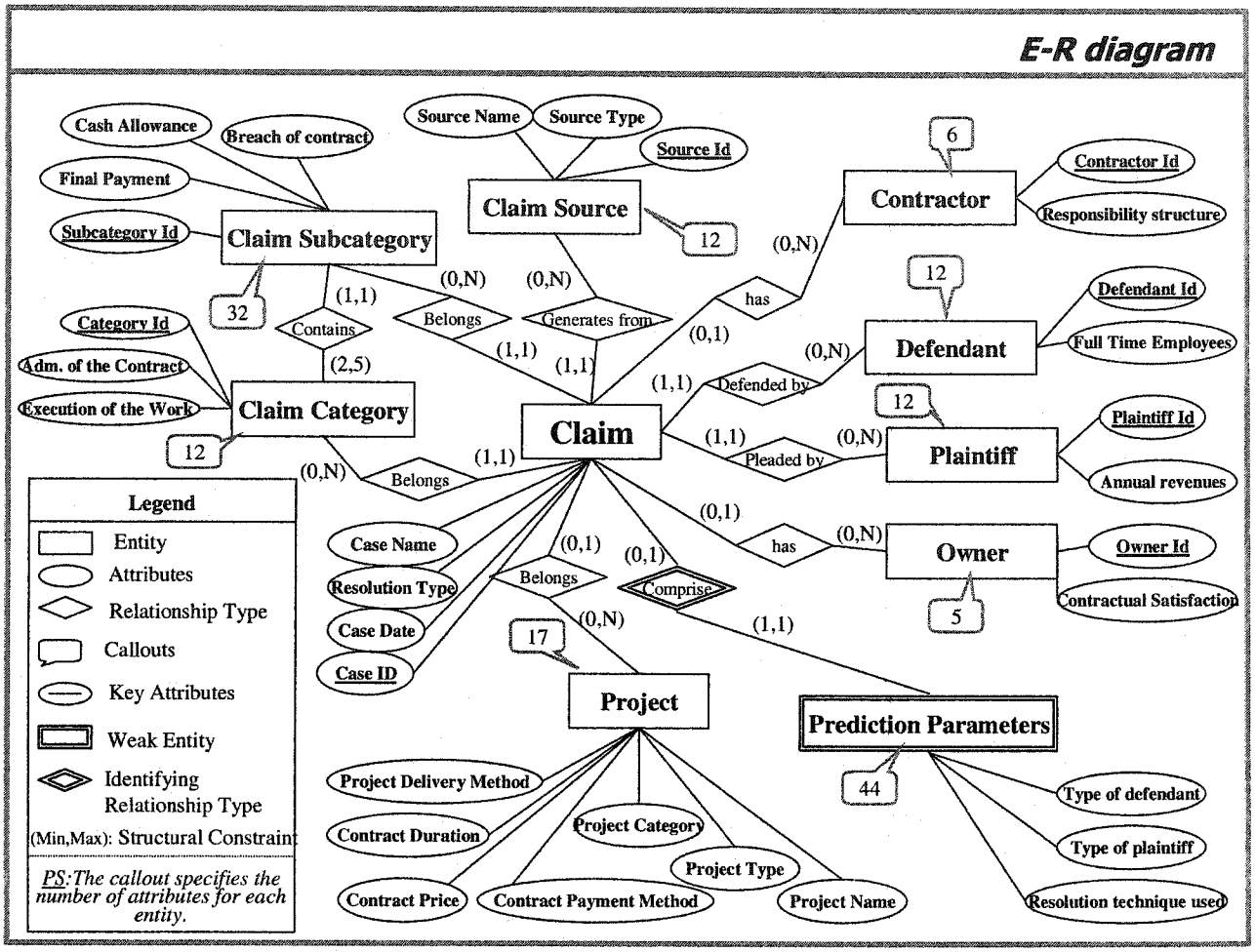

Figure 3.5: E-R Diagram

There are ten entities in the E-R diagram: claim, plaintiff, defendant, claim source, claim category, claim subcategory, project, owner, contractor and prediction parameters. The callouts in the E-R diagram specify the number of attributes for each entity. The ten entities in the database and the list of all of the attributes are shown in Figure 3.6. For every attribute, a 'one of a list' option is presented.

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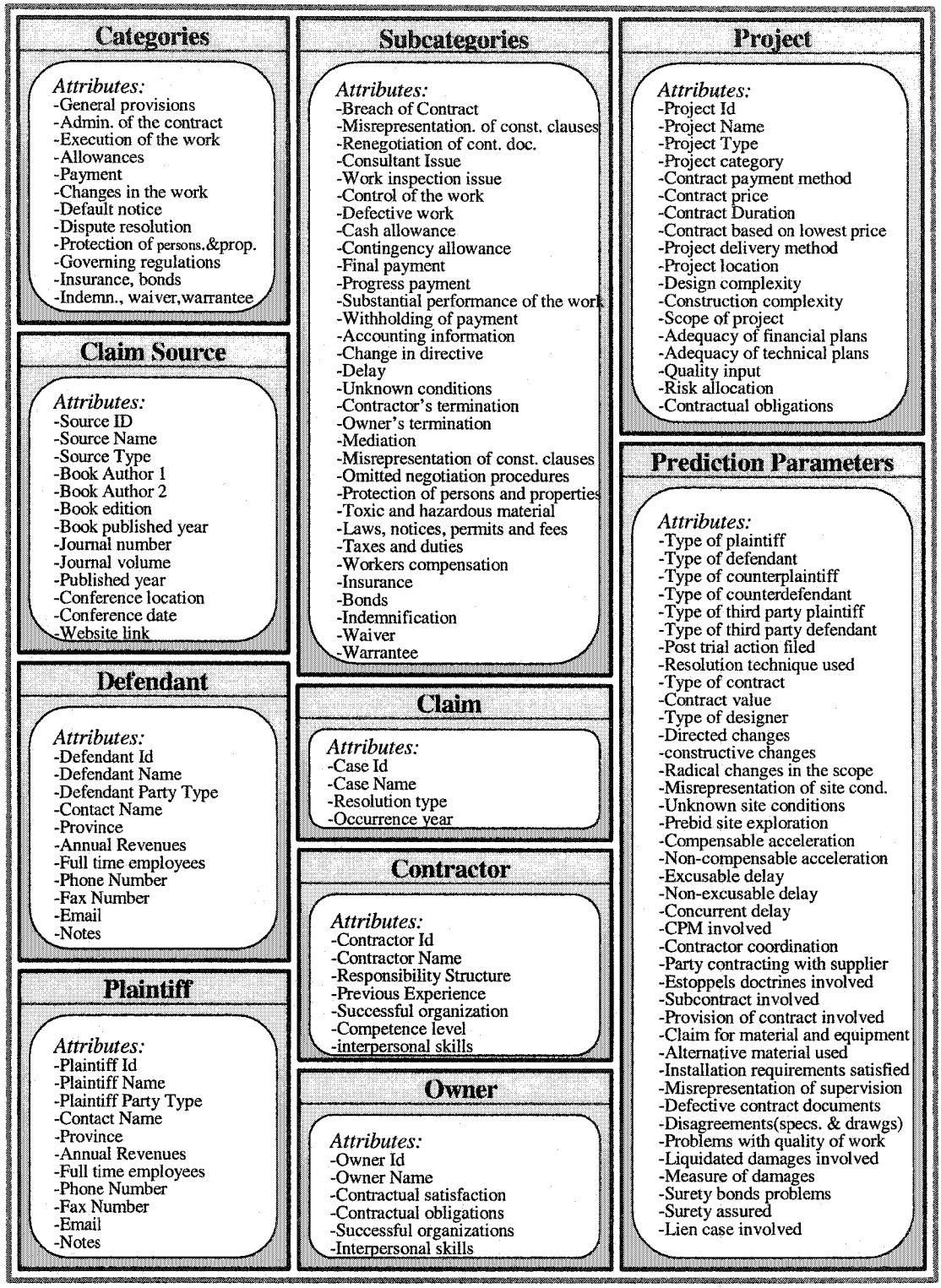

Figure 3.6: Attributes of the E-R diagram

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3.5 Conceptual Design of the Statistical, Classification and Prediction Modules

After designing the database, claims are now ready for analysis through the three developed modules. The database has been designed with the modules functionality in mind because the parameters inputted to the detailed claims information serve one or more of the three modules developed. The 'prediction input database' serves the 'prediction module', and the 'claims database' serves the 'classification module', however the 'statistical module' obtains its information from three databases: the 'claims database', the 'project database' and the 'parties database'.

3.5.1 Conceptual Design of the Statistical Module

The statistical module is only applied to the 107 'detailed cases' collected, due to limitations in the information provided by the 'limited cases'. Information from three databases are utilized by the 'statistical module': the project database', the 'claims database' and the 'parties database'; as illustrated in Figure 3.7, the 'project database' provides the contract and project statistics information, the 'claim database' provides the claim related statistics and the 'parties database' provides statistical information related to the contractor and the owner. The 'prediction input database', however, does not contribute to the statistical module because its information is used solely in the prediction module. Table 3.5 lists all statistical parameters and identifies the one-of-a-list selection options for each parameter. The statistical parameters used in this research were selected based on two criteria: 1) parameters of 'contractor statistics' and 'owner statistics' were extracted from a previous study performed by Vidogah and Ndekugri (1997) that proved the impact of these parameters on claim occurrences and 2) parameters of 'contract

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statistics', 'claim statistics', and 'project statistics' were developed based on the availability of claim information from official court websites as well as personal judgement. Implementation and results of the 'statistical module' and the 'central database' as a whole are presented in Chapter 4.

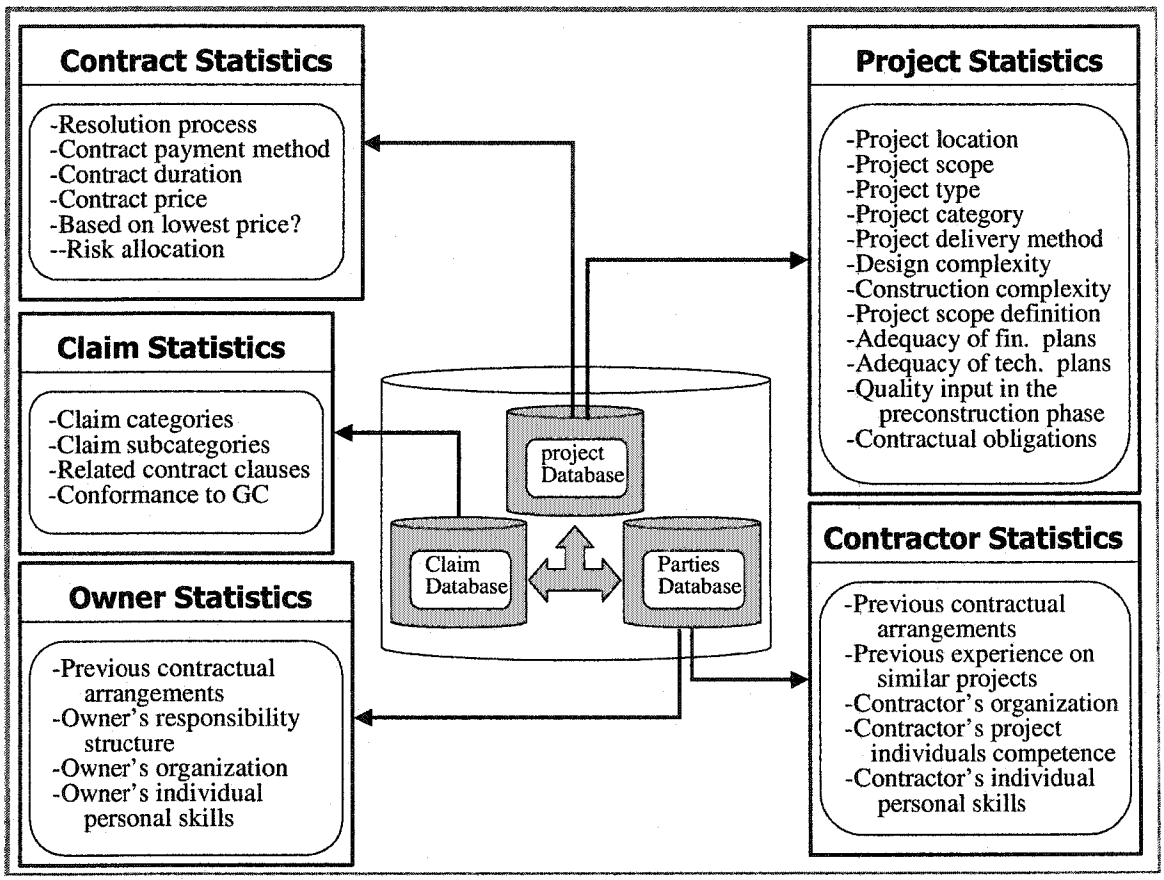

Figure 3.7: Data flow for the Statistical Module

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Table 3.5: Statistical Parameters

Statistical parameter	One of a list selection
Project Statistics	
Project location	BC, Prairies, Ontario, Quebec or Atlantic Region
Project Scope	Well defined or not well defined
Project Type	Public or private
Project Category	Commercial construction, residential construction, institutional, industrial, heavy civil, road construction, utility projects or specialty trades
Project delivery method	Traditional, design-build or construction management
Design Complexity	Easy, moderate or difficult.
Construction Complexity	Easy, moderate or difficult.
Adequacy of financial plans	Adequate or not adequate
Adequacy of technical plans	Adequate/ or not adequate
Quality input	Adequate/ not adequate
Contractual obligations	Realistic/ not realistic
Contract Statistics	
Resolution process	Litigation, mediation, negotiation or arbitration
Contract payment method	Stipulated Price, unit price or cost plus.
Bid Type	Prequalification, open bid or private bid.
Contract Price	1-5M; 5-10M; 10-20M; 20-50 M; >50 M (M of Can.dollars)
Contract Duration	< 6 mth; 6mth–1 yr; 1 yr–2yr; 2 year-5 year or > 5 yr
Risk allocation	Poorly, moderately or well identified
Contract based on lowest price?	Yes or no
Claim Statistics	
Claim category	One of the 12 categories: GC 1 to GC 12 selection
Claim subcategory	One of the 31 subcategories
Claim date	Date by year of the claim start date
Owner Statistics	
Contractual satisfaction	Owner's responsibility structure satisfied or not satisfied
Contractual Obligations	Owner's responsibility structure effective or not effective
Successful organizations	Owner's organization considered effective on previous projects or not effective
Interpersonal skills	Owner's individual interpersonal skills effective or not effective
Contractor Statistics	
Responsibility structure	Owner's responsibility structure satisfied or not satisfied
Previous experience	Contractor's organization ever had previous experience with this type of projects or not
Successful organizations	Contractor's organization considered successful based on previous projects
Competence level	Contractor considered competent and experienced or not
Interpersonal skills	Contractor's individual interpersonal skills considered effective or not effective

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3.5.2 Conceptual Design of the Classification Module

The category and subcategory selection for each claim is required upon inputting the 'claims database' information. Based on the categorization system, each claim is linked to a part of the CCDC 2-1994 contract document that is related to the subcategory in question. Once the construction claim has been assigned a CCDC category and subcategory, the claim is linked to relevant sections of various CCDC reference texts and descriptions in which similar issues were dealt with. In this way, practitioners are presented with the information they need in order to reach an informed decision on the validity of a claim. In presenting claim related contract provisions, advice regarding the congruity of the contract and the claim is presented for participants in the claim process. CCDC 2 -1994 is found to be the most appropriate contract document for the analysis of the claims in this research because it is currently widely used in owner-contractor contract within the Canadian construction industry. However, the same methodology can be applied to different contracts relevant to the parties involved in the claim process; if the claims relevant to the City of Edmonton are analyzed, the contract documents used by the city for their projects can be used to analyze contract-claims relations and can be adapted to the system. Table 3.6 illustrates an example of the relationship between classification and CCDC contract documents; the 'payment' category is selected as an example. The 'payment' category and its corresponding subcategories are linked to the CCDC contract document provisions via the subcategories.

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Table 3.6: Contract Provisions For the "Payment" Category

Category	Subcategory	CCDC Contract Provisions
Payment	Final Payment	Consultant responsibility First application of payment schedule of values
	Progress Payment	Deadline Application submission Workers compensation
	Substantial performance of the work	Contractor responsibility Owner responsibility payment of holdbacks Deadline
	Withholding of payment	Unforeseen conditions Non conforming work

Each subcategory is associated with specific contract clauses in the CCDC 2 -1994 contract documents. The CCDC contract documents have been slightly modified to account for the distribution of the contract documents within the subcategories. As illustrated in Table 3.6, the CCDC contract provision topics for the payment category are consultant responsibility, first application of payment and schedule of values. These headings contain CCDC contract descriptions that can be accessed in Appendix B. Each subcategory is similarly associated with specific contract headings that contain relevant contract clauses. Tables 3.7 and 3.8 present a randomly selected claim example, 'Bg Checo International limited v. British Columbia and Power Authority', which includes the category, subcategory and relevant CCDC contract clauses it belongs to.

Table 3.7: Contract Analysis for the 'Bg Checo International' Case

Case	Category	Subcategory	CCDC Contract provision
Bg Checo International Limited v. British Columbia and Power Authority	Changes in the work	Delay	Deadline - delays due to owner issues - Miscellaneous delay - delay due to legal authority

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Table 3.8: Description of the CCDC Contract Provisions for the 'Bg Checo' Case

Subcategory	CCDC related headings	CCDC related provisions
Delay	Deadline	Written notice of claim is given to the consultant not later than 10 days after the commencement of the delay.
	Delays due to owner	REIMBURSEMENT: The contractor shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of said delay
		TIME EXTENSION: The contract time shall be extended for such reasonable time as the consultant may recommend in consultation with the contractor
	Miscellaneous delay	REIMBURSEMENT: The contractor shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of said delay
		TIME EXTENSION: The contractor shall not be entitled to payment for costs incurred by said delays unless such delays result from the actions of the owner
	Delays due to legal authority	REIMBURSEMENT: The contractor shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of said delay
		TIME EXTENSION: Then the contract time shall be extended for such reasonable time as the consultant may recommend in consultation with the contractor

3.5.3 The conceptual Design of the Prediction Module

The 'prediction input database' provides the input attributes presented in Table 3.9. The objective is to predict the outcome of the litigation process (owner, contractor, subcontractor, engineer, supplier or insurance). The 107 'detailed cases' collected have been analyzed and the attributes listed in Table 3.9 have been applied to all the detailed claims. Arditi and Tokdemir (1998) introduced a method to predict the outcome of construction claims using ANNs; 40 input parameters were used to predict the outcome of 102 Illinois Circuit Court cases. These same parameters are shown in Table 3.9 and are validated in this research regarding Canadian construction claims. When information

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about specific attributes was unavailable, the attribute was disregarded. Note, however, that some sources of claim information such as the Canadian official provincial courts, provided valuable information about each construction claim.

Table 3.9: Prediction Input Parameters

Prediction Parameters (1)	Prediction Parameters (2)
Type of plaintiff	Non-excusable delay
Type of defendant	Concurrent delay
Type of counterplaintiff	CPM involved
Type of counterdefendant	Contractor coordination
Type of third party plaintiff	Party contracting with supplier
Type of third party defendant	Estoppels doctrines involved
Post trial action filed	Subcontract involved
Resolution technique used	Provision of contract involved
Type of contract	Claim for material and equipment
Contract value	Alternative material used
Type of designer	Installation requirements satisfied
Directed changes	Misrepresentation of supervision
Constructive changes	Defective contract documents
Radical changes in the scope	Disagreements (specs and drawings)
Misrepresentation of site conditions	Problems with quality of work
Unknown site conditions	Liquidated damages involved
Prebid site exploration	Measure of damages
Compensable acceleration	Surety bonds problems
Non-compensable acceleration	Surety assured
Excusable delay	Lien case involved

The challenge lies in identifying claims that are directly related to construction. For example, the Supreme Court of Canada handles all types of litigations, and the only way to search for construction claims is by performing a keyword search on all the available claims. The search for claims providing attributes for the 'prediction input database' has been laborious. Figure 3.9 presents the methodology followed in the prediction module to predict the outcome of the 107 construction claims. The methodology is implemented in

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three steps: 1) the prediction input information is extracted from the database; 2) the prediction information is changed from the one-of-a-list format to binary format; and 3) the 'binary format' data is introduced to the prediction software NeuroShell for analysis. Two sets of data are developed: 1) 87 training data used for the training of the network and 2) 20 test data used for testing the trained data points. Some of the factors that affect the prediction rate are the number of hidden layers, number of hidden neurons, NN architecture, pattern selection, weight updates and learning ratio. The best prediction rate is configured only after optimization of the network.

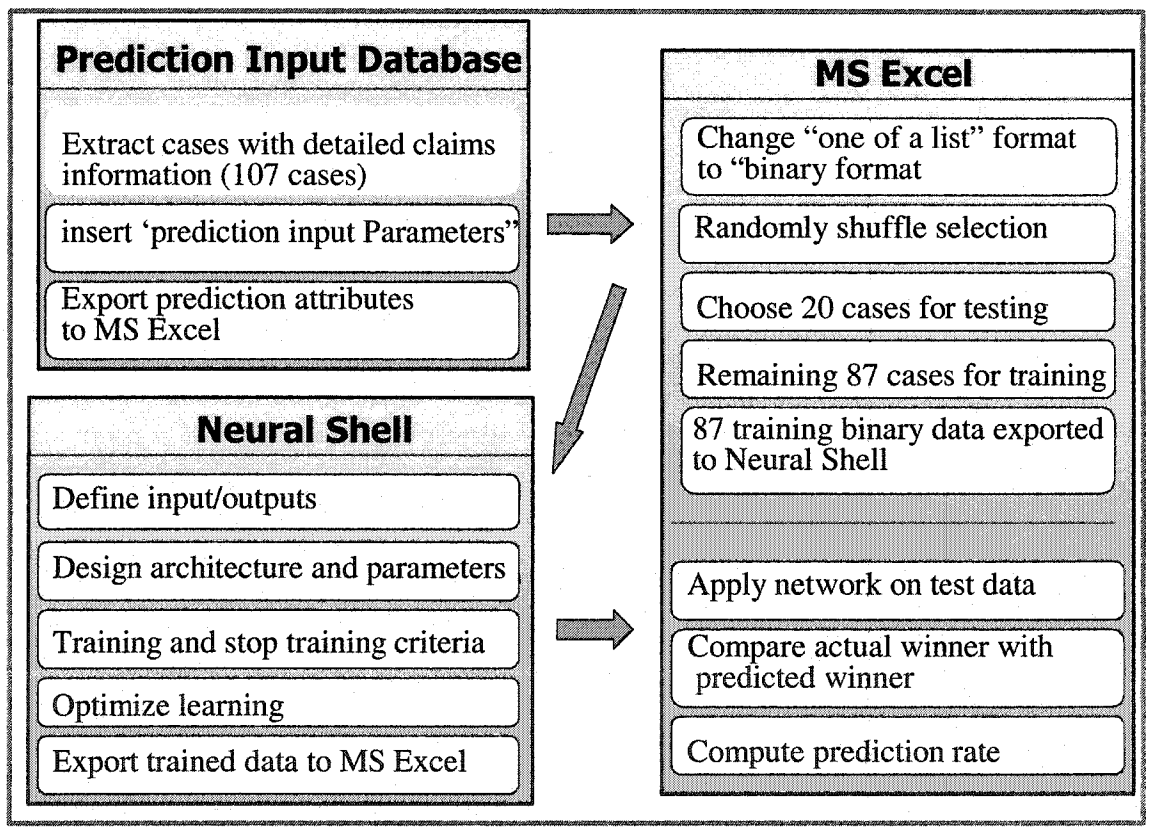

Figure 3.8: Prediction Module Data Flow

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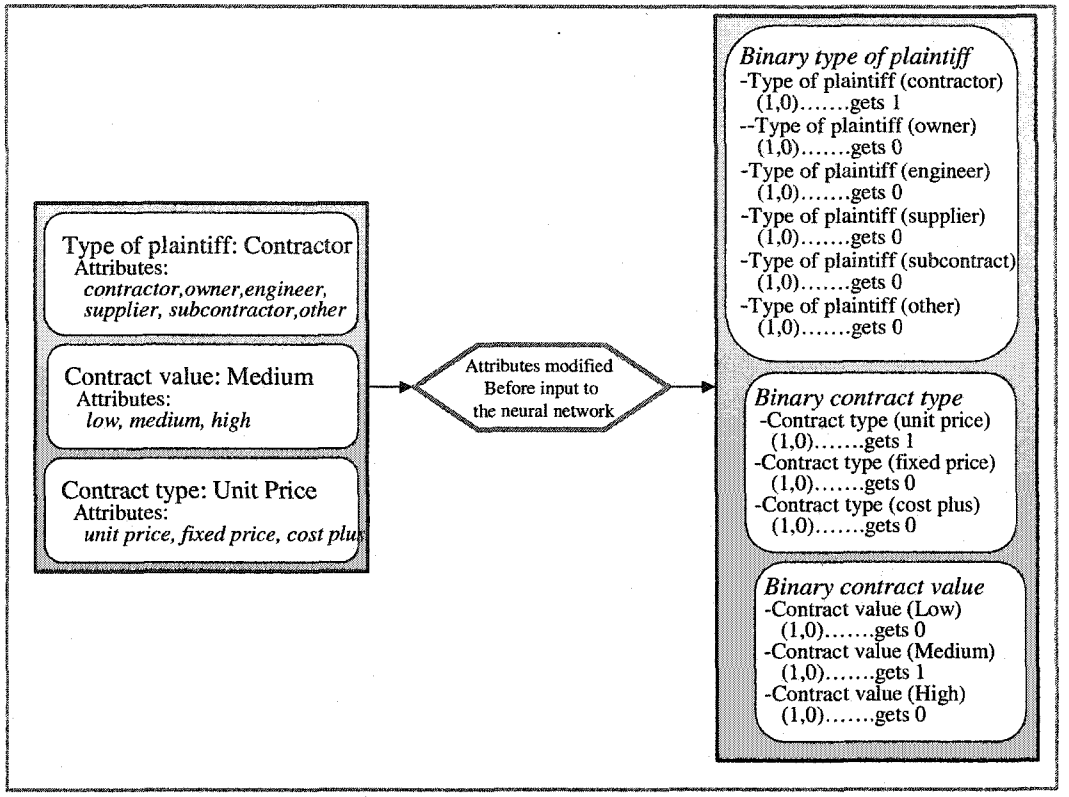

Figure 3.9: Example of a Binary Format Transformation

Artificial Neural Networks deal only with numeric input data. Features have to be in binary format; if there are two alternatives for a given feature, then one of these alternatives would get '1' and the other '0', depending on which one is involved in the case. An example of the binary format transformation is presented in Figure 3.9. Three examples of attributes are changed from the "one of a list" format to binary format. The elements that were defined by multiple alternatives (one of a list) were split into separate elements, one for each alternative, and each alternative was represented in a binary format. While the methodology for inputting the prediction parameters to the prediction software has been discussed in this chapter, the implementation and the results of the ANNs in NeuroShell will be discussed in Chapter 4.

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3.6 Proposed Prototype System Conceptual Design

Following description of the different databases and modules, the prototype system illustrated in Figure 3.10 summarizes the methodology presented in this research and illustrates the proposed system main process. Building on the input parameters and the criteria, the proposed system formulates the desired output through its four main elements: the database design and implementation, the 'statistical module', the 'classification module', and the 'prediction module'. The input parameters are related to the four main streams of the collected data: claim based, project based, parties based, and prediction-based data. Many criteria have to be taken into account before developing the prototype system, some of which have been included in Figure 3.10.

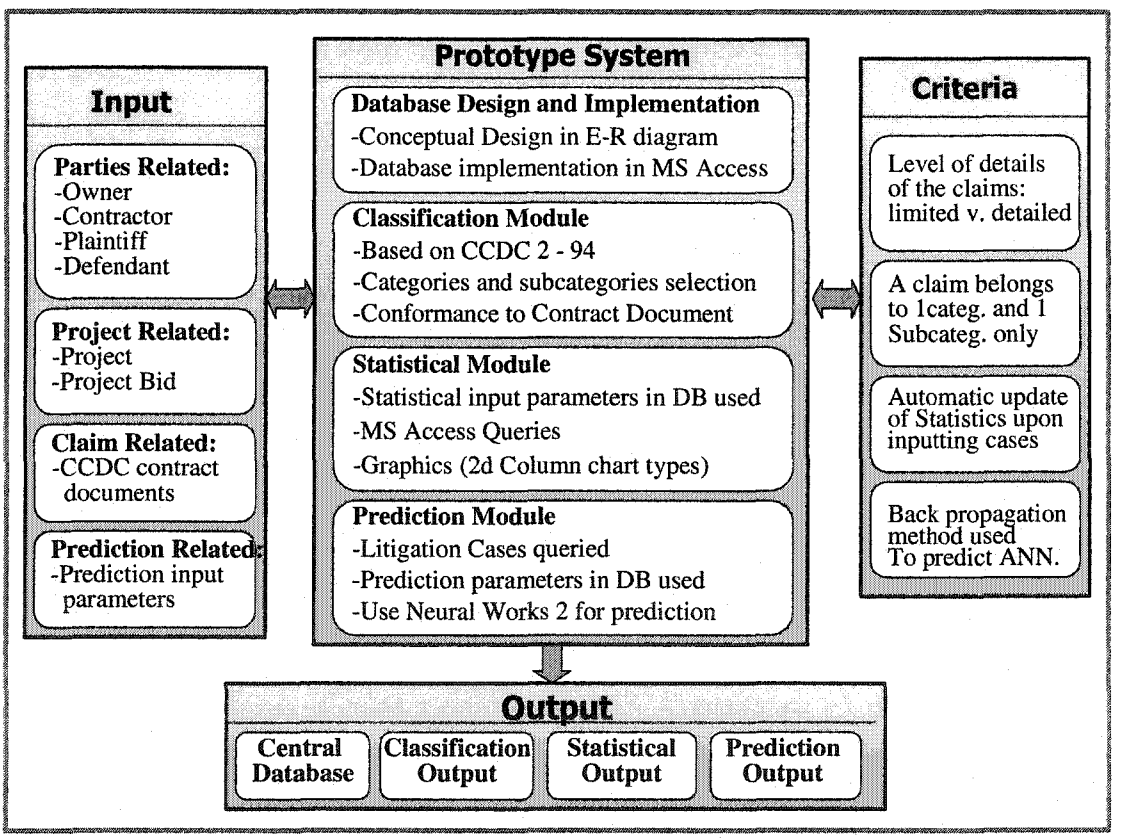

Figure 3.10: Proposed System Main Components

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3.7 Closing

The proposed methodology has been summarized in the last section as a collection of databases and three modules. Currently, the database stores information about 567 Canadian construction claims from ten different sources. Eventhough the modules serve different purposes, they all help in the analyses of Canadian construction claims; the statistical outputs assist users in benchmarking Canadian claims. The 'classification module' presents the users with the information needed to reach an informed decision on the validity of a claim and the 'prediction module' assists in validating the applicability of predicting litigation claims within the Canadian construction industry. The next step is to implement the database in DBMS software; MS Access is chosen for this construction claim system. The conceptual schema is transformed from the high-level data model into the implementation data model. This step is called the logical database design, or data model mapping, and is fully described in the following chapter.

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4 SYSTEM IMPLEMENTATION

4.1 Introduction

The implementation of the prototype system mentioned in Chapter 3 is discussed in this chapter. The system is called the 'Canadian Construction Claims Tracker' (CCCT) and is constructed using MS Access and Visual Basic for Application (VBA). CCCT is composed of two major components: the central database and the analysis modules. The central database implemented in CCCT includes the 'claims database', the 'project database', the 'parties database' and the 'prediction input database'. The Canadian Construction Claim Tracker also integrates the central database with the analysis modules. The 'statistical module' and the 'classification module' are implemented in CCCT while the 'prediction module' is implemented using NeuroShell.

4.2 Database Implementation

The conceptual schema represented by the E-R diagram in Figure 3.5 is referred to as a high-level data model and has been discussed in Chapter 3. The E-R diagram is transformed into a data model represented by the MS Access relationships illustrated in Figure 4.1. The transformation process is called data model mapping; entities are transformed into MS Access tables and E-R representations are transformed into MS Access relationships. The conceptual schema of the CCCT is represented in a set of data forms as shown in Figure 4.2. Visual Basic for Application has been used to customize

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the application. The main screen of CCCT contains six components: 'view claims', 'update claims', 'search claims', 'statistics', 'classification' and 'prediction info'. The 'view claims' section allows the user to view the stored detailed and limited cases from the database. A separate 'update claims' section is proposed for the user to add or edit cases. The 'search claims' section allows different types of queries to facilitate the search for specific cases based on specific criteria. The 'statistical module', the 'classification module' and the 'prediction module' are implemented in the 'statistics', 'classification' and 'prediction info' sections respectively and are discussed later in the chapter.

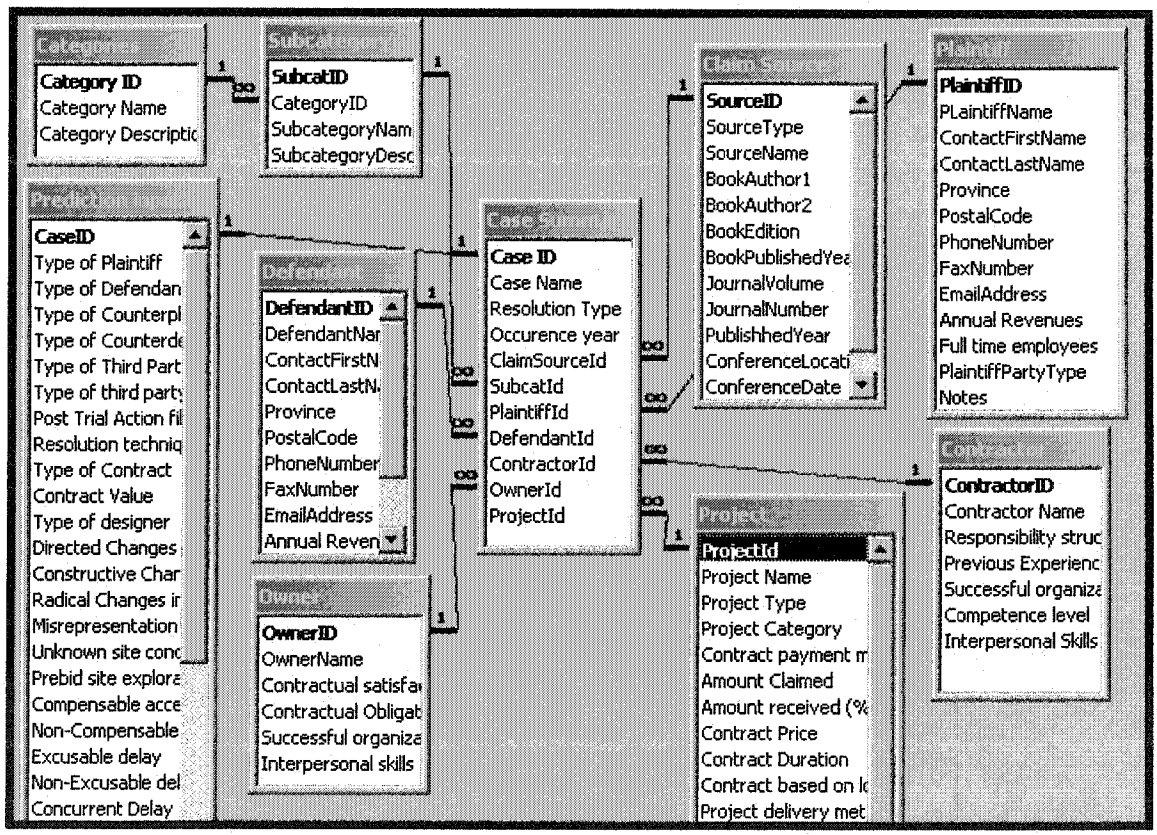

Figure 4.1: CCCT Data Model Mapping

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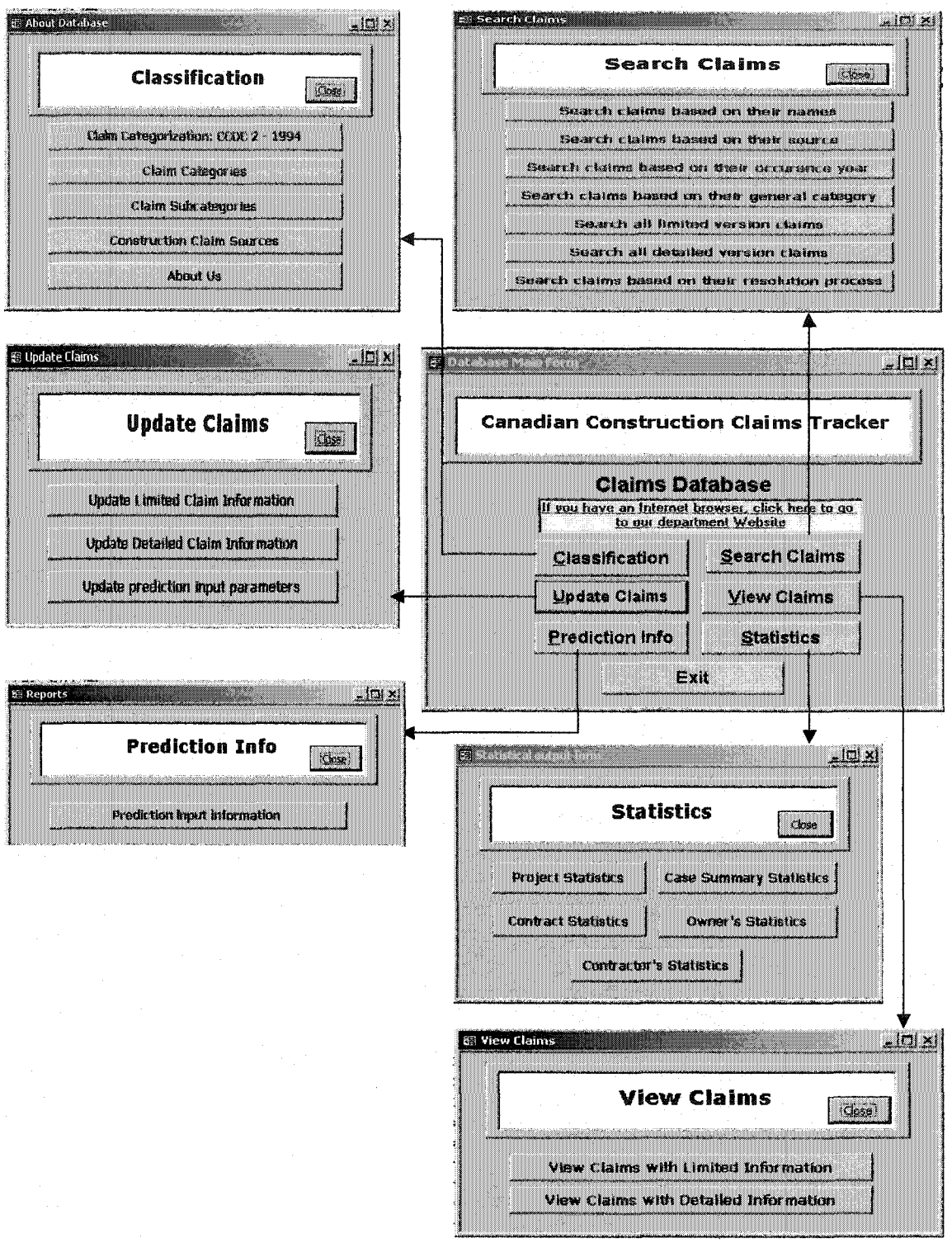

Figure 4.2: General Structure of CCCT

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4.3 View Claims

The user can either view specific claims with all their relevant parameters or update the claims in the database. In order to view the claims in the database, the user is referred to the 'view claims' main form. The claims have been divided according to detailed and limited claims.

The detailed claim information considers information regarding the defendant/plaintiff, the contractor/owner, the project, and the prediction input parameters, whereas the limited claim information considers any claim that meets the minimum amount of required information. The 'view limited claim information' form is shown in Figure 4.3. The following information is required for every 'limited claim': case name, resolution type, occurrence year, defendant name, source name, source type, defendant name, defendant party type, plaintiff name, plaintiff party type, CCDC category and subcategory. 460 limited claims are included in the database.

The 'view detailed claim information' form is presented in Figure 4.4. Detailed claims format claims contain the following information: case name, resolution type, occurrence year, source name, source type, defendant detailed information, plaintiff detailed information, CCDC category and subcategory, project information, contractor information and owner information. The 107 detailed claims provide details used by the 'statistical module', the classification module' and the 'prediction module' for analysis.

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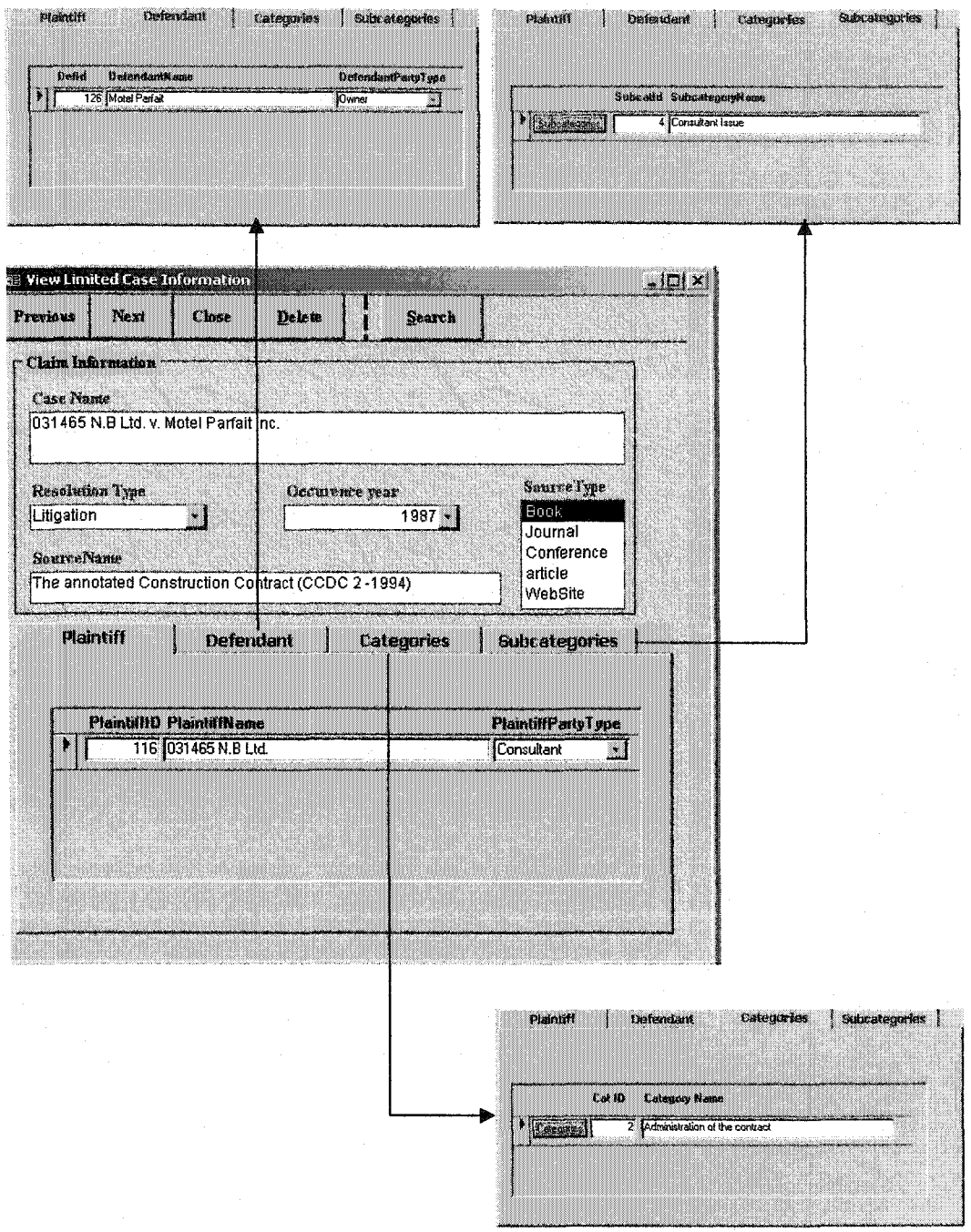

Figure 4.3: 'View Limited Claim Information' Forms

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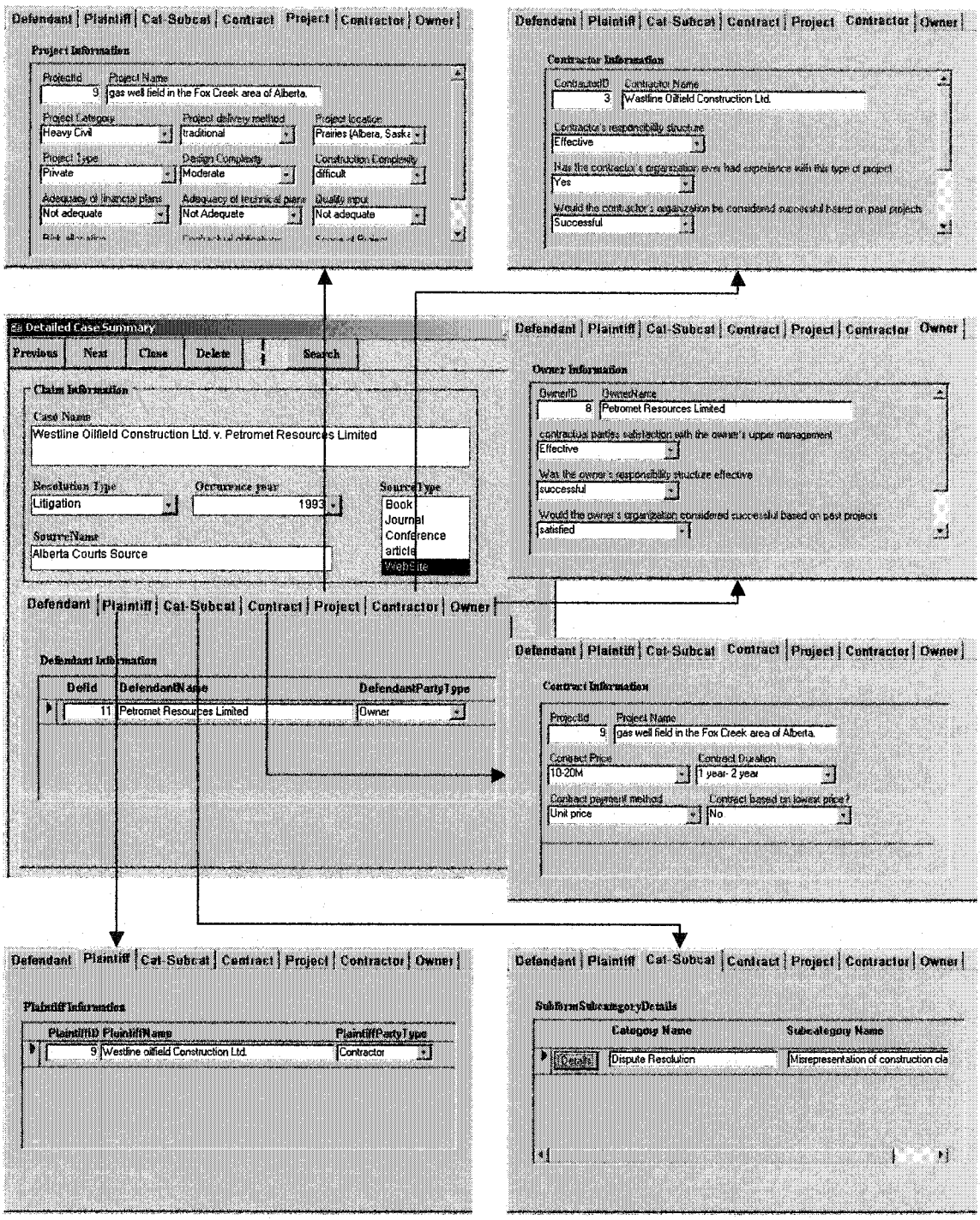

Figure 4.4: 'View Detailed Claim Information' Forms

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4.4 Update Claims

As demonstrated in the 'view claims' section, a claim can take either a limited or detailed form. Figure 4.5 presents an example of the updating of a 'limited case', in which the 'M.J.B Enterprises v. Defense Construction Canada' case is used. The information related to the 'occurrence year', 'resolution process', 'source', 'plaintiff/defendant' and 'category/subcategory' are required for a 'limited case'. The occurrence year is '2002', the resolution process is 'litigation', and the source of information is the 'Institute 2000'. The plaintiff is 'M.J.B Enterprises' and the defendant is 'Defense Construction Canada'. The case belongs to the 'dispute resolution' category, and to the 'misrepresentation of construction clauses' subcategory.

The 'detailed cases' have been updated separately from the limited cases. Information required for a 'detailed case' includes: 'case information', 'plaintiff information', 'defendant information', 'project information', 'contractor information', owner information', and 'prediction input information'; detailed cases are used for analysis purposes and serve the analysis modules. The 'International Piping Inc. v. Polytubes (West) Inc.' case is presented in Figure 4.6 as an example of a 'detailed case'. The 'litigation' case occurred in '2002' and belongs to the 'defective work' subcategory under the 'execution of the work' category. This information was extracted from the 'Alberta Provincial and Supreme Courts websites' (Courts of Alberta, 2004). The plaintiff, also the contractor in this case, is 'International Piping Inc.', the defendant is 'Polytubes (West) Inc.' and the owner is 'Talisman Energy Inc.'

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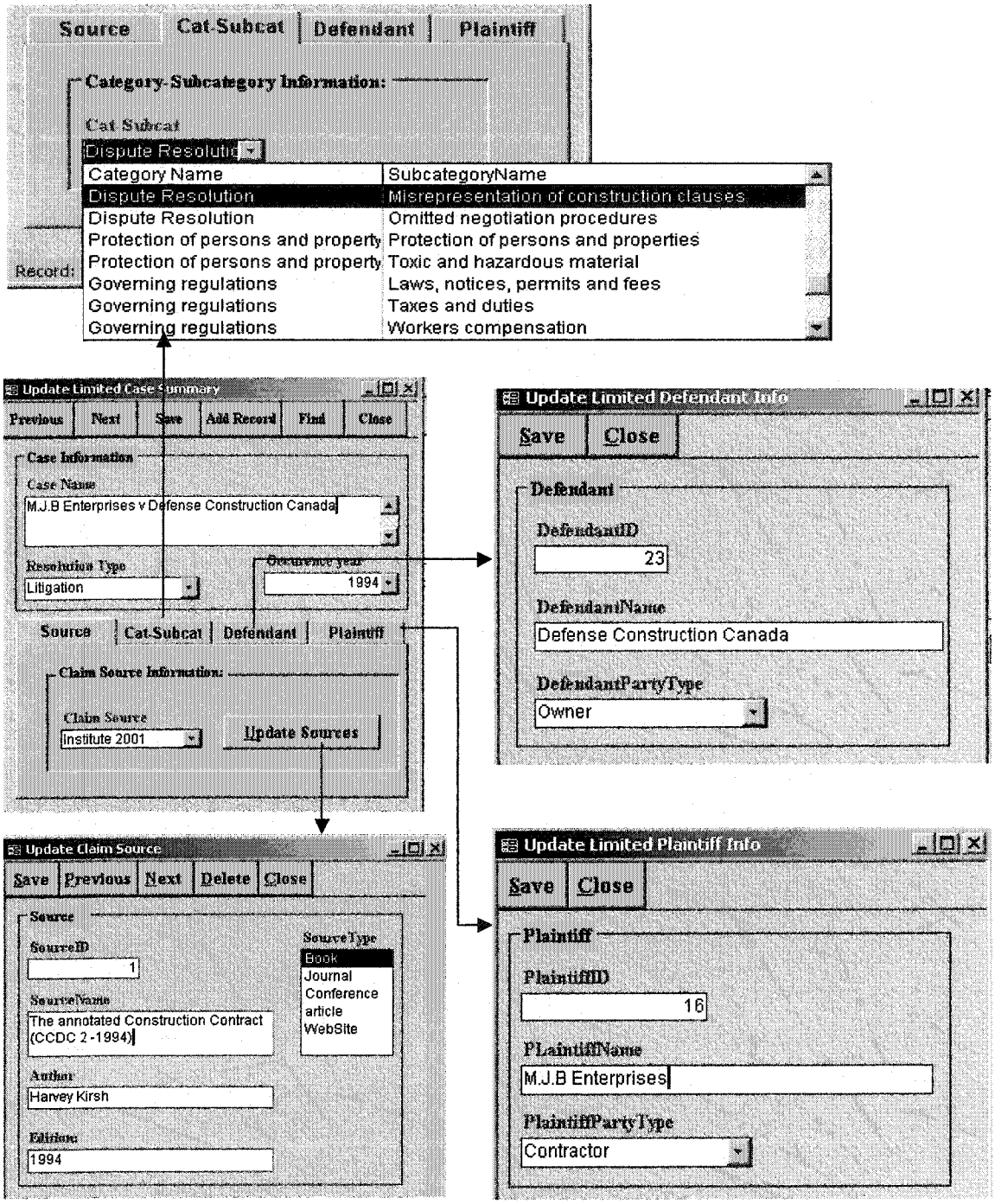

Figure 4.5: 'Update Limited Claims Information' Forms

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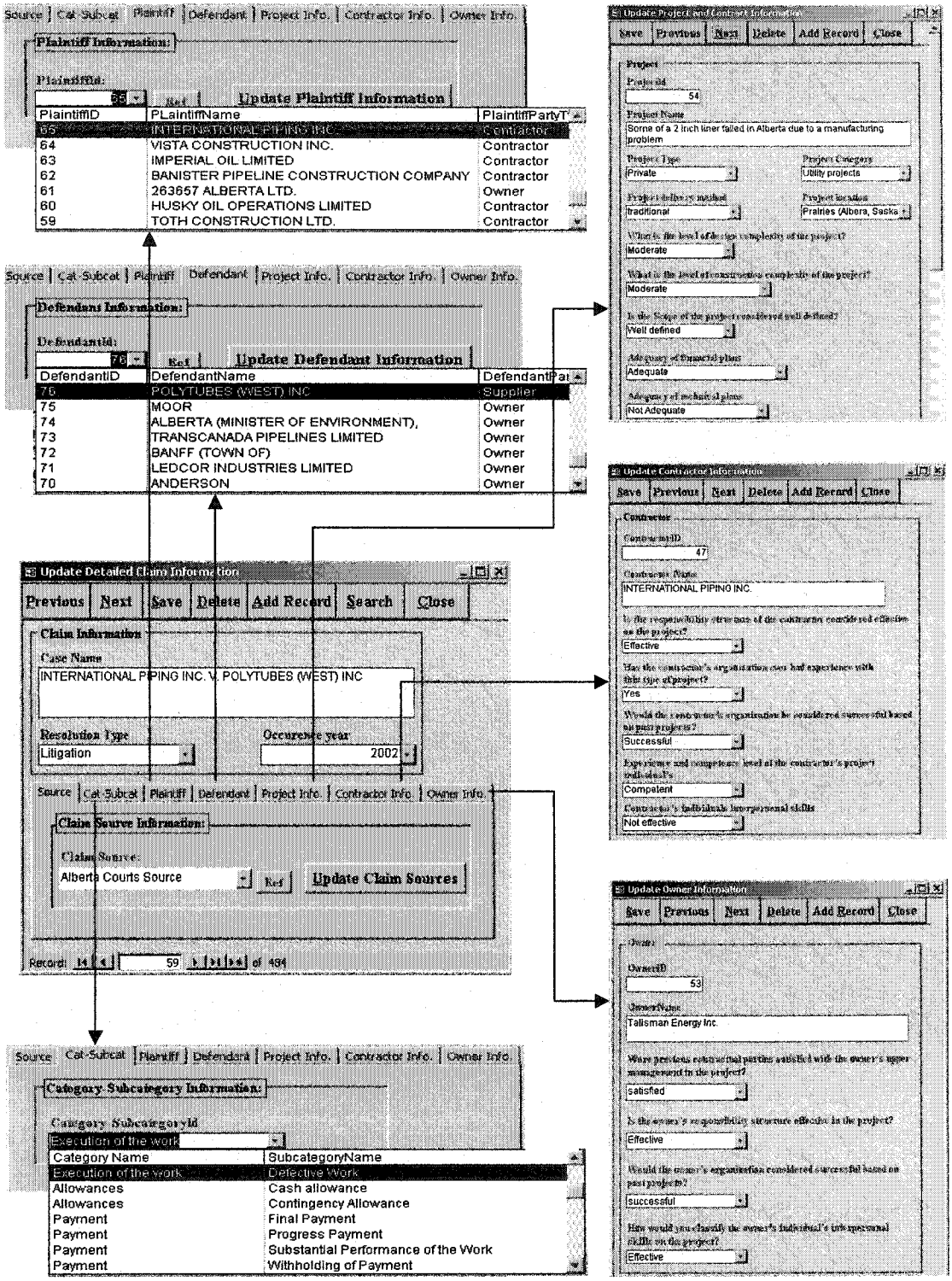

Figure 4.6: 'Update Detailed Claims Information' Forms

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4.5 Search Claims

The 'search claims' section allows the user to perform a direct search for a claim based on specific criteria as shown in Figure 4.7. The user can search and/or query claims based on criteria such as name, year of occurrence, the CCDC category, resolution process and source of information. Claims can also be searched within their respective limited or detailed forms. The search section is useful for users looking for cases with specific criteria.

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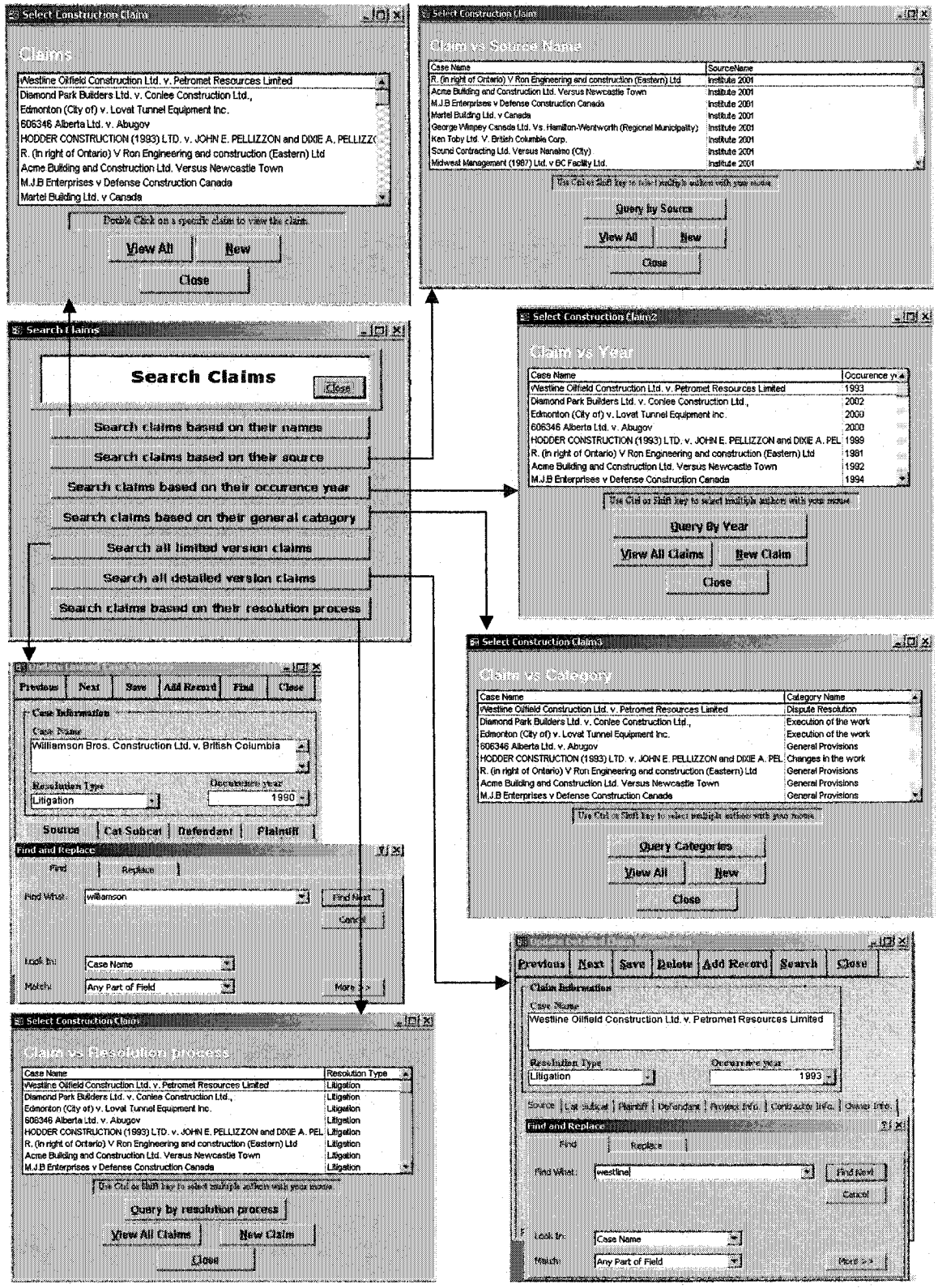

Figure 4.7: 'Search Claims' Forms

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4.6 Statistical Module

The statistical module described in Chapter 3 is implemented in the 'statistics' section of CCCT, as shown in Figure 4.8. The five main statistical categories are: 'case summary statistics', 'contract related statistics', 'project related statistics', 'owner's related statistics' and 'contractor's related statistics'. The 'statistical module' is implemented to provide automatic statistical results for all the parameters shown in Figure 4.8. When new cases are added to CCCT, the statistics are updated automatically. Currently, the statistical module contains statistical information for 107 detailed claims. The statistical results and findings are discussed in Chapter 5.

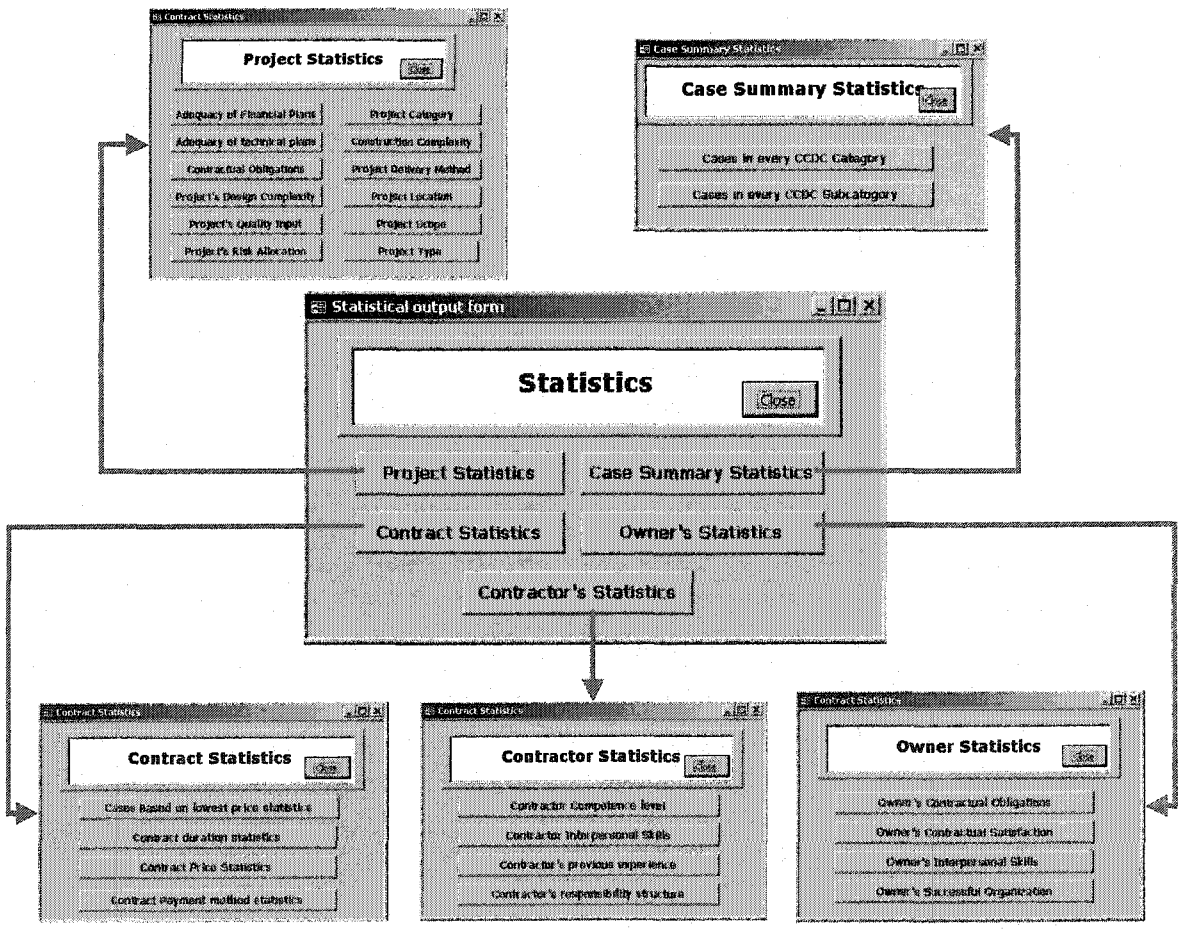

Figure 4.8: Statistics Main Forms

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4.7 Classification Module

The categorization methodology developed for the construction claims has been implemented in the 'classification' section; all the subcategories are associated with their corresponding categories and the interrelations between categories and subcategories are illustrated in Figure 4.9. A descriptive text, outlining the relevant issues related to each subcategory in the contract document, has been appended to each subcategory in the 'subcategory description'. The entire CCDC contract document has been included in the 'subcategory description', and the CCDC texts and descriptions have been separated into categories and subcategories. As discussed in chapter 3, the 'subcategory description' provides a relationship between the claim and the contract document; based on a cases's subcategory, the 'subcategory description' provides all the CCDC contract clauses relevant to the case in the contract document. The 'Bg Checo International Limited v. British Columbia Hydro and Power Authority' case described in Chapter 3 is employed in Figure 4.10 to illustrate the functionality of the classification module. This case belongs to the 'delay' subcategory under the 'general provisions' category. For this case, the related contract provisions contain delay issues and are described in the 'subcategory description' section. Developing subcategories for the construction claims not only provides a standard categorization system for Canadian construction claims, but also relates the sources of problems by associating every claim with the relevant contract clauses. The subcategories of CCDC 2 -1994 and their relevant contract provisions are shown in Appendix B of this thesis.

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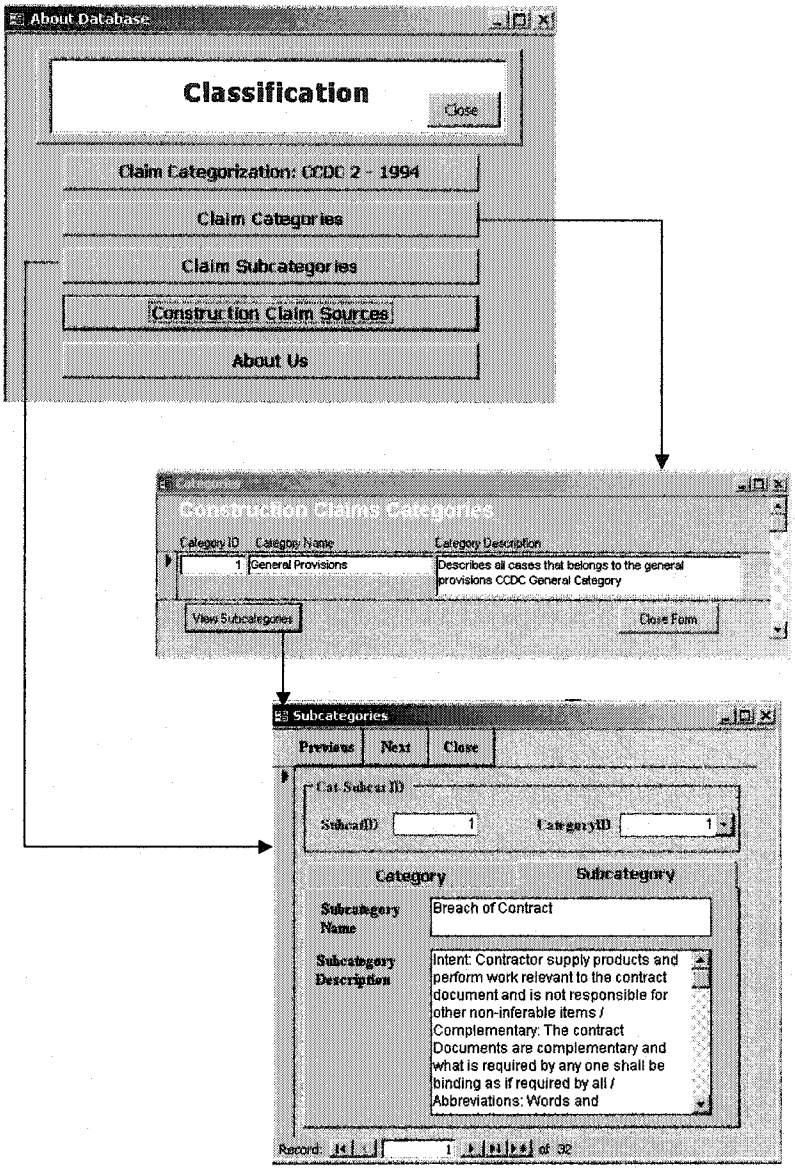

Figure.4.9: Categories and Subcategories Forms

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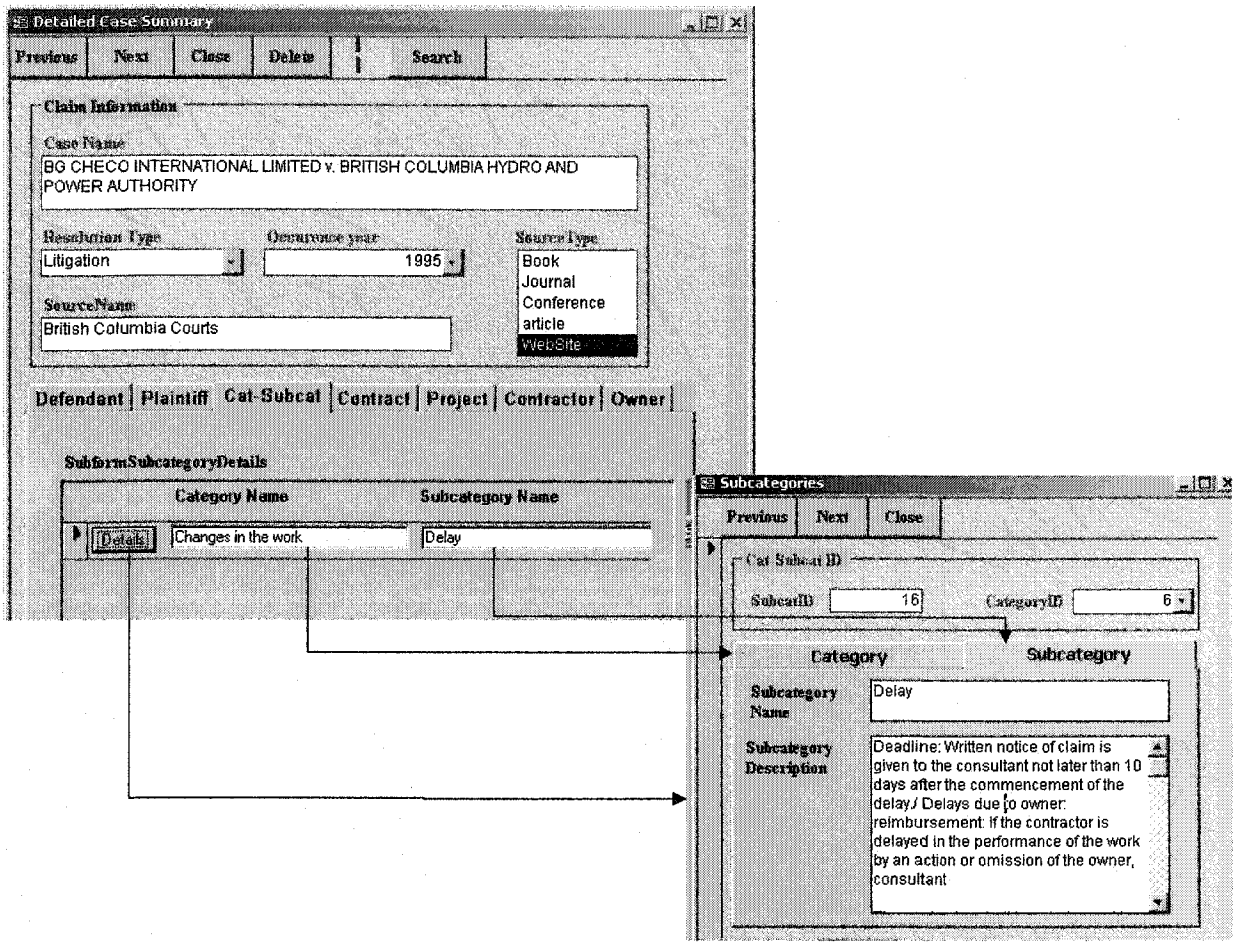

Figure 4.10: Example of the Functionality of the 'Classification Module' Through the Bg Checo v. BC Hydro and Power Authority' Example

4.8 Prediction Module

The binary input information is implemented in NeuroShell. The methodology described in Chapter 3 has been followed to compute the rate of successful prediction of outcome in the 107 detailed cases. The prediction input parameters and the actual case winner are first collected in the Canadian Construction Claim Tracker (CCCT) in the 'prediction input' section in a 'one of a list' format. The input and output parameters are then exported to MS Excel and transformed into binary format, as shown in Figure 4.11. The data is divided into 20 testing data points and 87 training data points; the latter are then

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imported into NeuroShell for training. The methodology set by NeuroShell in Figure 4.12 is used to optimize the trained Neural Network. The binary spreadsheet file is first inputted into NeuroShell and transformed into a NeuroShell internal file format, at which point the variables are separated into input and output variables. Different learning parameters are tested to optimize the learning results after a default 20% test set has been extracted.

The coefficient of multiple determination R squared is used to compute the accuracy of the prediction model obtained. R squared is a statistical indicator that compares the accuracy of the model to the accuracy of a trivial benchmark model in which the prediction is simply the mean of all of the samples. A perfect fit would result in an R squared value of 1, a very good fit near 1, and a very poor fit around 0 (NeuroShell, 2003). The parameters for the optimized neural network are shown in Table 4.1. The fit of the neural network can be considered very good, with an R square (average) equal to 0.92, according to the latter analysis. Once the learning has been finalized, the file can be executed in MS Excel and compared to the test data set. NeuroShell has the ability to save the network in a file so that it can be accessed later via the Dynamic Link Library in Excel (DLL). The data is compared to the 20 testing data in MS Excel and a prediction rate of 13/20 or 65% is computed. Arditi and Tokdemir (1999) implemented an ANN on 102 Illinois circuit courts and obtained a 67% prediction rate. A comparison of the results obtained in predicting Canadian court cases and those obtained in the Illinois circuit courts indicates a difference of 3% between the two studies. This comparison validates the results obtained in this study as well as the results obtained in the study of Arditi et el. (1998), and demonstrates that the application of ANN in the prediction of winners of

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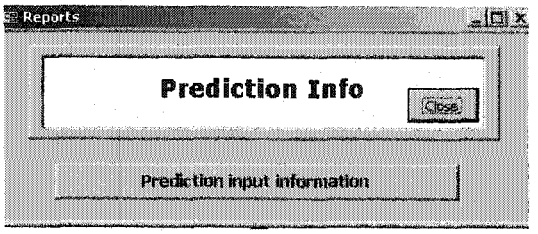
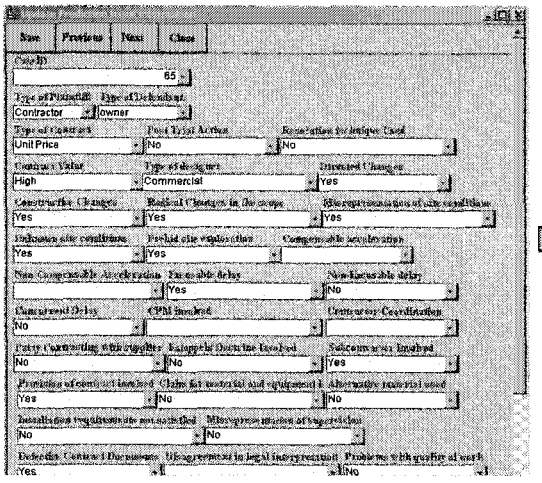
litigated claims gives similar outcomes when input criteria is applied on a different set of cases in a different country.

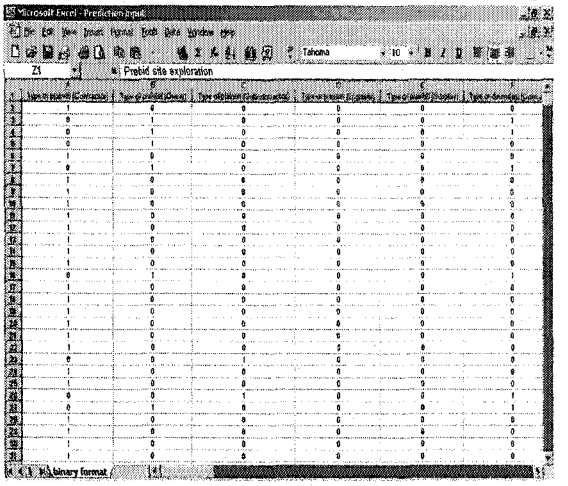
Prediction Info In CCCT



'One of a list' Format in CCCT



Binary Format in Excel



Binary Format in NeuroShell2

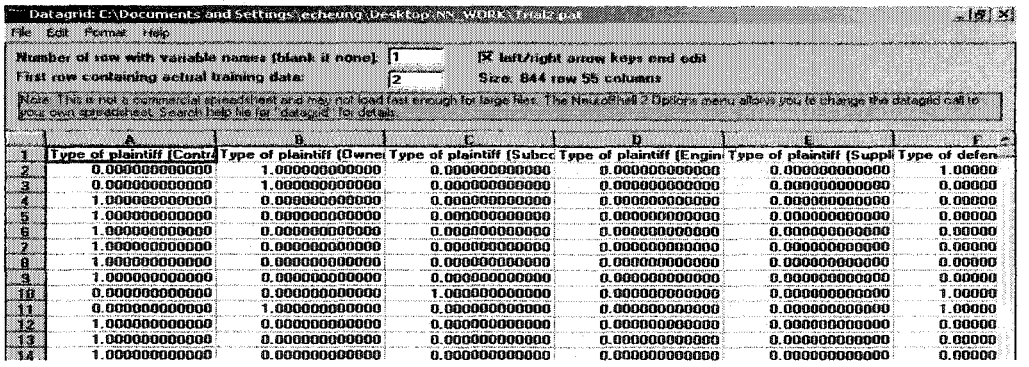


Figure 4.11: Prediction Input in NeuroShell

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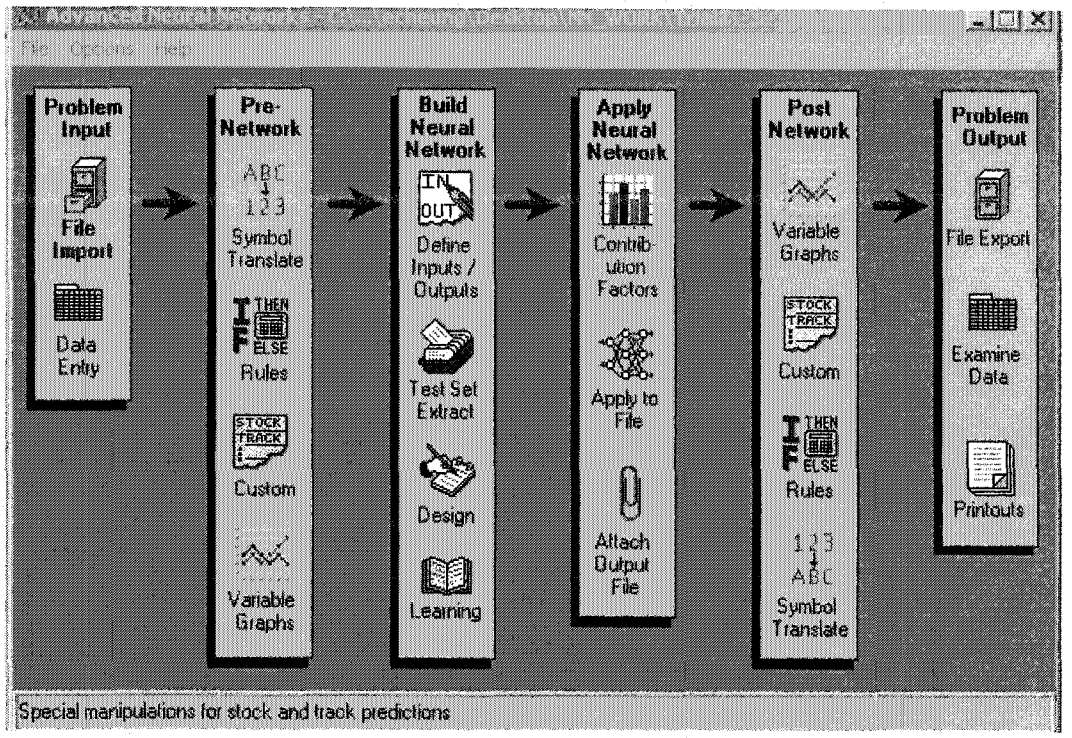

Figure 4.12: NeuroShell Training Methodology (Courtesy NeuroShell2)

Table 4.1: Optimized NeuroShell Results

Input Parameters	
Architecture	*Backpropagation*
Hidden Layers	*3*
Learning Rate	*0.6*
Momentum	*0.9*
Hidden Neurons	*37*
Pattern Selection	*Rotational*
Complexity	*Very Simple*
R Square Values (trained data)	
Winner (contractor)	*0.95*
Winner (owner)	*0.96*
Winner (subcontractor)	*0.92*
Winner (supplier)	*0.9*
Winner (surety)	*0.89*
Prediction Rate (test data)	
Test Data	*20*
Prediction Rate	*65%*

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The prediction rate could improve upon adding the missing prediction input parameters, however the prediction of court decisions will always be affected by factors such as social, political, cultural, psychological and environmental which will affect the prediction rate.

4.9 Closing

The 'Canadian Construction Claims Tracker' (CCDC) illustrates the relationships between the databases and the modules. The central database functions as an automated repository for Canadian construction claims; the purpose of the modules is to analyze the collected construction claims. The 'statistical module' functions as a benchmark for the collected claims, the validity of which is improved upon imputing new claims. The 'classification module' integrates the categorization of the construction claims with the contract document and allows the user not only to know what the outcome of a legal dispute is, but also to find out what clauses in the contract documents lead to the disputes. The 'prediction module' validates the applicability of the Artificial Neural Network (ANN) and supports the results of the ANN module introduced by Arditi and Tokdemir (1999) in predicting the outcome of a construction claim with a limited prediction rate of 65%. The statistical results and analysis are presented in Chapter 5.

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5 SYSTEM'S STATISTICAL OUTPUTS

5.1 Introduction

The implementation of the 'statistical module', the 'prediction module' and the 'classification module' was presented in Chapter 4. The statistical analysis of the 'statistical module' is described in this Chapter. MS Graph is integrated with MS Access to automatically extract from the Canadian Construction Claims Tracker (CCCT) five sets of statistics which are 'case summary related statistics', 'project related statistics', 'contract related statistics', 'contractor related statistics' and 'owner related statistics'. Upon input of new limited and detailed cases, the statistical outputs are updated automatically. A questionnaire that compiles the summary of the facts has been circulated to 15 construction practitioners including owners, contractors and consultants to validate the findings of the statistics. Data of each set of statistics is presented under the 'fact' heading and feedbacks by the construction practitioners on the facts provided are presented under the 'practitioner's feedback' heading. The data extracted from 'case summary related statistics', 'project related statistics', and 'contract related statistics' are analyzed in this chapter to illustrate the integration between CCCT and the 'statistical module'. It is important to note that the main idea of this chapter is to illustrate the methodology used in delivering statistical outputs; the statistical results presented in tables and figures reveal the possible outputs of CCCT. The statistics shown in this chapter is limited to the claims sample of this research.

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5.2 Limitations of the Statistical Findings

The statistical findings of CCCT presented in this Chapter are based on the information extracted from 567 'limited' and 'detailed' claims of ten different sources. Fifteen (15) practitioners from the construction industry, including owners, consultants, and contractors, provided feedbacks on the statistical results of CCCT through a questionnaire that has been included in Appendix C. The analysis of the statistical results is subjective and varies greatly between the practitioners questioned because their personal judgment is greatly impacted by their past experiences and the type of work they are involved in. Due to the 'soft' nature of construction claim analysis, the practitioners were asked to provide their viewpoints and their feedbacks have been summarized under the 'practitioner's feedback' section of each category. The statistical outputs presented in this Chapter are not representative of the Canadian construction industry as a whole because the analysis is limited to the cases collected. However the methodology integrating between CCCT and the 'statistical module' presents an initiative towards benchmarking the Canadian construction claims.

5.3 Case Summary Related Statistics

Statistics of 'cases in every category' and 'cases in every subcategory' are summarized in Tables 5.1 and 5.2. These results have been extracted from the two automatic output graphs from the 'statistics' section of CCCT shown in Figure 5.1.

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'Cases in every category'

Fact: Of the 567 'limited' and 'detailed' cases that were studied in this research, 118 of the claims (20.9%) resulted from changes in the work during the completion of a project, 102 of the claims (18.1%) were caused by general provisions, and 91 of the claims (16.1%) were related to payment issues. These three categories combined contributed to more than 50% of the total cases studied. The two categories 'changes in the work' and 'general provisions' comprise 220 cases, which represents 39% of all the cases collected.

Practitioner's Feedback:

- According to the study, 'changes in the work', 'general provisions', and 'payment issues' are found to be the three main general causes of claims within the Canadian construction industry. The statistics of this category only reflect the conditions of the claims sample.

'Cases in every subcategory'

Fact: The study revealed 'breach of contract' (67 of 564 cases) and 'change in directive' (55 of 564 cases) to be the two largest subcategories; they belong to the two largest general categories, 'general provisions' and 'changes in the work', respectively. Other influential subcategories include 'substantial performance of the work' (36 cases), 'withholding of payment' (35 cases), 'consultant issues' (33 cases), 'delay' (33 cases), 'misrepresentation of the contract document' (32 cases), and 'defective work' (32 cases).

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Practitioner's Feedback:

- The statistics of this category suggests that claims within the Canadian construction industry are mainly the result of contract violations and changes made after contract award.

Table 5.1: 'Cases in Every Category' Statistics

CCDC General Provisions	Number of cases	% Per category
Administration of the contract	48	8.5
Allowances	0	0
Changes in the work	118	20.9
Default Notice	28	5
Dispute resolution	18	3.2
Execution of the work	50	8.9
General provisions	102	18.1
Governing regulations	18	3.2
Indemnification-Waiver-Warranty	23	4.1
Insurance-Bonds	42	7.4
Payment	91	16.1
Protection of persons and property	26	4.6
Total	**564**	**100**

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Table 5.2: 'Cases in Every Subcategory' Statistics

CCDC Subcategories	Number of cases	% Per subcategory
General provisions	102	100
Breach of contract	67	65.7
Misrepresentation of contract documents	32	31.4
Renegotiation of contract documents	3	2.9
Administration of the contract	48	100
Consultant issue	33	68.8
Work inspection issue	15	31.3
Execution of the work	50	100
Control of the work	18	36.0
Defective work	32	64.0
Allowances	0	100
Cash Allowances	0	0.0
Contingency Allowances	0	0.0
Payment	91	100
Final Payment	18	19.8
Progress Payment	2	2.2
Substantial performance of the work	36	39.6
Withholding of payment	35	38.5
Changes in the work	118	100
Accounting Issue	20	16.9
Change in directive	55	46.6
Delay	33	28.0
Unknown Conditions	10	8.5
Default Notice	28	100
Contractor's termination	17	60.7
Owner termination	11	39.3
Dispute resolution	18	100
Mediation	2	11.1
Misrepresentation of contract clauses	12	66.7
Omitted negotiation procedures	4	22.2
Protection of persons and property	26	100
Protection of persons and property	22	84.6
Toxic and hazardous material	4	15.4
Governing regulations	18	100
Laws, notices, permits and fees	14	77.8
Taxes and duties	3	16.7
Workers compensation	1	5.6
Insurance-Bonds	42	100
Insurance	27	64.3
Bonds	15	35.7
Indemnification-Waiver-Warranty	23	100
Indemnification	13	56.5
Waiver	1	4.3
Warranty	9	39.1

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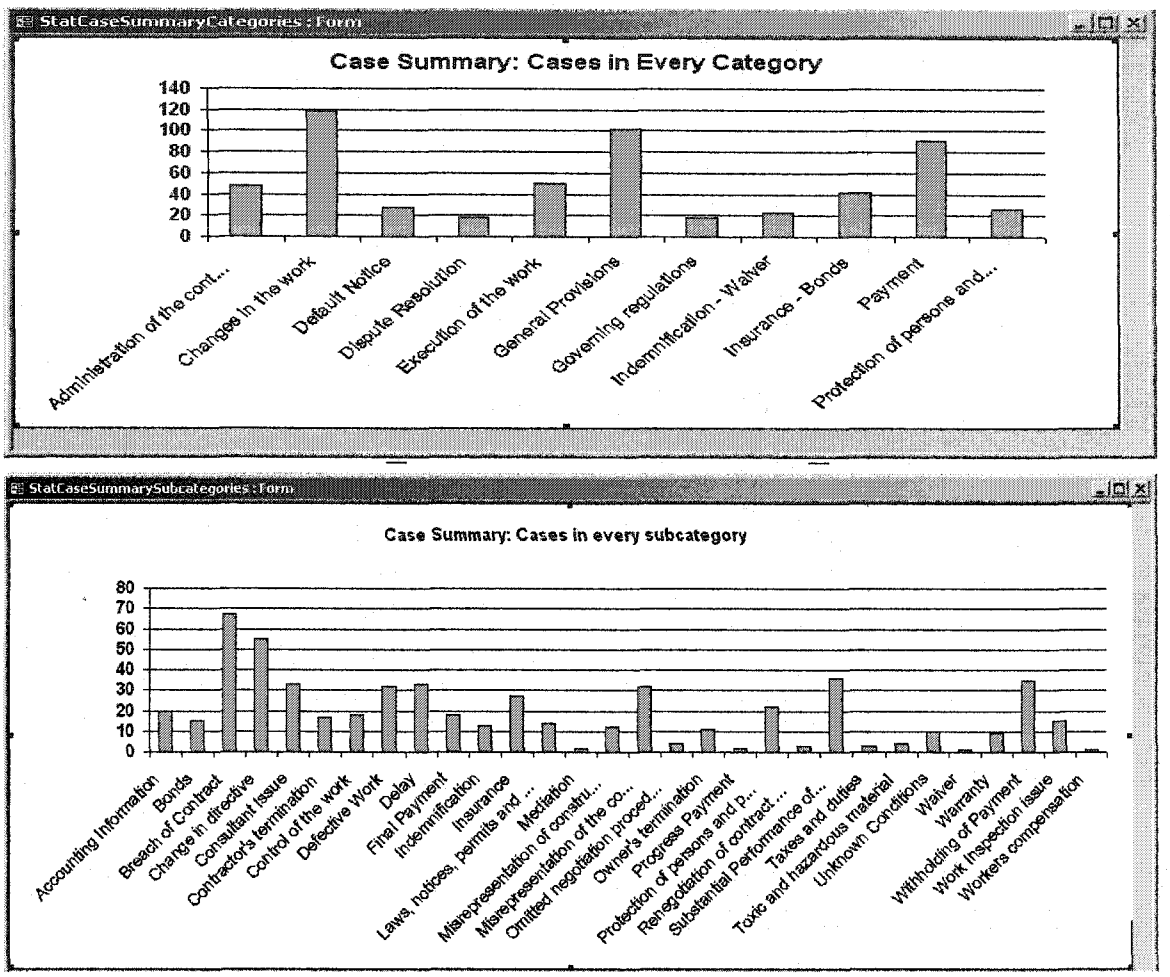

Figure 5.1: Cases in Every Category and Subcategory Statistics

5.4 Project Related Statistics

The project related statistics are separated into two sets of data for clarity purposes, each of which is analyzed separately. Table 5.3, represented graphically in Figure 5.2, presents the first set of project related statistics that include 'project categories', 'project type', 'project delivery method', 'design complexity', 'construction complexity', and 'project location'. Table 5.4, represented graphically in Figure 5.3, presents the second set of data that include 'project scope', 'adequacy of technical plans', 'adequacy of financial plans',

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'contractual obligation', 'risk allocation', and 'quality input'. A total of 12 parameters related to the project are analyzed in this section.

'Project category'

Fact: 'Commercial construction' and 'residential construction' are identified to be the two largest project categories in this study; they contributed to 35 and 23 of the 93 claims respectively.

Practitioner's Feedback:

- Commercial and residential construction projects are at the highest risks of encountering claim problems because the frequency of these projects is greater than the other categories. For instance, there are more commercial and residential construction projects than institutional projects each year; it is logical to assume that there would be more claims from categories that have a higher occurrence rate.

'Project type'

Fact: Public projects contributed 32 of 93 cases while private projects contributed 61 of 93 cases. According to the project statistics, private projects are twice as likely to involve claims than public projects.

Practitioner's Feedback:

- The natural competitive instinct exhibited by members of the private sector makes it difficult for them to compromise with one another.

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- Private companies are more hesitant to file a claim against the government because they may ruin a good working relationship, or may jeopardize the opportunity for future work with the same government.
- Public contracts are prepared with greater care, are reviewed by more people, and tend to use more sophisticated documents.
- Private projects are often 'fast-tracked' with insufficient checks in the design process.
- Issues in public projects may be more frequently resolved outside the courtroom using alternative dispute resolution techniques.
- Public tenders have fewer chances of changes due to budgetary constraints. Private sector is more susceptible to changes and quality requirements based on prevailing trends and competitiveness.

'Project delivery method'

Fact: Projects delivered using the traditional, design-built, and construction management (CM) methods contributed 54 cases, 35 cases, and 3 cases respectively. The occurrence of claims for projects using the traditional delivery method is much higher than for those using the design-built or CM delivery methods. The percentage of claims filed against the construction management project delivery method is extremely low (3.3%).

Practitioner's Feedback:

- For projects delivered using the traditional method, the relationships between parties are more confrontational and each party's main concern is to achieve personal gain.

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- Construction management teams have the resources and experiences required to resolve disagreements quickly and effectively; this ensures that small problems do not fester into uncontrollable issues.
- The CM is generally a contractor and, as a part of the owner's team, he provides valuable information during the design and tendering stages that can reduce claims.
- The statistical results of this category is not representative of the industry because more projects utilizes the traditional method than the CM method; the number of projects done by each method needs to be considered prior to drawing conclusions from the statistics.
- Under the CM project delivery method, the contractor is involved from the beginning and is given control of the project; to make a claim would imply he wasn't doing a good job managing the project.
- Construction management is a technique to control time, cost, and quality; it will definitely ensure the control of project scope, delays, changes, and disputes before condition deteriorates to litigation.

'Design complexity'

Fact: The number of cases contributed by projects of easy, medium, and difficult designs are 11 cases, 45 cases, and 36 cases respectively. These data suggests that medium and difficult project designs leads to a greater number of claims.

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Practitioner's Feedback:

- The higher rate of claim occurrence for projects with medium and difficult designs is due to a lack of familiarity of contractors, consultants, or owners with such projects.
- Complex projects tend to have longer durations; it leads to a greater opportunity for disagreements to arise between parties.
- Complex projects tend to have more unexpected situations that were not contemplated in the contract documents. Larger projects tend to have more errors/omissions in design documents and experience greater numbers of changes to original designs.

'Construction complexity'

Fact: The number of cases contributed by projects of easy, medium, and difficult construction methodologies are 11 cases, 39 cases, and 42 cases respectively.

Practitioner's Feedback:

- The occurrence of claims for a project is directly related to its construction complexity.
- Contractor, consultant, or owner's lack of familiarity with complex construction techniques, prolonged project durations, and the greater opportunities for unexpected situations to occur increase the likelihood for claim occurrences.

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'Project location'

Fact: According to the statistics, the number of claims contributed by British Columbia, the Prairies, the Atlantic region, Ontario, and Quebec are 40 cases, 43 cases, 1 case, 8 cases, and 0 cases respectively.

Professional Feedback:

- The lack of claims from the Atlantic region and Quebec suggests that the 'project location' statistics is only representative of the claims sample used in this study; the statistics are heavily dependent on the claim sources used. No official court records from the Atlantic region were incorporated and Quebec claims were excluded because of its civil-law legal system.

'Project scope'

Fact: Of the 92 claims studied in the 'project scope' category, 83 (90.2%) were filed against projects with poorly defined scopes and only 9 (9.8%) were filed against projects with well-defined scopes.

Practitioner's Feedback:

- Projects with unclear scope have a higher chance for change orders, extra work, or rework. As a result, there are more opportunities for contractors to dispute contractual terms and to claim for compensation.

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'Adequacy of technical plans'

Fact: Of the 92 claims studied, 26 claims had technical plans that were adequately prepared and 66 claims had technical plans that were poorly prepared.

Practitioner's Feedback:

- Poorly prepared technical plans are more prone to change orders, extra work, and rework.
- Even though poorly prepared technical plans can lead to claims, it is the contractor's responsibility to ask for clarification of an unclear issue prior to bidding for work.

'Adequacy of financial plans'

Fact: Of the 92 claims studied, 23 claims had financial plans that were adequately prepared and 69 claims had financial plans that were poorly prepared.

Practitioner's Feedback:

- Inadequate financial plans can negatively impact a project's cost and schedule. Funding deficiencies lead to delays, conflicts, and claims.
- Inadequate financial plans can affect project scope; owners may scale back project due to insufficient funding.
- Poor capitalization/poor cash flow can lead to many problems.

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'Risk allocation'

Fact: Projects that clearly identify the risks of each participant have a 1.1% chance of encountering claims while projects with poor risk allocations have a chance of 98.9%.

Practitioner's Feedback:

- Concise risk allocations can dramatically reduce claim occurrences because participants who are aware of their risks are better prepared for their responsibilities and have more appropriate expectations.

'Quality input shared during the preconstruction stage'

Fact: Of the 92 cases studied in the 'quality input shared during the preconstruction stage' category, 4 (4.3%) of the claims had adequate quality input while 88 (95.7%) had inadequate quality input.

Practitioner's Feedback:

- Adequate quality input shared among parties during the preconstruction stage of a project significantly reduces the occurrence of claims. Greater information sharing and open communication between project participants can lead to lower incidences of claims.

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Table 5.3: Project Related Statistics, Set 1

Project statistical findings -1-	Number of cases	% of total cases
Project category	93	100
Commercial construction	35	37.6
Heavy civil	6	6.5
Industrial	7	7.5
Institutional	3	3.2
Residential construction	23	24.7
Road construction	8	8.6
Specialty trades	6	6.5
Utility projects	5	5.4
Project type	93	100
Public	32	34.4
Private	61	65.6
Project delivery method	92	100
Traditional	54	58.7
Design built	35	38
Construction management	3	3.3
Design complexity	92	100
Easy	*11*	12
Medium	*45*	48.9
Difficult	*36*	39.1
Construction complexity	92	100
Easy	11	12
Medium	39	42.4
Difficult	42	45.7
Project location	92	100
Quebec	0	0
Ontario	8	8.7
British Columbia	40	43.5
Atlantic Region	1	1.1
Prairies	43	46.7

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Table 5.4: Project Related Statistics, Set 2

Project statistical findings -2-	Number of cases	% of total cases
Project scope	92	100
Well defined	9	9.8
Not well defined	83	90.2
Adequacy of technical plans	92	100
Adequate	26	28.3
Not Adequate	66	71.7
Adequacy of financial plans	92	100
Adequate	23	25
Not Adequate	69	75
Contractual obligations	92	100
Realistic	70	76.1
Not realistic	22	23.9
Risk Allocation	92	100
Well identified	1	1.1
Not well identified	91	98.9
Quality input shared during the preconstruction stage	92	100
Adequate	4	4.3
Not adequate	88	95.7

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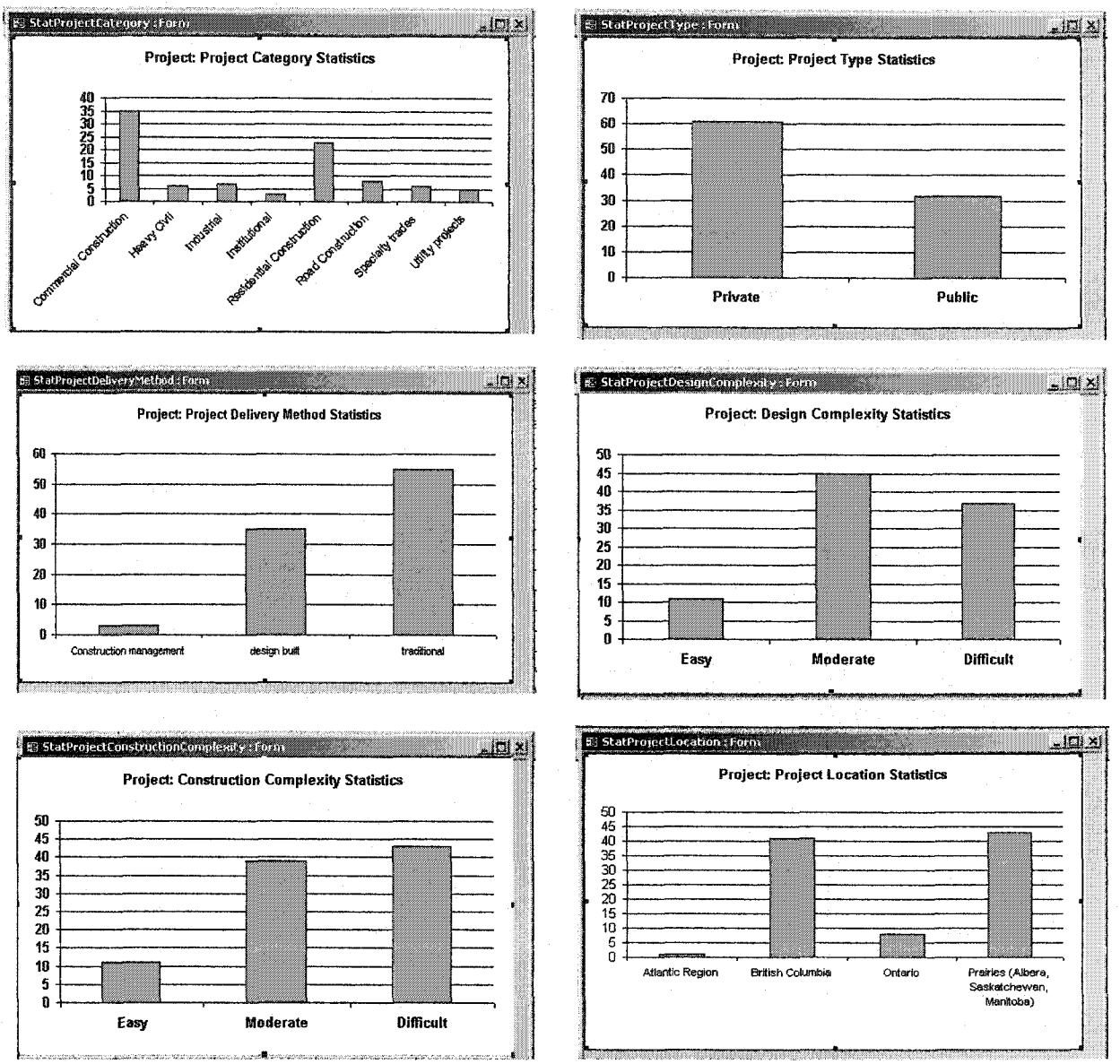

Figure 5.2: Project Related Statistics, Set 1

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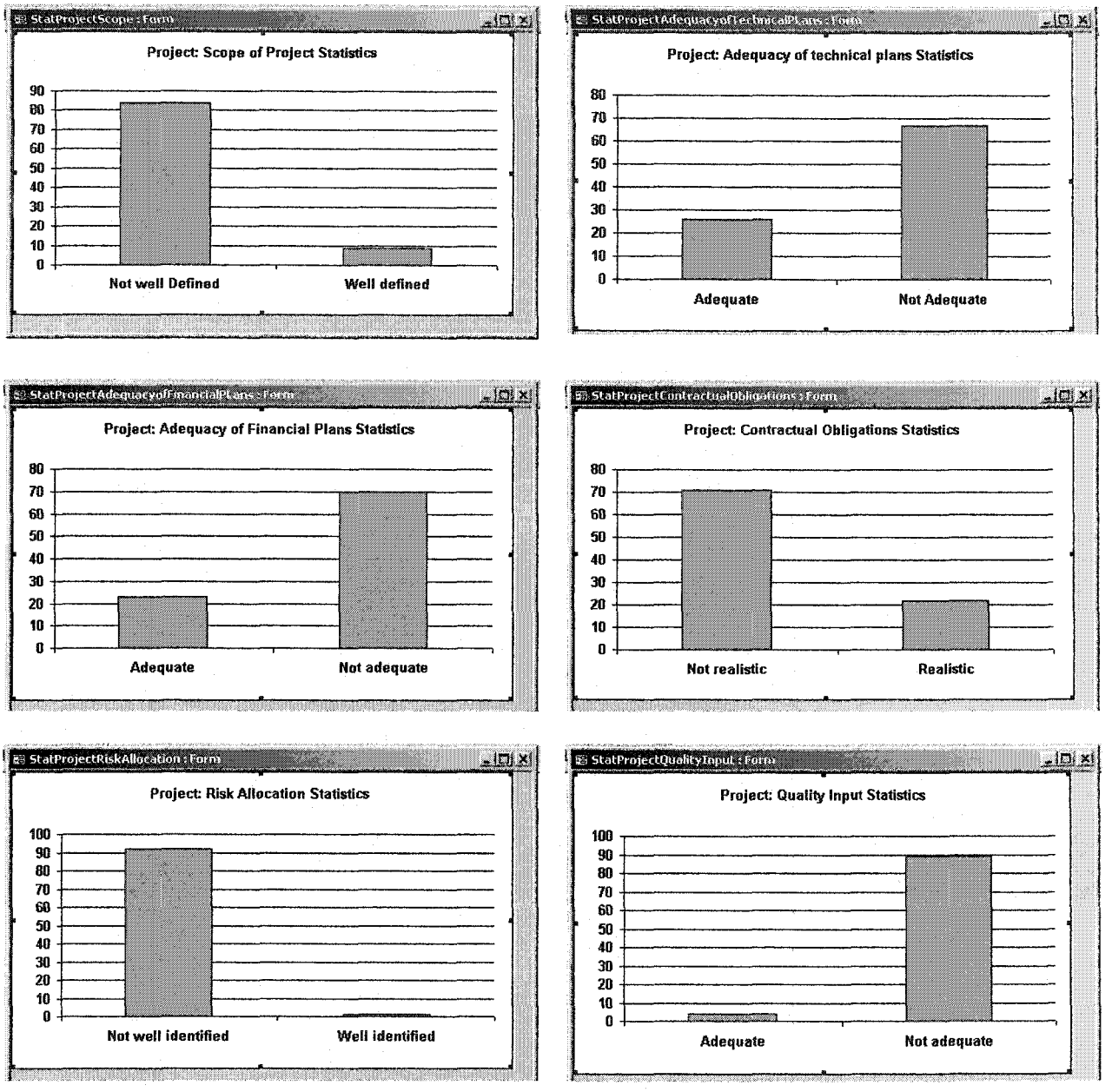

Figure 5.3: Project Related Statistics, Set 2

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5.5 Contract Related Statistics

Four contracts related parameters are studied in this section: 'contract based on lowest price', 'contract payment method', 'contract duration', and 'contract price'. The statistics of each parameter are presented in Figure 5.4 and Table 5.5.

'Contract based on lowest price'

Fact: Of the 93 cases studied, 44 (47.3%) were awarded based on lowest price and 49 (52.7%) were not.

Practitioner's Feedback:

- Based on the statistics, there are no major differences in the occurrence of litigation between contracts that were awarded based on lowest prices and those that were not.

'Contract payment method'

Fact: Of the 89 cases that were considered in the 'contract payment method' category, 51 (57.3%) were unit price contracts, 31 (34.8%) were stipulated price contracts, and 7 (7.9%) were cost plus contracts. These results are shown in Figure 5.4 and Table 5.5.

Practitioner's Feedback:

- The majority of the risks involved with unit price and stipulated price contracts lie with the contractor because any mistakes made by the contractor in estimating the price can result in monetary losses. Contractors may try to recover losses through litigations.

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- Unit price contracts are more favorable to contractors as they have no risk towards quantities and any item not in included are separately negotiated.
- Claims are more likely to arise when the majority of the risks lie with the private sector.

'Contract duration'

Fact: The occurrence of claims for contracts with durations of between one and two years is relatively high (47.3%) compared with other contract duration lengths. Out of the 93 cases that were studied in this category, 7 cases (7.5%) were filed against projects with durations of less than six months and 18 cases (19.4%) were filed against projects with durations of between six months and a year. The chance for projects with contract durations greater than five years to encounter claim problems is 3.2%.

Practitioner's Feedback:

- The statistic of this category does not accurately reflect situation of the construction industry because it fails to consider the number of projects that are performed under each time period. The high occurrence of claims for projects with duration between one to two years is likely due to the fact that most construction projects fall within this time period.
- Short-term projects tend to have simple and straightforward terms; contractors can deliver work without major problems.

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- Contractors may be more willing to discuss claims if a mutual working relationship must be maintained for a longer period of time.

'Contract price'

Fact: The occurrence of claims for projects costing < 1 million dollars, 1 to 5 million dollars, and > 5 million dollars are 47 cases, 21 cases, and 14 cases of 82 cases respectively. Contracts costing less than one million dollars are at the highest risk of encountering claims (62.4%).

Practitioner's Feedback:

- Short-term low-value projects are very risky to the contractor because any mistake can have a large impact on project. Contractors may file claims to compensate for monetary losses.
- Projects that are worth > 5 million dollars have low claim occurrence rates because the number of contracts this size is relatively low. The budget of most contracts fall within the '> 1 million' price range.
- The statistics of this category is not representative of the construction industry because it does not consider the number of projects from the construction industry that occur within each price range.

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Table 5.5: Contract related Statistics

Contract statistical findings	Number of cases	% of total cases
Based on lowest price?	**93**	100.0
Yes	44	47.3
No	49	52.7
Contract payment method	**89**	100.0
Unit price	51	57.3
Stipulated price	31	34.8
Cost plus	7	7.9
Contract duration	**93**	100
< 6 month	7	7.5
6 month - 1 year	18	19.4
1 year – 2 year	44	47.3
2 year- 5 year	21	22.6
> 5 years	3	3.2
Contract price	**82**	100.0
< 1 M	47	62.4
1- 5 M	21	22.6
5 - 10 M	4	4.3
10-20 M	6	6.5
20 - 50 M	2	2.2
> 50 M	2	2.2

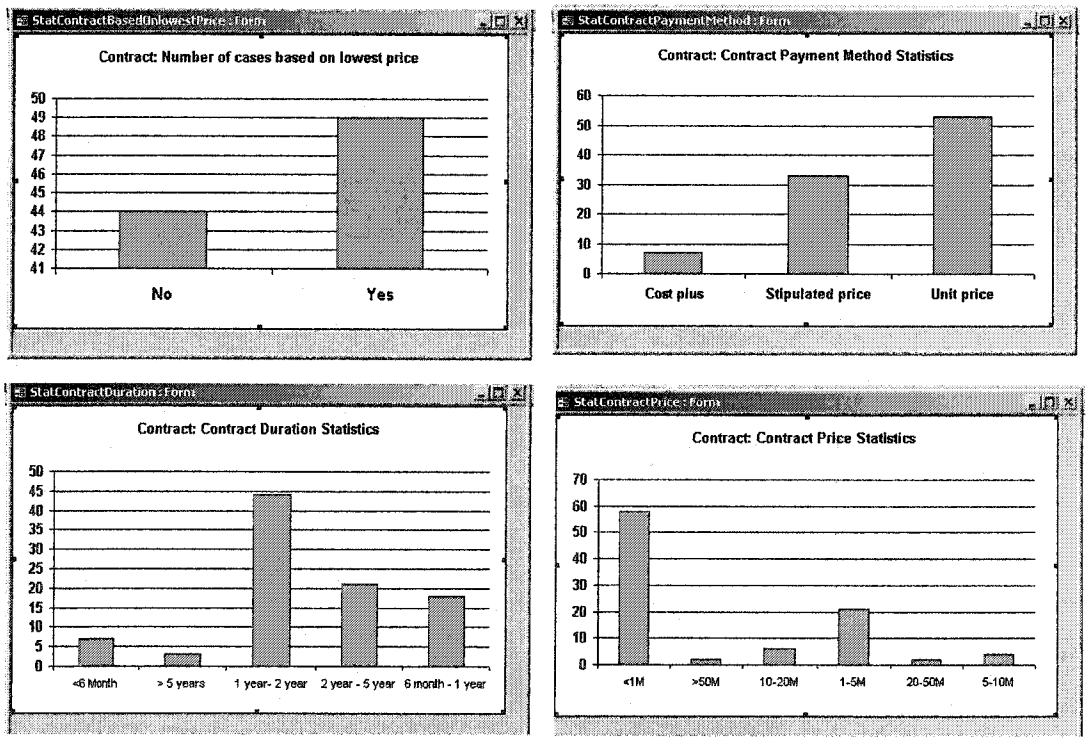

Figure 5.4: Contract Related Statistics

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5.6 Closing

This study explored many claim-prone factors; the case summary statistics represented in the distribution of cases into categories and subcategories suggested that the main causes of claims within the construction industry are contract violations and last minute changes. Project related statistics suggested a higher occurrence of claims in private projects, projects with complex designs, projects of prolonged durations and projects with unclear scopes. The contract related statistics suggest that disputes are more likely to arise in stipulated price contracts where the contractor assumes the majority of the risks.

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6 CONCLUSION

6.1 Research Summary

This thesis presented an innovative approach for collecting, classifying and analyzing Canadian construction claims. For this purpose, three main objectives have been identified: 1) a methodology for collecting and classifying Canadian construction claims; 2) a methodology for making use of the repository to analyze the Canadian construction environment; and 3) a methodology for integrating the cases and analysis modules into a computer-integrated repository system called the Canadian Construction Claim Tracker (CCCT).

A categorization methodology incorporating 12 categories and 32 subcategories has been developed to classify the 567 collected construction cases. The CCDC 2-1994 general provisions have been used to standardize the developed classification system. Two conditions govern the collection of cases in the repository: 1) the validity of the repository depends on the number of cases collected; and 2) the analysis of the collected cases requires detailed information about each case. To deal with these conflicting conditions, cases were divided into two types: 'detailed cases' and 'limited cases'. The 460 collected 'limited cases' have been included in the repository but are not used in all analysis. The 107 'detailed cases' collected have sufficient detailed information to be used for analysis purpose. Once the 'detailed cases' were collected and categorized, three methods for analyzing Canadian construction claims were proposed: 1) a 'statistical

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module' to benchmark Canadian construction claims; 2) a 'classification module' to provide suggestions as to the causes of the claims in the contract document; and 3) a 'prediction module' to forecast the outcome of a dispute using ANN (65% successful prediction rate was achieved). To validate the proposed statistical analysis in the 'statistical module', the statistical findings have been circulated to construction professionals and their feedbacks have been included in the analysis. A multifunctional computer-integrated repository system called CCCT has been developed to integrate the different proposed methodologies. The tools employed to implement CCCT are MS Access, VB for Application, MS Graph and NeuroShell.

From a practical perspective, CCCT provides the Canadian industry with a unique, computer-integrated repository system for the construction claims which was tested on 567 cases; the system is implemented in a user-friendly environment that has the capacity to house a large number of new construction claims. CCCT can become a standard databank for Canadian construction claims if adopted by the Construction research Institute of Canada (CRIC). A large number of parties can benefit from CCCT including contractors, owners, subcontractors, consultants and law and/or engineering academia. From a research perspective, the system integrates the repository of cases collected and the proposed analysis modules. This research does not touch on legal issues and the litigation cases presented would not suffice as a substitute for a lawyer.

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6.2 Research Contributions

The research contributions can be summarized in the following points:

- Defined a methodology to categorize and analyze Canadian construction claims.
- Developed a repository system for the Canadian construction claims.
- Developed the following three 'analysis modules' to analyze the Canadian construction claims.
  - 'Statistical Module': Proposed a methodology to benchmark the Canadian construction.
  - 'Classification Module': Proposed a methodology that recommends suggestions as to the causes of claims in the contract document by relating each case to CCDC texts and descriptions of similar issues encountered in the cases.
  - 'Prediction Module': Validated the use of ANN for predicting the outcome of court decisions. The prediction-modeling tool was effective for predicting the outcome of a sample of 107 Canadian construction claims (Successful prediction rate of 65%).
- Designed and implemented a computer-integrated repository system, which is flexible for input of new cases, integrating the repository of cases collected and the analysis modules.

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6.3 Limitations on the Canadian Construction Claim Tracker (CCCT)

- This research can be used as a platform for future studies. Claim information within CCCT can be updated or manipulated for future work and more sources such as the 'Construction Law Report' and 'CanLaw' can be incorporated into system.
- Feedbacks from practitioners of the Canadian construction industry revealed that there is a need for a methodology to benchmark issues relating to construction claims. Also, the methodology used for the statistical module can be developed into a benchmarking system by implementing a sampling technique that can reflect the Canadian construction environment.
- In this research, cases that result from bidding and tendering issues were grouped with claims of construction nature. Contract law litigations cover a wide range of topics; additional methodologies can be developed to classify claims that results from the bidding process, Contract A, or Contract B. In addition, methodologies can also be developed for dispute resolution methods other than litigation (such as arbitration and mediation).
- Additional prediction input parameters can be used to try and improve the existing prediction rate of 65%.

6.4 Recommendations for Future Research

- The classification methodology used in CCCT can be modified for different owners to fit their needs.
- A 'cost module' can be investigated to analyze claim-cost related issues; the 'cost module' can be linked to the categorization system and a knowledge-based system

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can be developed to estimate the cost of a claim and relate its cost to the general category of its occurrence.

- A 'time module' can be investigated to analyze delay claims based on the category of their occurrence; a knowledge-based system can be developed to estimate the delays based on the CCDC category and subcategory of the delay claim. However, a lack of cost and time information in the collected cases limits the development of cost and time modules.

- The classification system can be configured to different contract documents; a personalized classification system can be developed to take into consideration the standard contract document used by the owner and then to classify claims based on the owner's request. A link can then be developed between the contract document and the claims. This is a proposed project control method that could help owners monitor their claims and the efficiency of their contract documents.

- From the parameters collected for the cases, new prediction techniques can be tested to predict the outcome of litigated construction claims. As discussed in chapter 2, Arditi and Tokdemir (1999a), (1999b) applied a Case Based reasoning approach for predicting the outcome of construction claims. Also, different input parameters can be used to optimize the prediction results obtained.

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APPENDIX A: LIST OF THE 567 CASES COLLECTED

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The following is a list of all cases examined in this study. There are 567 cases in total.

- 031465 N.B Ltd. v. Motel Parfait Inc., 1987
- 049665 N.B Ltd. v. Opron Maritimes Construction Ltd., 1992
- 153261 Canada Ltd. v. T&M Electrical Contractors Ltd., 1995
- 263657 Alberta Ltd. v. Banff (Town of) Subdivision And Development Appeal Board, 2003
- 3027539 N. S Ltd. v. Mogon, 2003
- 3112630 British Columbia Ltd. v. Alta Surety Co., 1994
- 327647 B.C. Ltd. v. Addco Drywall, 1991
- 606346 Alberta Ltd. v. Abugov, 2000
- 688558 Ontario Ltd. v. Morgan, 1995
- A.C. Landry & Fils Ltee v. New Bunswick, 1987
- A.C.V Construction Ltd. v. Przy, 1985
- A.J. Hendriks Construction Ltd. v. Central Park Lodges Ltd., 2003
- Abbot Construction Ltd. v. Future Way Enterprises Ltd., 1991
- ACL Holdings Ltd. v. St. Joseph's Hospital of Estevan, 1996
- Acme Building and Construction Ltd. v. Newcastle Town, 1992
- Acme Investments Ltd. v. York structural Steel Ltd., 1974
- Acme Masonry Ltd. v. Bird Construction Ltd., 1986
- Act Contracting Ltd. v. Kelowna (City), 1992
- Addco Drywall Ltd. v. White rock manor joint venture, 1993
- Agra Foundations Ltd. v. Koncrete Construction Ltd., 2001
- Aiello v. Central Gas Ontario, 2000
- Aim Electric Ltd v. Tobac Construction Ltd, 1984
- A-Jac Demolition (London) Ltd. v. Urlin Rent a car Inc., 1990
- Al Vogel Construction Ltd. v. Forbes, 1998
- Al Vogel Construction Ltd. v. Woods, 2002
- Alden Contracting Ltd. v. Newman Bros. Ltd., 1998
- Alex Gair Sons Ltd. v. Lepinski, 1998
- Alexander Insulations Ltd. v. Urlin Rent-a-car Inc., 1990

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- Alie v. Bertrand & Frere Construction Co. Ltd., 2002
- Allied Canada Inc. v. General Signal Ltd., 1994
- Amoco Canada Petroleum Company v. Quantel Engineering (1981) Ltd., 2002
- Anc Developments Inc. v. Dilcon Constructors Ltd., 2000
- Andco Distributors (1975) Ltd. v. Regard Enterprises Ltd., 1983
- Angus v. Pinalski, 1990
- Anron Mechanical Ltd. v. valantori Construction Ltd., 1990
- Ansco Construction Ltd. v. Audax Investments Inc. et al., 1994
- Anzac Construction Ltd v. Speers Construction Ltd., 1994
- Apex Construction Ltd v. Cairns, 1995
- Applecrest Investments Ltd. v. Guardian Insurance Co., 1992
- Applied insulation Co. v. Megatech Contracting Ltd., 1994
- Aquicon Construction Co. Ltd. v. Vaughan (City of), 2003
- Arctic distributors Ltd. v. Nordine, 1984
- Arjon Construction Ltd. v. Sandstar Corporation, 2000
- Arnoldin Construction & Forms Ltd. v. Alta Surety Co., 1995
- Arrow Construction Products Ltd. v. Nova Scotia (Attorney General), 1995
- Atlantic basement Co. v. Welland, 1993
- Atrium Construction Ltd. v. Homestead Heights Ltd., 1990
- Auto Concrete Curb Ltd. v. South Nation River Conservation Authority, 1988
- Automatic Systems Inc. v. E.S. Fox Ltd., 1995
- B.C Rail Ltd. v. Canadian Pacific Consulting Services Ltd., 1990
- Babb Construction Ltd. v. Fong, 1984
- Baker (trustee of) v. Aprok Drywall Ltd., 1990
- Banister Pipeline Construction Company v. Transcanada Pipelines Limited, 2003
- Bank of Boston v. Scarborough construction, 1994
- Bank of Montreal v. Bail Ltee, 1992
- Banque de Montreal v. Hydro-Quebec, 1990
- Barbican Properties Inc. v. Bentall Properties Ltd., 1995
- Barclay Construction Corporation v. Du Pont Canada Inc., 2000
- Barkey v. Maier, 1991
- Baroney estates Ltd. Effect Construction Ltd., 1995

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- Bate Equipment Ltd. v. Ellis-Don Limited, 1992
- BC Rail Ltd. v. American Home Insurance Company, 1996
- Beacon Developments Corporation v. Schular, 1998
- Beaver Lumber Co. v. Sieffert, 1964
- Beaver, Cook & Lietch Ontario Ltd. v. Simpsons's Ltd., 1989
- Begro Construction Ltd. v. St. Mary River Irrigation District, 1994
- Belle River Community Arena Inc. v. W.J.C. Kaufmann Co. Ltd., 1977
- Belmar Sheet Metal Co. v. 849539 Ontario Inc., 1994
- Bemar Construction (Ontario) Inc. v. Toronto Transit Commission, 1995
- Bemar Construction Ltd. v. Canada, 1999
- Ben Bruinsma & Sons Ltd. v. Chatham (City), 1984
- Best Cleaners and Contractors Ltd. v. Federal Department of Transport, 1985
- Betts Enterprises (1983) Ltd. v. Washburn, 1993
- Bg Checo International Limited v. British Columbia Hydro and Power Authority, 1995
- BG Checo International Ltd. v. British Columbia Hydro and Power Authority, 1993
- Bird Construction Company Ltd. v. Sault Ste Marie P.U.C., 1997
- BJ's Contracting Ltd. v. Eastern Shredding Ltd., 1990
- Black Construction Inc. v. The Corp. of the City of Vernon, 1996
- Blackwood Hodge Equipment Ltd. v. Humford Developments Ltd., 1985
- Blair v. Alderney Consultants (1987) Ltd., 1999
- BMW Investments Ltd. v. Saskferco Products Inc., 1993
- Bob Dionisi & Sons Ltd. v. F.J. Davey Home for the Aged, 1992
- Bonavista-Triniti-Placenta Integrated School Board v. Lundrigan's Ltd., 1989
- Bosher v. United Contractors Ltd., 1991
- Bot Construction Ltd. v. Ontario (Ministry of Transportation and Communication), 1994
- Boulder Construction Builders Ltd. v. Calgary (City), 1985
- Bow Valley Husky (Bermuda) Ltd. v. Saint John Shipbuilding, 1998
- Boychuk Construction Corp. v. O'lain, 1997
- Bradscot (MCL) Ltd. v. Hamilton-Wentworth Catholic School Board, 1999
- British Columbia Hydro and Power Authority v. N.D. Lea & Associates Ltd., 1998

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- British Columbia v. R.B.O. Architecture Inc., 1995
- Brookswood Ironworks Ltd. v. DGS Construction Co., 1993
- Brown & Huston Limited v. York (Borough), 1983
- Bruce Butler (1974) Ltd. v. Bonavista Peninsula Interfaith Senior Citizens Foundation, 1989
- Brunswick Construction Ltee v. New Brunswick, 1986
- Bryan v. Malone, 1997
- BWV Investments Ltd. v. Saskferco Products Inc., 1994
- C&M Mcnally Engineering Inc. v. Greater Moncton Sewerage Commission, 1993
- C&R Logging Ltd. v. Greater Vancouver (Regional District), 1994
- Calgary v. Northern Construction Company, 1985
- Campbell v. Aker, 1978
- Campbell v. Murphy, 1993
- Campeau Corp. v. Canada, 1986
- Canada Mortgage And Housing Corporation v. Barclay Construction Corporation, 2001
- Canadian General Insurance Co. v. John Jacobs and Sons Ltd., 1995
- Canadian National Railway Co. v. Volker Stevin Contracting Ltd., 1991
- CanAmerican Auto Lease and Rental Ltd. v. R., 1985
- Can-Dive Services Ltd. v. Intec Engineering Inc., 1993
- Can-Dive Services Ltd. v. Pacific Coast Energy Corp., 2000
- Canyon Court Apartments Ltd. v. E.J. Faraci and Associates Ltd., 1986
- Caradon Ltd. v. Pay-Zone Construction Ltd., 1998
- Cardinal Construction Ltd. v. Brockville (City), 1984
- Carl de Wilde Contracting Ltd. v. Thomas, 1990
- Carman Construction Ltd. v. Canadian pacific Railway Co., 1982
- Carosi Construction Ltd. v. Niagara (Regional Municipality), 2003
- Catre Industries Ltd. v. Alberta, 1989
- Cegeco Construction Ltee v. Ouimet, 1991
- Central Reinforcing Steel Service Ltd. v. Pigott Project Management Ltd., 1992
- Centre Town Developments v. Gray & Associates Inc., 1983
- Century Holdings Ltd. v. Delta (District), 1992

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- Charter Construction Ltd. v. Calgary (City), 1982
- Chaston Construction Corp. v. Henderson Land Holdings (Canada) Ltd., 2002
- Chicoutimi (Ville) v. Martineau, 1991
- Chinook Aggregates Ltd. v. Abbotsford (Municipal District), 1987
- Chung v. Hoy, 1994
- Citadel General Insurance Co. v. Johns-Manville Canada Inc., 1983
- Citta Construction v. E. Lane Holdings Et Al, 2003
- Clan Glass & Metal Ltd. v. Ledcor Industries Ltd., 1999
- Cohen v. Ostry, 1992
- Colautti Brothers Marble Tile and Carpet (1985) Inc. v. Windsor (City), 1996
- Colautti Construction Ltd. v. Ottawa (City), 1984
- Collavino (Nfld.) v. Dobbin, 1985
- Collavino Brothers Construction Co. v. Windsor (City), 1972
- Colt Engineering and Construction Ltd. v. Bond Architects & Engineers Ltd., 1993
- Condor Construction Ltee v. Bathurst (City), 1994
- Conmac Western Industries v. Budd Bros. Ltd., 1990
- Continental Asphalte Inc. v. Canada, 1986
- Continental Insurance Co. of Canada v. Phase Construction Ltd., 1992
- Convert a Wall Ltd. v. Brampton Hydro-Electric Commission, 1988
- Corazzin v. Donavan, 1993
- Corban Construction Co. Ltd. v. Nankivell, 1995
- Cormode & Dickson Construction (1983) Ltd. V. Harrison, 1999
- Corpex (1977) Inc. v. The Queen, 1995
- Crane Canada Inc. v. Titan Holdings Ltd., 1989
- Cross Atlantic Developments Ltd. v. City of Prince George, 1996
- Crystal Rose Home Ltd. v. Alberta New Home Warranty Program, 1994
- Custom Drywall (Manitoba) Ltd. v. Eriksdale Construction Ltd., 1990
- D.A Sharp Construction Co. v. Proman Projects Ltd., 1987
- D.B. & J. (1971) Inc. v. Cornwall (Village), 1978
- D.J. Lowe (1980) Ltd. v. Nova Scotia (Attorney General), 1993
- Dabbous v. Zuliani, 1976
- Daiwood Construction Co. v. Wright Schuchart Construction Ltd., 1992

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- Danrik Construction Ltd. v. Canadian Surety Company, 2003
- Dartmouth (City) v. Acres Consulting Ltd., 1995
- Dashchuk Lumber Ltd. v. Proman Projects Ltd., 1987
- Dave's Plumbing & Heating (1962) Ltd. v. Voth Brothers Const. (1974) Ltd., 1986
- David T. Williams Ltd. v. Green, 1990
- Dawson Construction Ltd. v. Victoria Insurance Co. of Canada, 1986
- Dayton's Mechanical Ltd. v. West Hill Developments Ltd., 1976
- Defense Construction (1951) Ltd. v. D.J. Lowe Ltd., 1982
- Degelder Construction Co. Ltd. v. Dancorp Developments Ltd., 1994
- Del Ridge Construction Inc. v. General Accident Assurance Co. of Canada, 2003
- Deman Construction Corp. v. Magna International Inc., 2002
- Deman Construction Corp. v. Magna International Inc., 2003
- Deneschuk Construction Ltd. v. Waywayseecappo First Nation, 2000
- Derby Holdings Ltd. v. Wright Construction Western Inc., 2002
- Derco Industries Ltd. v. A.R. Grimwood Ltd., 1986
- Derrick Concrete Cutting & Coring Ltd. v. Central Oilfield Service Ltd., 1995
- Dexter Construction Co. v. Nova Scotia (Attorney General), 1988
- Diamond Park Builders Ltd. v. Conlee Construction Ltd., 2002
- Diamond Willow Ranch Ltd. v. Oliver (Village), 1988
- Dilcon Constructors Inc. v. British Columbia Hydro & Power Authority, 1992
- Dilcon Constructors Inc. v. British Columbia Hydro & Power Authority, 1992
- District of Logan Lake v. Rivtow Industries Ltd., 1990
- Doell V. Lawrence, 1977
- Domco Construction Inc. v. Aliva Holdings Inc., 2003
- Don Pocock Construction Ltd. v. Brady, 2004
- Donald Developments Ltd. v. Nova Scotia Power Corp., 1989
- Dow & Duggan prefabrication Ltd. v. Paquet, 1993
- Doyle Construction Co. v. Carling O'Keefe Breweries of Canada Ltd., 1988
- Dunhill Construction Ltd. v. Ledcor Industries Ltd., 1993
- Dynatec Mining Ltd. v. PCL Civil Constructors (Canada) Inc., 1996
- East Kootenay Community College v. Nixon & Browning, 1988
- Eastern Buildings Centres Ltd. v. Transeastern Properties Ltd., 1991

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- Ed Bulley Ventures Ltd. v. Eton-West Construction, 2003
- Edgeworth Construction Ltd v. N. D. Lea & Associates Ltd., 1991
- Edgeworth Construction Ltd. v. N.D. Lea & Associates Ltd., 1993
- Edgeworth Construction Ltd. v. Thurber Consultants Ltd., 1995
- Edmonton (City of) v. Lovat Tunnel Equipment Inc., 2000
- Edmonton (City) v. Triple Five Corp., 1994
- Elgin Construction Ltd. v. Russell Township, 1987
- Ellis-Don Construction Ltd. v. Canada (Minister of Public Works), 1992
- Ellis-Don Ltd. v. Toronto Parking Authority, 1978
- Elmford Construction Co. v. Canadian Indemnity Co., 1995
- Embar Construction Ltd. v. Newfoundland (minister of works, services and transportation), 1995
- Emil Anderson Construction Co. v. British Columbia Rialway Co., 1991
- Emros Development Corp. v. Gil-Bern-Charles Corp., 1989
- Enercon Limited v. Canadian General Insurance Co., 1996
- Engineering and Plumbing Supplies Ltd. v. Quesnel (City), 1987
- English and Lepage Ltd. v. Maric, 1991
- Entreprises PEB Ltee v. Ports Canada, 1987
- Epstein v. Cressey Development Corp., 1990
- Erickson Construction Ltd. v. Elance Steel Fabricating Co., 1989
- Etobicoke (City) v. Masino Construction Ltd., 1992
- F.P Construction Ltd. v. B.U.K Investments Ltd., 1993
- Falconer Construction Ltd. v. EY Construction Ltd., 1992
- Falk Bros. Industries Ltd. v. Elance Steel Fabricating Co., 1989
- Fame Construction Ltd. v. 430863 B.C. Ltd., 1997
- Familiy Home Improvements Ltd. v. Scopa, 1992
- Farmer Construction Ltd. v. Doncaster Holdings Ltd., 1990
- First City Development Corp. v. Stevenson Construction Co., 1984
- Five-Fifty Beatty Street Ltd. Partnership v. Markwood Construction Ltd., 1989
- Fluor Canada Constructors Ltd. v. Lethbridge (City), 1989
- Folbar v. Alto Construction Ltd., 2003
- Forest Contract Management v. C&M Elevator Ltd., 1988

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- Forte Aluminum Ltd. v. Frank Plastina Investments Ltd., 1988
- Foundation Co. of Canada Ltd. v. American Home Assurance Co., 1995
- Fox Mechanical Ltd. v. Barclay Construction, 1995
- Fraser Gate Apartments Ltd. v. Western Surety Co., 1995
- Fuller Austin Insulation Inc. v. Wellington Insurance Co., 1995
- G.M. Kelly Contracting & Landscape Services Ltd. v. Redden, 1990
- Gateway Construction Co. v. Provincial Drywall Supply Ltd., 1987
- Gateway Village Shopping Center Inc. v. Tri-Stads Designs Ltd., 1991
- Gauvin Construction Inc. v. Soco Investments Inc., 1991
- George Wimpey Canada Ltd. v. Hamilton-Wentworth (Regional Municipality), 1997
- Gest (G.M) Contractors Inc. v. Nova Scotia Power Corp., 1985
- Geyer v. Kimberley Plumbing & Heating (1984) Co., 1990
- Giffels Associates Ltd. v. Eastern Construction Co., 1978
- Gilbart v. Ventura Custom Homes Ltd. et al., 2003
- Glenn Sergius and Frank Mesich v. Janax Design & Drafting Services Ltd., 1991
- Globe Construction Company (1976) Ltd. v. Vision Enterprises Ltd., 2001
- Gloge Heating & Plumbing Ltd. v. Northern Const. Company Ltd., 1984
- Golden Hill Ventures Ltd v. Kemess Mines Ltd., 2002
- Graham Construction and Engineering (1985) Ltd. v. Alberta, 1992
- Graham Construction and Engineering Ltd. v. BFI Constructors Ltd., 2001
- Granview Fram Ltd. v. CBCL Ltd., 1999
- Granville Constructors Ltd. v. Somerset Place Developments of Georgetown Ltd., 1990
- Greenan v. R.J. Maber Construction Co., 1992
- Greene v. Canadian General Insurane Co., 1991
- Grene v. Canadian General Insurance Co., 1996
- Greystone Construction Ltd. v. Maclean, 1994
- H & H Concrete & Drain Inc. v. Flin Flon (City), 2000
- H & R Drilling Inc. v. Aquilo Energy Inc., 2000
- Hadrian Development Ltd. v. Sansom, 1991
- Halton Region Conservation Authority v. Toronto Underground Contractors Ltd., 1985

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- Harris Steel Ltd. v. Alta Surety Co., 1993
- Hawl-Mac Construction Ltd. v. Campbell River (District), 1997
- Hearn/Actes v. Commonwealth Insurance Company, 2001
- Hedley Byrne & Co. Ltd. v. Heller & Partners Ltd., 1961
- Hein v. Stratychuk, 1981
- Henderson v. Raymond Massey Builders Ltd., 1963
- Herve Pomerleau Inc. v. Canada, 1988
- Hilderman Construction Ltd. v. Hill Top Manor Ltd., 2001
- Hillier's Trades Ltd. v. Savoury Enterprises Ltd., 1988
- Hiscock v. Nolan, 1993
- Ho v. Yip, 1995
- Hodder Construction (1993) Ltd. v. John E. Pellizzon and Dixie A. Pellizzon, 2002
- Hoeppner v. Horstman Contracting Ltd., 1992
- Homes by Jayman Ltd. v. Kellman Berg Engineering & Surveys Ltd., 1995
- Homes by Wallace Ltd. v. Werklund, 1992
- Howe Ridchardson Inc. v. Newfoundland Scale Co., 1990
- Husky Oil Operations Limited v. Ledcor Industries Limited, 2003
- Husky Oil Operations Ltd. v. M.N.R., 1993
- Husky Oil Operations Ltd. v. Minister of National Revenue, 1995
- ICI Paints (Canada) Inc. v. J.M. Breton Plastering (1984) Co., 1992
- Imperial Oil Limited v. Alberta (Minister of Environment), 2003
- Industrial Construction Ltd. v. Lake Side Center Co., 1976
- Ingles v. Tutkaluk Construction Ltd., 1994
- Inland Cement Limited v. Stantec Consulting Ltd., 2002
- International Piping Inc. v. Polytubes (West) Inc., 2002
- Isaac v. Bastarache, 1990
- Isotec Consulting Engineers Limited v. 672850 Alberta Corporation, 2001
- J.F. Markell Homes Ltd. v. Milne, 1986
- J.P. Metal Masters Inc. v. Busby Bridger Holdings Ltd., 1997
- J.P. Metal Masters Inc. v. David Mitchell Co., 1998
- J.P.R. Form Work Ltd. v. Beaudouin, 1991
- J.R. Jones Builders Ltd. v. Gossen, 1978

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- J.W. Price Construction Ltd. v. Elan Construction Ltd., 2001
- Jacobsen v. Lacey, 1980
- James More and Sons Ltd. v. University of Ottawa, 1974
- Janeland Developments Inc. v. Michelin Masonry Inc., 1996
- Jayasinghe v. Ang, 1981
- Jenkens v. Leclaire, 1976
- JJM Construction Ltd. v. Sandspit Harbour Society, 1998
- Jjm Construction Ltd. v. Westmar Consultants Inc., 1999
- John Doyle Construction Ltd. v. Laing Management Ltd., 2003
- John Jacobs and Sons Ltd. v. N.D. Dobbin Ltd., 1988
- John Susin Construction Co. Ltd. v. London (City), 1990
- Joseph Silaschi General Contracting (Kitchener) Ltd. v. Kitchener City, 1986
- Joslyn & Olsen Contractors Ltd. v. Bouey, 1976
- K&C Electric Ltd. v. Canada, 1989
- K/S A/S Offshore Atlantic v. Marystown Shipyard Ltd., 1990
- Kamlee Construction Ltd. v. Oakville (Town), 1960
- Karl Mueller Construction Ltd. v. Northwest Territories (Commissioner), 1989
- Kathy's Construction Ltd. v. Boreal Engineering Services Ltd., 1989
- Kay v. Imperial Lumber (Jasper Place) Ltd., 1965
- Kei-Ron Holding Ltd. v. Coquihalla Motor Inn Ltd., 1997
- Ken Lawter Holdings Ltd. v. Steen Panduro Holdings Ltd., 1991
- Ken Toby Ltd. v. British Columbia Corp., 1999
- Kencor holdings Ltd. v. Saskatchewan, 1991
- Kerbel v. Carson, Dunlop & Associates Ltd., 1994
- Knappett Construction Ltd. v. Axor Engineering Construction Group Inc., 2003
- Komorowski v. Van Weel, 1993
- Kor-Ban Inc. v. Pigott Construction Ltd., 1993
- Kowcun v. Manitoba Housing and Renewal Corp., 1993
- Kvaerner Enviropower Inc. v. Tanar Industries Ltd., 1994
- Laird v. Edamura, 1990
- Landac Developments Ltd. v. Kerry T. Howe Ltd., 1990
- Landru v. Inter City Contractors Ltd., 1987

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- Lansing Building Supply (Ontario) Ltd. v. Kemp, 1992
- Laura Rae Wilson v. Gordon Spratt & Associates Ltd., 1991
- Ledcor Industries Limited v. Standard Electric (Northern) Limited, 2001
- Leo Gushue Construction Ltd. v. Thistle, 1990
- Lester Archibald Drilling and Blasting Ltd. v. Commercial Union Assurance Co. of Canada, 1987
- Lindsay Brothers Construction Ltd. v. Halton Hills Development Corp., 1992
- Lionel J.L. Maclean Ltd. v. Winters, 1989
- Litchfield Bulldozing & Demolition Ltd. v. PCL Construction Ltd., 1985
- Lloydminster Roman Catholic Separate School District No. 34 v. Border City Transit Mix (1980) Ltd., 1988
- Logan Lake (District) v. Rivtow Industries Ltd., 1990
- London Wholesale Plumbing Supplies Ltd. v. Castellani, 1984
- Longwell Enterprises Ltd. v. Mcgowan, 1989
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APPENDIX B: CLASSIFICATION MODULE: CONTRACT-CLAIMS RELATIONSHIP

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
General provisions	Breach of contract	Intent	•Contractor supply products and perform work relevant to the contract document and is not responsible for other non-inferable items.
		Consultant	•The specifications, drawings and models are not to be copied or altered without the written consent of the consultant.
		Complementary	•The contract Documents are complementary and what is required by any one shall be binding as if required by all.
		Rights and remedies	•The duties and obligations imposed by the contract documents shall be in addition to those imposed by law.
		Priority	•The priority in the contract documents is: Definitions, Executed agreement, supplementary conditions, General conditions, Material and finishing schedules and Drawings.
		Abbreviations	•Words and Abbreviations, which have a well-known technical meaning, are used in accordance with such recognized meanings.
		Specifications	•The specifications constitute written requirements and standards for the completion of the work of: products, systems, workmanship and services.
		Limitations	•The contractor shall not be controlled in dividing the work among a subcontractor by the specifications and drawings.
		Drawings	•The drawings are the graphic and pictorial portions of the contract documents showing design of the work, location of the work, dimensions of the work and governing large scale.
	Misrepresentation of construction clauses	Not associated	•Not associated

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
	Renegotiation of contract clauses	Not associated	•Not associated
Administration of the contract	Consultant issue	Authority	•The duties, responsibilities and limitations of authority of the consultant shall be modified or extended only with the written consent of the owner, contractor and consultant.
		New consultant	•The owner shall immediately appoint a new consultant against whom the contractor makes no reasonable objection upon the termination of the old consultant contract.
		Workplace visits	•The consultant will visit the place of the work at intervals appropriate to the progress of construction.
		Payments	•The consultant determines the amounts owing to the contractor under the contract and will issue certificates for payment.
		Responsibility	•The consultant will not be responsible for and will not have control, charge or supervision of construction means, methods, techniques, sequences or procedures.
		Interpretation	•The consultant shall make interpretations and findings as to the performance by both parties to the contract and these findings shall be consistent with the intent of the contract documents.
		Partiality	•When making interpretations and findings, the consultant shall not show partiality to either the contractor or the owner.
		Instruction	•The consultant furnishes supplementary instructions to the contractor during the progress of the work with reasonable promptness or in accordance with a given schedule.
		Review	•The consultant will review and take appropriate action upon such contractor's submittals as shop drawings, product data and samples.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
		Certificates	•All certificates issued by the consultant shall be to the best of the consultant's knowledge, information and belief.
Administration of the contract	Consultant issue	Corrections	•If the work is not in accordance with the requirements of the contract documents, the contractor shall correct the work and pay the cost of examination and correction.
		Inspections	•If work is designated for tests, inspections or approvals in the contract documents, the contractor shall give the consultant reasonable notice of when the work will be ready for review.
	Work inspection issue	Access of the work	•The owner and the consultant shall have access to the work at all times. The contractor shall provide sufficient, safe and proper facilities at all times for the review of the work.
		Contractor's notice	•The contractor shall give the consultant reasonable notice of when the work will be ready for review and inspection.
		Consultant interruptions	•If the work ordered to be inspected is in accordance with the requirements of the contract documents, the owner shall pay the cost of examination and replacement.
Execution of the work	Control of the work	Separate contracts	When Separate contracts are awarded for other parts of the project: •Owner responsibility-owner responsibilities include coordination, construction safety and labor disputes. •Contractor responsibility-contractor responsibilities include site clearance, coordination and deficiency report.
		Conformity	•The work has to conform with the contract documents including the construction methods, construction techniques, construction sequences and construction procedures.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
		Supervisor	•The supervisor on site should represent the contractor at all times.
Execution of the work	Control of the work	Labor	•The contractor pays for the labor and insures that there is good order among them.
		Supervisor change	•If the supervisor of the work has been changed there should be a valid change for his change.
		Products	•Accepted: The products shall be accepted by consultant •Paid for: The products paid for by the contractor.
		Documents on site	•The contract documents, the submittals, reports and records of meetings shall be available on site at any time.
		Shop drawings	•The contractor shall provide shop drawings as described in the contract documents or as the consultant may reasonably request.
		Construction schedule	•The construction schedule shall include the timing of major activities, sufficient details of critical events and schedule updates all conforming with the Contract documents.
		Subcontractor	•Conformity: Incorporate the terms and conditions of the contract documents into all contracts or written agreement with subcontractors and suppliers. •Omissions: The subcontractor shall be as fully responsible to the owner for acts and omissions by the subcontractor. •Acceptance: The subcontractor shall be accepted by both the contractor and the owner.
		Supplier	•Conformity: Incorporate the terms and conditions of the contract documents into all contracts or written agreement with subcontractors and suppliers. •Omissions: The supplier shall be as fully responsible to the owner for acts and omissions by the supplier. •Acceptance: The supplier shall be accepted by both the contractor and the owner.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Execution of the work	Defective work	Poor workmanship	◆Defective work resulting from Poor workmanship and failing to conform to the contract documents shall be removed promptly and replaced or re-executed at the contractor expense.
		Defective products	◆Defective work resulting from defective products shall be removed promptly from the place of the work by the contractor and replaced or re-executed at his expense.
		Acts of omissions	◆Defective Products resulting from acts of omissions or carelessness by the contractor shall be removed promptly from the place of work and replaced and re-executed promptly.
		Corrections	◆If in the opinion of the consultant it is not expedient to correct defective work as provided in the contract documents, the owner may deduct that amount from the amount due to the contractor.
Allowances	Cash allowances	Contract price	◆The contract Price includes cash allowances stated in the contract documents, which allowances includes the contractor's overhead and profit.
		Cash allowances	◆Cash allowances cover the net cost to the contractor of services, products, construction machinery and equipment, freight, unloading, handling, storage, installation and other authorized expenses.
		Change orders	◆The contract price shall be adjusted by change order to provide for any difference between the actual cost and each cash allowance.
	Cash allowances	Progress of the work	◆The contractor and the consultant shall jointly prepare a schedule that shows when the consultant and owner must authorize ordering of items called for under cash allowances.
		Owner's responsibility	◆Financial arrangements: Financial arrangement with the contractor. ◆Material change: Notify the contractor for any material change during the performance of the work.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Payment	Contingency allowances	Not Associated	•Not Associated
	Progress payment	Consultant responsibility	•Deadline: Receipt of application of payment to the owner no later than 10 days after the receipt. •Amendments: Amendments are allowed if they are promptly notified.
		First application of payment	•Time: Contractor shall submit to the consultant at least 14 days before the first application for payment a schedule of values for the part of the work. •Schedule: The schedule of values shall be submitted for the parts of the work. •Aggregation: The total amount of the contract price shall be aggregated in order to facilitate the evaluation of applications for payment.
		Schedule of values	•Format: Shall be made out in such form and supported by such evidence as the consultant may reasonably direct and when accepted by the consultant. •Basis: Shall be used as the basis for application of payment.
	Substantial performance of the work	Contractor responsibility	•Substantial performance: Establish substantial performance of the work or part of the designated work. •List of items: Prepares and submits to the consultant a list of items to be completed.
		Consultant responsibility	•Certificate: State the date of substantial performance in a certificate. •Established date: Following the issuance of the certificate, the contractor establishes a reasonable date for finishing the work.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Payment	Substantial performance of the work	Payments of holdbacks	•Application: Contractor submits an application for payment of the holdback amount. •Sworn statement: Submits a sworn statement that the owner may be held responsible. •Certificate: Consultant issue a certificate for payment of holdback amount. •Payments due date: Payment due and payable on the day following the expiration of the holdback.
		Deadline	•Review: The consultant should review the work to verify the validity of the application no later than 10 days. •Notification: No later than 7 days after completing the review will the owner notify the contractor whether the work is substantially performed.
	Withholding of payments	Unforseen conditions	•Reasons beyond the control of the contractor, owner may withhold only such an amount that covers the cost of performing such remaining work.
		Non-conforming work	•No payment by the owner shall constitute an acceptance of non-conforming work.
	Final payment	Deadline	•Validity: Consultant will no later than 10 days after the receipt of an application review the work to verify validly of application. •Notification: Consultant will no later than 7 days after reviewing the work notify the contractor or give reasons why not.
		Application submittal	•When the contractor considers that the work is completed, the contractor shall submit an application for final payment.
		Workers compensation	•Workers Compensation later than 5 days after issuance of a certificate for payment pay the contractor.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Changes in the work	Accounting issue	Definition	•The contractor shall keep and present, in such form as the consultant may require an itemized accounting of the cost of expenditures and savings together with supporting data.
	Accounting issue	Wages and benefits	•Labor: Wages and Benefits paid for labor in the direct employ of the contractor under applicable collective bargaining agreements. •Office personnel: Salaries, wages and benefits of the contractor's office personnel engaged in a technical capacity and other personnel engaged in a technical capacity.
		Taxes	•Contributions, assessments or taxes incurred for such items as unemployment insurance, provincial health insurance, workers compensation and Canada pension plan.
		Travel expenses	•Travel and subsistence expenses of the contractor's personnel.
		Cost of products	•The cost of all products including cost of transportation thereof.
		Subcontracts	•The contractor shall keep and present the amounts of all subcontracts.
		Quality assurance	•The cost of quality assurance such as independent inspection and testing services.
		Removal of waste products	•The cost of removal and disposal of waste products and debris.
		Safety of personnel	•Cost incurred due to emergencies affecting the safety of persons or property.
		Bonds and insurance	•Any adjustment in premiums for all bonds and insurance which the contractor is required by the contract documents to purchase and maintain.
		Fascimile communications	•Charges for long distance telephone and facsimile communications, courier services, expressage and petty items incurred.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Changes in the work	Change in directive	Contract price	•Overhead: If the change in the work results in a net increase in the contract price, an allowance for overhead shall be included. •Profit: If the change in the work results in a net increase in the contract price, an allowance for profit shall be included.
		Agreement	•Agreement on the adjustment to the contract price and to the contract time, should be recorded as a change order.
	Change in directive	Progress payment	•Undisputed Value should be included in the progress payment.
		Definition	•Prior to the owner and the contractor agreeing upon the adjustment in contract time and price.
		Contractor	•Contractor proceeds promptly with the change in the work.
		Consultant	•Consultant determines the adjustment in the contract price in case.
	Delay	Deadline	•Written notice of claim is given to the consultant not later than 10 days after the commencement of the delay.
		Delays due to owner	•Reimbursement: The contractor shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of such delay. •Time extension: Then the contract time shall be extended for such reasonable time as the consultant may recommend in consultation with the contractor.
		Miscellanous delay	•Reimbursement: The contracotr shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of such delay. •Time extension: The contractor shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the owner.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Changes in the work	Delay	Delays due to legal authority	◆Reimbursement: The contractor shall be reimbursed by the owner for reasonable costs incurred by the contractor as a result of such delay. ◆Time extension: Then the contract time shall be extended for such reasonable time as the consultant may recommend in consultation with the contractor.
	Unknown conditions	Timing	◆Not later than 5 working days after first observance of the conditions.
		Consultant's findings	◆Unknown conditions are seen in both cases: differed physical conditions or subsurface conditions.
		Definition	◆Consultant issues with the approval of the owner change orders or he finds that the conditions are not materially
Default notice	Contractor's termination	Deadline	◆Written notice to the owner advising that if the default is not corrected within 5 working days, the contractor may stop or terminate the contract.
		Bankruptcy	◆Owner is bankrupt.
	Contractor's termination	Authority intervention	◆Owner violates requirements of the contract to substantial degree and the consultant confirms by written statement that sufficient cause exists.
		Contractual obligations	◆Financial arrangements: Owner fails to furnish when so requested by the contractor reasonable evidence that financial arrangements have been made to fulfill the owner's obligations under the contract. ◆Progress payments: Consultant fails to issue a certificate for progress payment . ◆Contract violation: Owner violates requirements of the contract to substantial degree and the consultant confirms by written statement that sufficient cause exists.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Default notice	Owner's termination	Deadline	•Contractor correct the default in 5 working days following the receipt of notice or if cant be corrected in 5 days, commences the correction of the default and provides the owner with an acceptable schedule for such corrections.
		Contractual obligations	•Contractor neglects to prosecute the work properly and fails to comply with the requirements of the contract, the owner is allowed to terminate the contract.
		Bankruptcy	•In case of bankruptcy, the owner shall be allowed to terminate the contract.
		Owner's entitlements	•Prior to the owner and the contractor agreeing upon the adjustment in contract time and price. •Possession of the work: Take possession of the work. •Withhold further payments: Withhold further payments. •Charge costs: Charge contractor the amount by which the full cost of finishing the work. •Excess costs: Charge the contractor the amount by which the costs of corrections in expiry of the warranty.
Dispute resolution	Negotiation, mediation, arbitration	Arbitration	•Within 10 days of the terminated negotiations, either party may refer the dispute to be finally terminated.
		Negotiation	•All efforts have been spent to resolve the dispute by amicable negotiations.
	Negotiation, mediation, arbitration	Project mediator	•Mediator assistance: After the period of 10 working days following receipt of a responding party's written notice, the negotiator ends the negotiation process. •Appointment deadline: Appointed either within 30 days after the contract award or within 15 days after either party requests by written notice its appointment.
Dispute	Misrepresentation of construction clauses	Not associated	•Not associated

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
resolution	Omitted negotiation procedures	Not associated	•Not associated
Protection of persons and properties	Protection of work and property	Contractor responsible	•Contractor shall make good such damages at his expenses.
		Contractor non-responsible	•Contractor is considered not responsible if there are errors in contract document or omissions from the contractor.
	Toxic and hazardous material	Contractor responsibility	•Delays and extra costs: Contract time shall be extended and contractor reimbursed. •Precautions: If he encounters or has reasonable grounds that toxic material is available at the place of work, he should take all reasonable steps to ensure that no person suffers injury. •Report: Report circumstances to the consultant.
Governing regulations	Laws, notices, permits and fees	Place of the work	•The laws of the place of the work shall govern the work.
		Owner's duty	•Shall obtain and pay for the building, permits, permanent easements, and rights of servitude.
		Contractor's duty	•He shall give the required notices and comply with the laws, ordinances, rules, regulations and codes and he shall notify the consultant in writing in case of a change in laws.
		Change in regulations	•If changes in laws, regulations, or codes, the consultant shall make the changes required.
	Taxes and duties	Contract price	•Contract price shall include all taxes and customs duties in effect at the time of the bid closing.
		Increase in costs	•Any increase or decrease in costs to the contractor due to changes shall increase the contract price accordingly.
Governing	Workers	Contractor's duty	•The contractor shall provide evidence of compliance with workers compensation legislation at the place of the work, including payments.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
regulations	compensation	Evidence	•The contractor shall provide evidence of compliance with workers compensation legislation at the place of the work, including payments.
Insurance and bonds	Insurance	Gneral liability insurance	•Amount limit: Not less than 2,000,000 per occurrence. •Time Limit: Not less than 2,000,000 per occurrence.
		Automobile liability insurance	•Amount limit: Any increase or decrease in costs to the contractor due to changes shall increase the contract price accordingly. •Time limit: Any increase or decrease in costs to the contractor due to changes shall increase the contract price accordingly.
		Contractor's equipment insurance	•Amount limit: Not less than 2,000,000 per occurrence. •Time limit: Any increase or decrease in costs to the contractor due to changes shall increase the contract price accordingly.
		Aircraft and watercraft liability insurance	•Amount limit: Not less than 2,060,000 per person or 2,000,000 for aircraft passenger hazards. •Time limit: Provide Owner with no less than 15 days written notice.
		Property and boiler machinery insurance	•Amount limit: IBC form 4042 or its equivalent replacement. •Time limit: Coverage until 10 days after the date of the final certificate.
	Bonds	Bond	•Contractor shall within the specified time provide to the owner any surety bonds required under the contract.
		Joint	•Should be in the joint name of the contractor, owner and contractor.
Insurance and bonds	Bonds	Insurance policy criteria	•Insurers or surety licensed to underwrite.

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Categories	Subcategories	CCDC 2-1994 Headings	CCDC 2-1994 Contract Clauses
Indemnification, waiver and warranty	Indemnification	Contractor	**1)** Bodily injury or destruction of property. **2)** Negligent acts or omissions. **3)** Made in written within a 6 year period from the date of substantial performance of the work.
		Owner	◆The contractor shall indemnify and hold harmless the owner and the consultant, their agent and employees from and against claims, demands, losses costs damages, actions, suits by third parties.
	Waiver	Contractor's waiver	◆Limitations: Still unsettled issues and those arising from the contractor bringing toxic or hazardous material. ◆Waiver: As of the date of the final certificate for payment, the contractor expressly waives and releases the owner from all claims.
		Owner's waiver	◆Limitations: Still unsettled issues and those arising from the contractor bringing toxic or hazardous material. ◆Waiver:
	Warranty	Owner's responsibility	◆Give contractor written notice of observed defects.
		Contractor's responsibility	◆Correct or pay for damage resulting from corrections to defects.
		Time	◆One year from the date of the substantial performance of the work.

APPENDIX C: STATISTICAL ANALYSIS EVALUATION FORM

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STATISTICAL ANALYSIS EVALUATION FORM

Name of Evaluator: _____

Profession: _____ Permission to publish comments: ☐ YES ☐ NO

	Refer To	Fact	Proposed Analysis	Agree	Disagree	No Opinion	Comments
Case Summary Statistics:							
General Categories	Table 5.1 Figure 5.1	•'Changes in the work', 'payment issues', and 'general provisions' contributed to 311 of the 564 claims.	'Changes in the work', 'payment issues', and 'general provisions' are the three main general causes of claims within the Canadian construction industry.	☐	☐	☐	
Subcategories	Table 5.2 Figure 5.1	•'Breach of contract' and 'change in directive' are the two largest subcategories; they belong to the 'general provisions' and 'changes in the work' categories respectively.	Contract violations and last minute changes are the two main causes of claims within the Canadian construction industry.	☐	☐	☐	
Project Statistics:							
Project Category	Table 5.3 Figure 5.2	•'Commercial construction' and 'residential construction' are identified to be the two largest project categories in this study; they contributed to 35 and 23 of the 93 claims respectively.	The statistics of this category is not representative of the Canadian construction industry because the data is heavily dependent on the claim sources used. The results only reflect the claims sample used in this study.	☐	☐	☐	
Project Type	Table 5.3 Figure 5.2	•Public - 32 of 93 cases. •Private - 61 of 93 cases.	The large difference is mainly due to private sector's competitive instincts and their hesitancy in ruining good working relationships with the government.	☐	☐	☐	
Project Delivery Method	Table 5.3 Figure 5.2	•Traditional - 54 of 92 cases. •Design-built - 35 of 92 cases. •Construction management - 3 of 92 cases.	Projects using the construction management delivery method has a lower chance of encountering claims because they have more readily available resources to resolve disagreements quickly and effectively. Problems are addressed before situation deteriorates.	☐	☐	☐	
Design Complexity	Table 5.3 Figure 5.2	•Easy - 11 of 92 cases. •Medium - 45 of 92 cases. •Difficult - 36 of 92 cases.	Contractor's lack of familiarity with medium or difficult projects, prolonged project durations, and the greater opportunities for disagreements heighten tension between parties and increase the likelihood for claim occurrence.	☐	☐	☐	

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	Refer To	Fact	Proposed Analysis	Agree	Disagree	No Opinion	Comments
Project Statistics:							
Construction Complexity	Table 5.3 Figure 5.2	•Easy - 11 of 92 cases. •Medium - 39 of 92 cases. •Difficult - 42 of 92 cases.	Contractor's lack of familiarity with medium or difficult projects, prolonged project durations, and the greater opportunities for disagreements heighten tension between parties and increase the likelihood for claim occurrence.	☐	☐	☐	
Project Location	Table 5.3 Figure 5.2	•British Columbia - 40 of 92 cases. •Prairies - 43 of 92 cases. •Atlantic Region - 1 of 92 cases. •Ontario - 8 of 92 cases. •Quebec - 0 of 92 cases.	The project location statistics does not reflect the current situation within the Canadian construction industry because it is heavily dependent on the claims sources used. The data only represent the claims sample used for this study.	☐	☐	☐	
Project Scope	Table 5.4 Figure 5.3	•Well defined - 9 of 92 cases. •Not well defined - 83 of 92 cases.	The higher occurrence of change orders, extra work, and rework for projects with unclear scope give rise to greater opportunities for contractors to dispute contracutual terms and claim for compensation.	☐	☐	☐	
Adequacy of Technical Plans	Table 5.4 Figure 5.3	•Adequate - 26 of 92 cases. •Not adequate - 66 of 92 cases.	Poorly drafted technical plans are more prone to change orders, extra work, and rework. 'Changes in directive' is one of the major causes of claims.	☐	☐	☐	
Adequacy of Financial Plans	Table 5.4 Figure 5.3	•Adequate - 23 of 92 cases. •Not adequate - 69 of 92 cases.	Inadequate financial plans can negatively impact a project's cost and schedule. Funding deficiencies lead to delays, conflicts, and claims.	☐	☐	☐	
Contractual Obligations	Table 5.4 Figure 5.3	•Realistic - 70 of 92 cases. •Not realistic - 22 of 92 cases.	Appropriate allocation of risks and responsibilities between project participants creates more cooperative environments.	☐	☐	☐	
Risk Allocation	Table 5.4 Figure 5.3	•Well identified - 1 of 92 cases. •Not well identified - 91 of 92 cases.	Concise risk allocations can dramatically reduce claim occurrences because participants who are aware of their risks are better prepared for their responsibilities and have more appropriate expectations.	☐	☐	☐	
Quality Input Shared During the Preconstruction Stage	Table 5.4 Figure 5.3	•Adequate - 4 of 92 cases. •Not adequate - 88 of 92 cases.	Greater information sharing and open communication between project participants can lead to lower incidences of claims.	☐	☐	☐	

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	Refer To	Fact	Proposed Analysis	Agree	Disagree	No Opinion	Comments
Contract Statistics:							
Contract Duration	Table 5.5 Figure 5.4	•< 6 month - 7 of 93 cases. •6 month to 1 year - 18 of 93 cases. •1 year to 2 year - 44 of 93 cases. •2 year to 5 year - 21 cases. •> 5 years - 3 of 93 cases.	Short term projects tend to have simple and straightforward terms; contractors can deliver work without major problems. Long term projects are less likely to encounter claims due to dispute resolution clauses and better relationships between project participants. The risk involved for contracts that last between 1 to 2 years may be contributed by a lack of adequate claim prevention strategies or inexperience.	☐	☐	☐	
Contract Payment Method	Table 5.5 Figure 5.4	•Unit price - 51 of 89 cases. •Stipulated price - 31 of 89 cases. •Cost-plus - 7 of 89 cases.	Disputes are more likely to arise in contracts where the majority of the risks lie with the private sector. Any major mistake made by the contractor can result in large monetary losses; the contractor may try to recover part of their loss through litigation.	☐	☐	☐	
Contract Price	Table 5.5 Figure 5.4	•< 1 M - 47 of 82 cases. •1 M to 5 M - 21 of 82 cases. •> 5 M - 14 of 82 cases.	Expensive projects are more likely to have special clauses within their contracts or teams of experts to address potential problems. The risk involved with contracts below one million dollars may be due to a lack of preventative measures, a shortageof trust between participants, or the underestimation of project complexity by contractor.	☐	☐	☐	
Based on Lowest Bid	Table 5.5 Figure 5.4	•Based on lowest bid - 44 of 91 cases. •Not based on lowest bid - 47 of 91 cases.	The awarding of contracts to lowest bidders does not impact the occurrence of litigations.	☐	☐	☐	

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	Refer To	Fact	Proposed Analysis	Agree	Disagree	No Opinion	Comments
Contractor Statistics:							
Competence Level	Table 5.6 Figure 5.5	•Competent - 20 of 88 cases. •Not competent - 68 of 88 cases.	Incompetent contractors are more likely to make major mistakes; they may attempt to pass on any additional cost to the owner through claims.	☐	☐	☐	
Interpersonal Skills	Table 5.6 Figure 5.5	•Effective - 17 of 88 cases. •Not effective - 71 of 88 cases.	Contractors with effective interpersonal skills are better able to resolve disputes quickly and effectively.	☐	☐	☐	
Previous Experience on Similar Projects	Table 5.6 Figure 5.5	•Yes - 27 of 94 cases. •No - 67 of 94 cases.	Contractors who are experienced are more aware of the potential problems that may arise and can provide practical inputs or solutions.	☐	☐	☐	
Successful Organization Based on Past Projects	Table 5.6 Figure 5.5	•Successful - 27 of 88 cases. •Not successful - 61 of 88 cases.	Successful organizations likely have more readily available resources to resolve conflicts and have better work practices in place to reduce the occurrence of disputes. Staff of succeeful organizations may be more knowlegable in areas of teamwork and open communication. Interpersonal skills are crucial to the process of claim avoidance.	☐	☐	☐	
Responsibility Structure of the Project Individuals	Table 5.6 Figure 5.5	•Effective - 21 of 88 cases. •Not effective - 67 of 88 cases.	Ineffective responsibility structures may result in unproductive procedures or unnecessary confusion due to inappropriate placement of responsbilities. Confusion can progress into misunderstanding, tension, arguments, or legal action.	☐	☐	☐	

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	Refer To	Fact	Proposed Analysis	Agree	Disagree	No Opinion	Comments
Owner Statistics:							
Interpersonal Skills	Table 5.7 Figure 5.6	•Effective - 26 of 87 cases. •Not effective - 61 of 87 cases.	Contractors with effective interpersonal skills are better able to resolve disputes quickly and effectively.	☐	☐	☐	
Successful Organization Based on Past Projects	Table 5.7 Figure 5.6	•Successful - 30 of 87 cases. •Not successful - 57 of 87 cases.	Successful organizations likely have more readily available resources to resolve conflicts and have better work practices in place to reduce the occurrence of disputes. Staff of succeeful organizations may be more knowlegable in areas of teamwork and open communication. Interpersonal skills are crucial to the process of claim avoidance.	☐	☐	☐	
Contractual Obligation	Table 5.7 Figure 5.6	•Effective - 26 of 87 cases. •Not effective - 61 of 87 cases.	Appropriate allocation of risks and responsibilities between project participants creates more cooperative environments.	☐	☐	☐	
Contractual Satisfaction	Table 5.7 Figure 5.6	•Satisfied - 27 of 87 cases. •Not satisfied - 60 of 87 cases.	Discontented owners may seek compensation through the filing of claims.	☐	☐	☐	

APPENDIX D: REVOLUTION IN THE CANADIAN TENDERING PROCESS: 10 EXAMPLES

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Introduction

Appendix D presents the after effects of the 'Ron Engineering and Construction' case on the contractual relationships of the tendering process in Canada. Various Canadian lower courts have built upon the 'Ron Engineering' framework, which makes it the starting point for understanding the principles of tendering applicable to Canadian construction projects. Ten (10) Canadian cases that were influential in the revolution of the contract tendering process are presented.

R. (in right of Ontario) v. Ron Engineering and Construction (Eastern) Ltd. (1981)

Ron Engineering established a basic framework for defining the contractual relationships of the tendering process. In order for a legally binding contract to exist between two parties, one party must make an offer and another party must accept that offer. In the context of tendering, this gives rise to difficult questions, such as when is the offer made, and when is the contract formed. In the case of Ron Engineering, the low bidder realized shortly after tenders were opened that a serious calculation error had been made in the bid and immediately recommended that the owner withdraw its tender and have the tender deposit returned. Upon rejection of this request, the contractor refused to sign the construction contract and to perform the work. The owner eventually awarded the construction contract to the second lowest bidder.

The contractor commenced an action for the return of its tender deposit and the court was required to decide whether a contract had indeed been formed between the owner and the contractor, and if so, when that contract arose. In a unanimous ruling delivered by justice

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Estey, the court held that an owner's call for tenders gives rise to a two-step process, resulting in two separate contracts:

- **Contract A**: The court held that the call for tenders constitutes an offer which, when responded to by a bidder through the submission of a bid in compliance with the call for tenders, automatically gives rise to the existence of an initial tender contract called Contract A. The terms of contract A are the terms of the call for tenders. Contract A is ordinarily specified to be irrevocable for a stipulated period of time, in which the owner may elect to accept or reject any of the tenders.

- **Contract B**: Contract B is a construction contract that comes into existence between the owner and the successful bidder upon the acceptance of one of the tenders by the owner. Until such a time, or until the stipulated period of irrevocability expires, the parties' actions are governed by the terms of Contract A. The terms of Contract B are set out in the tender documents, which often include a sample of the construction contract.

The contractor in the Ron Engineering case maintained that the mistake made in the calculation of the tender price was not discovered until the tenders were opened. After a failed request to withdraw its tender, the contractor refused to execute the construction contract. In contravention of an express requirement of the tender, the owner retained the contractor's tender deposit and awarded the contract to the second lowest bidder.

The Supreme Court of Canada found that the contractor breached Contract A and rejected the contractor's argument that its tender had contained a mistake rendering it unacceptable to the owner. The court justified its ruling on the grounds that permitting

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the contractor to come forward after tenders had been opened and allege that its low price was mistaken would threaten the integrity of the bidding system.

Acme Building and Construction Ltd. v. Newcastle Town (1992)

The Ontario Court of Appeal broadly interpreted a privilege clause in finding that the express language of the tender documents gave the owner the right to reject the lowest bidder and to accept any other bidder without providing a reason. The Acme Building and Construction Ltd. case represents the high mark for owners in the tendering and bidding process. The low bidder sued the town, arguing that the industry custom and usage required the town to accept its bid. The Ontario Court of Appeal found that the expressed wording of the privilege clause was sufficient to override any industry custom and usages, and ruled that the lower qualifying tender was to be accepted (Hot calls in construction, 2001).

M.J.B. Enterprises v. Defense Construction Canada (1994)

Defense Construction Canada called for tenders for the construction of a water distribution system in Alberta. The owner received four tenders and the contract was awarded to the lowest bidder. The second lowest bidder, M.J.B., argued that the successful bidder's bid was invalid because it included a qualification on alternate pricing and ought to have been rejected by the owner in favor of the unqualified bid submitted by M.J.B.. On this basis, M.J.B. sued the owner for breaching Contract A. Unfortunately for M.J.B., the instructions to bidders contained a standard privilege clause stating that 'the lowest or any tender shall not necessarily be accepted'.

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At trial, the Alberta Queen's bench misconstrued the meaning of Ron Engineering in concluding that 'the mere act of submitting a tender does not create a contract,' and therefore, because M.J.B.'s tender was not accepted, there was no breach of any tender contract (Contract A). M.J.B.'s action was accordingly dismissed. The trial judge also found that the owner had not acted fairly in awarding the contract and directed the owner to pay M.J.B. for the costs of preparing the tender.

The Alberta Court of Appeal, by a unanimous ruling, dismissed the appeal, stating bluntly that the privilege clause is a complete answer to M.J.B's action. Justice McClung suggested that the words "or any tender" contained in the privilege clause provided the owner with broad discretion. Justice Iacobucci delivered the unanimous judgment of the Supreme Court of Canada and posted the following question: 'does the respondent's inclusion of a privilege clause in the tender documents allow the respondent to disregard the lowest bid in favor of any other tender, including a non-compliant one?'. The answer is no. Returning to the principles established in the case of Ron Engineering, Justice Iacobucci clarified that a Contract A will not arise in all cases where there is a tender process, but rather it must always be determined by the specific terms and conditions of the tender call. The main concern is whether the parties intended to initiate contractual relations by the submission of a bid. If so, Contract A is to be governed by the terms of the tender documents.

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Martel Building Ltd. v. Canada (2000)

There are cases that have arisen since the M.J.B. Enterprises case that have endeavored to dissect the principle of compliancy. These cases are mainly result-oriented decisions that have attempted to differentiate between strict compliance and substantial compliance in order to justify a finding of whether or not Contract A exists.

In November 2000, the Supreme Court of Canada released its ruling for the case of Martel Building Ltd. v. Canada. The case addressed the duty of care in conducting negotiations of a commercial lease and the fairness of the tendering process. Although not a construction tender case, the principles of this decision are also applicable to construction tenders. In this case, Martel entered into negotiations over the terms of a lease with the Department of Public Works. Having failed to reach an agreement, the department proceeded to call for tenders for the required lease space. Despite not being able to agree to terms in the negotiations, Martel submitted a tender in answer to the tender call and was found to be the lowest bidder. The department entered into a financial analysis of the various bids and made an upward adjustment to Martel bid's to include fit up and related costs. This price adjustment made Martel's bid the second lowest. Consequently, the department elected to enter into a lease agreement with the party that had the lowest reviewed bid price.

An appeal to the Supreme Court of Canada raised the following two issues that are relevant to this paper:

- Does a duty of care exist in the conduct of commercial negotiations?

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- Did the Federal Court of Appeal err in finding that the department owed Martel a duty of care in the tendering process and that this duty was breached?

On the first issue, the court concluded that no duty of care arose in conducting commercial negotiations. Following the analysis of the Ron Engineering and the M.J.B. Enterprises cases, the second and more relevant issue pertaining to tendering was held as follows:

> *"...We believe that implying a term to be fair and consistent in the assessment of the tender bids is justified based on the presumed intention of the parties. Such implication is necessary to give business efficacy to the tendering process...We find it difficult to believe that the respondent in this case, or any of the three tenderers, would have submitted a bid unless it was understood by those involved that all bidders would be treated equally and fairly...Implying an obligation to treat all bidders fairly and equally is consistent with the goal of protecting and promoting the integrity of the bidding process, and benefits all participants involved. Without this implied term, tenderers, whose fate could be predetermined by some undisclosed standards, would either incur significant expenses in preparing futile bids or ultimately avoid participating in the tender process."*
>
> *"A privilege clause reserving the right not to accept the lowest or any bids does not exclude the obligation to treat all bidders fairly. Nevertheless, the tender documents must be examined closely to determine the full extent of the obligation of fair and equal treatment."*

An important factor was the Court's preliminary and undisputed finding that Contract A had clearly come into existence. The British Columbia Court of Appeal noted this point

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when it recently decided, in the Midwest case, that there exists no 'freestanding' duty of fairness in the absence of Contract A. Also of note is the court's use of the terms "fair and consistent" and "fairly and equally" in describing the owner's obligation to bidders. It appears that, in order to protect the integrity of the tendering process, the court found that an owner must provide all bidders with consistent and equal treatment. Where an owner does not do so, it may be in breach of the terms of the tender.

George Wimpey Canada Ltd. v. Hamilton-Wentworth (Regional Municipality) (1997)

The courts of Ontario appear to have retreated from the broad interpretation approach characterizeing the 'ACME Building and Construction' case, as evidenced by the 1997 ruling in the George Wimpey v. Hamilton case. The George Wimpey case involved the awarding of a road paving contract to the second lowest bidder due to this bidder's ties to the local community. The lowest bidder sued the owner, claiming that the municipality had a duty to accept the lowest bid, notwithstanding the existence of a standard privilege clause in the tender call. The court allowed the action, finding that the privilege clause did not provide the municipality with unlimited discretion in awarding the tender, and that it could only do so on the basis of grounds that had been disclosed to the bidders.

The trial judge wrote:

> *"I find that the law implies an obligation on the owner of fairness in exercising its rights under the privilege clause. The reason is to ensure that everyone is bidding on the same basis with no hidden preferences. The language of the privilege clause is*

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clear, but more explicit language is required to exclude the implied obligation of fairness and good faith.

In the circumstances of this case, the plaintiff has established on the balance of probability that the defendant did not act fairly or in good faith when it awarded the contract to a tenderer who is not the low bidder, and no basis of possible decision on other grounds was disclosed in, nor can be implied from the tender documents or any unpublished policy of the defendant."

The Ontario Court of Appeal spent considerable time distinguishing this case from its decision in the case of ACME Building, reasoning that the completion date factor was essentially a criterion identified in the tender documents of the ACME Building case. Furthermore, the owner of the ACME Building case had given reasons for its decision whereas the municipality in the George Wimpey case had not.

The Court of Appeal found that the only variable permitted by the tender documents was price, and that the trial judge was entitled, therefore, to find that the municipality had breached its contractual obligation to treat the plaintiff's bid fairly by awarding the contract to the second lowest bidder.

The George Wimpey case invoked the questions 'What sort of criteria must be identified in the tender documents?' and 'How specific must the tender documents be before an owner can reject the lowest bid in favor of factors other than the tender price?'. These questions were answered shortly thereafter in the case of M.J.B. Enterprises from Alberta. The M.J.B. Enterprises case offered the Supreme Court of Canada an opportunity to revisit influential issues from the case of Ron Engineering, and to clarify the meaning of the privilege clause.

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Ken Toby Ltd. v. British Columbia Corp. (1999)

A subcontractor's claim against an owner in a bid depository situation was recently decided by the British Columbia Court of Appeal in the case of 'Ken Toby Ltd. v. British Columbia Corp'. In this case, a masonry subcontractor who had been the only trade to submit a tender for unit masonry work to a local bid depository sued the owner for breach of contract as well as breach of the duty of fairness and good faith. The owner had issued an addendum that made the plaintiff's tender unsuccessful.

At trial, the Court found the owner to be liable for a breach of contract and a breach of duty for care to the subcontractor. On appeal, the Court was asked to determine what the owner owed the subcontractor if indeed a contractual relationship did exist between the owner and the plaintiff. The Court reversed the decision of the trial judge on both breach issues, finding that no contractual relationship existed between the owner and the sub-contractor pursuant to the contractual model established by the Supreme Court of Canada in the Ron Engineering case. On the duty of care issue, the court adopted the approach that the Ontario Court of Appeal used in the 'Twin City' case. The court stated that an owner has a duty to all subcontractors to take reasonable steps to ensure the integrity of the bid depository system. However, the Court also concluded that the owner had taken such reasonable steps as to avoid liability to the subcontractor.

Sound Contracting Ltd. v. Nanaimo (City) (1997)

Recently, the British Columbia Court of Appeal upheld a lower court's ruling in the Sound Contracting case by favoring an owner's decision not to award a tender to the low

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bidder based on the owner's past experience with that contractor; the court did not consider this factor to constitute an undisclosed criterion. The court, relying upon a clause that went beyond the 'bare bones' privilege clauses presented in 'Ron Engineering' and 'M.J.B Enterprises', stated:

> *"On the basis of the clarification of the law in M.J.B, I am constrained to hold that in this case, the privilege clauses in the request for tenders releases Nanaimo from the obligation to award the work to the lowest bidder if there are valid, objective reasons for concluding that better value may be obtained by accepting a higher bid".*

By ruling in this manner, the Court started down a slippery slope in its representation of the M.J.B. notion of "other criteria" as including matters such as past dealings between parties, in the absence of express language in the tender documents. The Court concluded by stating:

> *"I would caution, however, that this discretion must not be exercised in such a way as to punish or to get even for past differences. Whenever the low bidder is not the successful tenderer, any additional factors in the analysis will have to be shown to be reasonable and relevant".*

The decision from Sound Contracting, while distinguishable on its facts, has done little to advance the rights of owners or contractors in situations where an owner's discretion is based upon undefined or vague criteria. The preferred approach would seem to be for owners to clearly and expressly identify the factors that they will weigh in considering tenders such that bidders can decide whether it is worth their while to submit a bid that considers more factors than simply the contract price.

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Midwest Management (1987) Ltd. v. BC Facility Ltd. (1999)

The owner reserves the right, in its sole and absolute discretion, to accept or reject any tender which in its view is incomplete. Incomplete documents are obscure or irregular documents that contain exceptions or variations, that omit one or more prices, that include unbalanced prices, or that are accompanied by a bid bond or consent of surety considered unacceptable by the owner.

> *"Owners reserve the right to reject any or all tenders, including without limitation the lowest tender, and to award the contract to whomever the owner in its sole and absolute discretion deems appropriate, not withstanding any custom of the trade to the contrary nor anything contained in the contract documents or herein. Owner shall not, under any circumstances, be responsible for any costs incurred by the tenderer in the preparation of the tender. Criteria which may be used in evaluating tenders and awarding the contract are in the owner's sole and absolute discretion and may include criteria such as price, total cost to owner, the amount of Canadian content, claims history of tenderer, qualifications of the tenderer, expertise of the tenderer, quality of services and personnel of the tenderer, ability of the tenderer to ensure continuous availability of qualified and experienced personnel, the construction schedule and plan, the proposed labor and equipment, and the proposed supervisory staff.*

If the owner is not satisfied with any of the received tenders, the owner reserves the right to re-tender the project or to negotiate a contract with any one of the tenderers.

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The Midwest case involved an action by an unsuccessful contractor whose tender was rejected by the owner on the grounds that it did not conform to or comply with the tender documents so that no Contract A came into existence. The lowest court ruled in favor of the owner on an application for summary judgment dismissing the contractor's action. Ironically, it was the contractor, rather than the owner, who argued unsuccessfully that, because of the apparent absolute discretion given to the owner by the privilege clause to accept or reject any tender, the plaintiff's tender, even though non-compliant, ought to have been suitable for acceptance, thereby creating Contract A. The court rejected this novel argument, finding that the contractor's tender was non-compliant, in accordance with the principle defined in the case of M.J.B. Enterprises.

On a separate issue, the Court rejected the contractor's claim that the owner had breached a duty of fairness, finding that there was no implied duty of fairness since no Contract A was formed. The Court left open the question of whether there might be a 'freestanding duty of fairness' arising in the context of the tender process, the breach of which could result in liability on the part of the owner, independent of any contract. The contractor appealed and lost. The owner cross appealed the Court's alternate ruling that a claim based upon a 'freestanding duty of fairness', independent of any contract, was not necessarily bound to fail; the owner won this argument.

To date, the issue of a 'freestanding duty of fairness' entirely apart from the existence of a contract is not an issue that has been fully addressed by the Supreme Court of Canada.

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Calgary v. Northern Construction Company (1985)

So what is the appropriate remedy for a breach of Contract A in circumstances where an owner accepts a tender but the bidder refuses to enter into Contract B? The Courts have found that the owner is entitled to accept the next lowest compliant tender and recover the differences in bid price as damages resulting from the tenderer's breach of Contract A.

It is trite law that a plaintiff may not allow its damages to accumulate, but has a positive obligation to mitigate its damages. However, an owner is not obliged to negotiate the bid price with the low bidder, as was the issue in the 'Calgary v. Northern Construction Company' case. In this case, the successful bidder had refused to perform the work unless the owner agreed to pay an amount in addition to the bid price. The defendant maintained that the owner had, accordingly, failed to mitigate its damages.

In dismissing the Contractor's argument, the Alberta Court of Appeal held as follows:

> "*Undoubtedly the city had the duty to mitigate its damages but to accept the argument of the contractor would be to change the tendering system to that of an auction. The city granted a construction contract to the second lowest bidder when the contractor refused to execute the construction sent it by the city. This would appear to be the reasonable thing to do, considering the amount of the bid made by the second lowest bidder. To accept the submission of the contractor would allow any contractor who made a low bid to refuse the contract but to offer to do the work for less than the second bidder and then argue the city must accept such an offer in mitigation of such*

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damages. The city was not under such duty and the contractor has not proven any failure of the city to mitigate."

In circumstances where a bidder proves that an owner has breached the terms of Contract A and caused the bidder to lose a reasonable expectation of receiving Contract B, the Courts appear to be consistent in finding that the appropriate measure of damages are expectation damages for the bidder's lost profits. In awarding damages, some Courts have appropriately reduced the bidder's loss of profits by taking into account such factors as the possibility that the contractor would not have been awarded the contract even if its bid had been treated fairly, the possibility that the contractor's profits would be reduced by entering into an arrangement with a trade union, contingencies for unforeseen difficulties on the job site, and a reduction based on the contractor's duty to mitigate and place itself on other projects as quickly as possible during the time the project would take place.

On occasion, contractors have been awarded the costs of preparing an unsuccessful tender, as in the initial trial court ruling of the M.J.B. Enterprises case. Owners often guard against such cost claims by including a provision in the tender documents expressly providing that they 'shall not, under any circumstances, be responsible for any costs inccurred by the tenderer in the preparation of its tender'.

Naylor Group v. Ellis-Don

In the M.J.B. Enterprises case, the court held that the contractor was entitled to damages in the amount of the profits it would have received had it been awarded Contract B. Since the parties had agreed on the damages, the court was not required to delve into a more

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detailed analysis of such damages. A somewhat different approach was taken by the Ontario Court of Appeal in the case of Naylor's Group. It was held that since Contract B has not been executed, Naylor's damages arose from the breach of Contract A and where restricted to its lost opportunity. Specifically, Justice Weiler, delivering the judgment of the court, stated the following:

> *"If a construction contract B had been entered into, the measure of damages to which Naylor would have been entitled to would have been its profit. Because I am dealing with the a breach of the preliminary contract A, the measure of damages is Naylor's lost opportunity to enter into a contract with Ellis-Don. While it is appropriate to consider the profit Naylor would have realized if it had been given the opportunity to perform the work, the contingency that Naylor would not have received the contract because of an unfavorable interpretation of the OLRB decision, and the contingency that its profit would have been reduced due to having to make an arrangement with an IBEW affiliated subcontractor, must be taken into account. The contingency of unforeseen difficulties on the job site must also be factored in a deduction from the assessment of Naylor's damages".*

It must be noted that the facts of the Naylor Group case are unique since there was a possibility that Naylor, a subcontractor, may not have been able to execute Contract B, based upon a ruling of the Labor Board. Nevertheless, where an owner is in breach of Contract A and not Contract B, the owner would not appear to be precluded from advancing the argument that the contractor's lost profit is only the starting point and that its overall damages ought to be reduced for contingencies.

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Closing

The cases presented in this Appendix serve as a tool to understanding the revolution in the tendering process in Canada. The case of Ron Engineering established a basic framework for determining the contractual relationships that are created in the course of the tendering process. The court held that an owner's call for tenders results in two separate contracts: Contract A and Contract B. To resume, the following considerations appear to be consistent in the Court's determination of whether an owner has breached Contract A or not (Hot Calls in Construction, 2001):

- Were the tender criteria expressly disclosed to all bidders?
- Were the bidders given a fair opportunity to submit a tender?
- Has the owner exercised its discretion in accordance with the express provisions of a privilege clause?
- Was the successful tender compliant with the requirements of the tender call

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